

Yuhang Yang  
Maode Ma  
*Editors*

Proceedings of  
the 2nd International  
Conference on Green  
Communications  
and Networks 2012  
(GCN 2012): Volume 1

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Editors

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 Springer

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# Preface

Welcome to the *Proceedings of the 2nd International Conference on Green Communications and Networks (GCN 2012)*, which was held on December 12–14, 2012, in Chongqing, China.

GCN 2012 will be a venue for leading academic and industrial researchers to exchange their views, ideas, and research results on innovative technologies and sustainable solutions leading to green communications and networks. The conference will feature keynote speakers, a panel discussion, and paper presentations.

The objective of GCN 2012 is to facilitate an exchange of information on best practices for the latest research advances in the area of green communications and networks, which mainly include the intelligent control, or efficient management, or optimal design of access network infrastructures, home networks, terminal equipment, etc. GCN 2012 will provide a forum for engineers and scientists in academia, industry, and government to address the most innovative research and development including technical challenges, social and economic issues, and to present and discuss their ideas, results, work in progress, and experience on all aspects of advanced green communications and networks engineering.

The GCN 2012 conference provided a forum for engineers and scientists in academia, industry, and government to address the most innovative research and development including technical challenges and social, legal, political, and economic issues, and to present and discuss their ideas, results, work in progress, and experience on all aspects of information computing and applications.

There was a very large number of paper submissions (1834). All submissions were reviewed by at least three Program or Technical Committee members or external reviewers. It was extremely difficult to select the presentations for the conference because there were so many excellent and interesting submissions. In order to allocate as many papers as possible and keep the high quality of the conference, we finally decided to accept 486 papers for presentations, reflecting a 26.5 % acceptance rate. We believe that all of these papers and topics not only provided novel ideas, new results, work in progress, and state-of-the-art techniques in this field, but also stimulated the future research activities in the area of information computing and applications.

The exciting program for this conference was the result of the hard and excellent work of many others, such as Program and Technical Committee members, external reviewers, and Publication Chairs under a very tight schedule. We are also grateful to the members of the Local Organizing Committee for supporting us in handling so many organizational tasks, and to the keynote speakers for accepting to come to the conference with enthusiasm. Last but not least, we hope you enjoy the conference program, and the beautiful attractions of Chongqing, China.

December 2012

Maode Ma  
Yuhang Yang  
General and Program Chairs  
GCN 2012

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GCN 2012 was organized by Chongqing Normal University, BeiHang University, Peking University, and sponsored by the National Science Foundation of China, Shanghai Jiao Tong University, Nanyang Technological University. It was held in cooperation with *Lecture Notes in Electrical Engineering* (LNEE) of Springer.

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# Contents

## Part I Web, Engineering and Applications

<b>1</b>	<b>Selection Model Based on Trust Domain and Personality Preference of Grid Service . . . . .</b>	<b>3</b>
	Xiaoxue Ma, Zixian Wang, Fei Liu and Jing Bian	
<b>2</b>	<b>Study on Relationship Between Network Public Opinion and New Function Mode of Ideological Education Based on Equations of Mathematical Physics . . . . .</b>	<b>13</b>
	Dongchao Jia and Linlin Li	
<b>3</b>	<b>Web-Based Cross-Country E-Pal Enhance Writing Teaching . . . . .</b>	<b>21</b>
	Shaojuan Zhang, Xitao Gu and Yuanyuan Zhang	
<b>4</b>	<b>Internet Marketing Strategy Based on E-Commerce . . . . .</b>	<b>27</b>
	Feng Xiao Shun	
<b>5</b>	<b>VNA Time-Domain Technology Analysis Based on Virtual Instrument . . . . .</b>	<b>35</b>
	Ying Liu, Rongyi Duan and Jiayu Xie	
<b>6</b>	<b>Campus Network Data Integration Based on XML . . . . .</b>	<b>43</b>
	Zhijian Yang, Xianyang Li and Bifeng Liao	
<b>7</b>	<b>Design and Research of Embedded Gateway Based on CAN Bus . . . . .</b>	<b>51</b>
	Ru Xue	
<b>8</b>	<b>Study on Mobile Internet in the Integration of Tourism Industrial Chain . . . . .</b>	<b>59</b>
	Gefen Zhou	

**9 An Improved Routing Algorithm Based on End-to-End Packet Reception Rate in Wireless Sensor Networks . . . . . 67**  
Zou Wensheng

**10 Study on Networking of Internet of Things . . . . . 73**  
Feng Zhang

**11 Study on the Risk Management of Floodwater Utilization Based on the Internet of Water Affairs . . . . . 79**  
Wen An and Jing Yu

**12 Feature of Gender in Computer-Mediated Communication . . . . . 89**  
Xiaoyi Zheng

**13 Concurrency Control of Real-Time Distributed Web Applications Based on J2EE Multi-Tier Architecture. . . . . 99**  
Chang-e Dong

**14 Petri Net-Based Workflow Technology in Office Automation . . . . . 111**  
Cuiping Wang

**Part II Control Engineering and Applications**

**15 Study of Partition Speed Method in Stock Forecasting. . . . . 119**  
Guobin Chen and Nanying Luo

**16 Topic Information Collection Based on the Hidden Markov Model . . . . . 127**  
Haiyan Jiang, Xingce Wang, Zhongke Wu, Mingquan Zhou, Xuesong Wang and Jigang Wang

**17 AMI Information Fusion Based on MAS. . . . . 137**  
Xianji Jin, Lei Lu and Weiming Tong

**18 Control Strategies of the Health Hazards of Wood Dust to the Woodworking. . . . . 145**  
Junwei Lou

**19 Modeling on Sensitivity of Influential Factors to City Water Demand Based on System Dynamic Mechanics Method . . . . . 153**  
Guang-Hui Wei, Feng Liu, Liang Ma and Liang-Liang Chen

**20 Agent-Based Risk Simulation System Design Model for Generation-Side Electricity Market . . . . . 161**  
 Xian Li and Cunbin Li

**21 3D Simulation of Rock Fractures Distribution in Gaosong Field, Gejiu Ore District . . . . . 169**  
 Chunzhong Ni, Chunxue Liu, Shitao Zhang and Chunming Fu

**22 Application-Oriented Designing for Remote Control Scheme of Robot Integrated Machine . . . . . 177**  
 Wenming Wang

**23 Network Intrusion Detection Based on Dynamic Self-Organizing Map . . . . . 189**  
 Baoping Gu and Hongyan Guo

**Part III Intelligent Evolutionary Algorithm**

**24 An Improved Particle Swarm Optimization Algorithm for QoS Anycast Routing . . . . . 201**  
 Yanyun Zhou, Zhenhong Jia, Xizhong Qin, Xiaoyan Xia and Lei Deng

**25 Asymptotic Distribution of Makespan in Permutation Flowshops. . . . . 209**  
 Gengcheng Liu, Shiji Song and Cheng Wu

**26 Optimized BP Neural Network Model Based on Niche Genetic Algorithm . . . . . 219**  
 HaoDong Zhu and HongChan Li

**27 Alphabet Recognition Based on Scaled Conjugate Gradient BP Algorithm . . . . . 227**  
 Feiyan Zhou and Xiaofeng Zhu

**28 Research on Rumors Spread Based on Cellular Automata . . . . . 235**  
 Yiran Gu and Jinzhu Ding

**29 Dynamic Method of Secure Access Cloud in Mobile Environment. . . . . 245**  
 Rong Ouyang, Yunfa Li, Zujie Ren and Jian Wan

<b>30</b>	<b>Intrusion Detection Engine Design Based on Immune</b> . . . . .	253
	Zong Jiang Wang	
<b>31</b>	<b>Research on Tourism Economic Early Warning Model</b> . . . . .	263
	Jiagui Wang and Jianhua He	
<b>32</b>	<b>One Commutativity Condition of Jacobson Semi-Simple Ring</b> . . .	271
	Hui Zhao and Xin Song Yang	
<b>33</b>	<b>Economic Forecasting Based on Time Series Analysis</b> . . . . .	277
	Qiaoling Feng	
 <b>Part IV Project Management and Applications</b>		
<b>34</b>	<b>Analysis of Fishery Production Efficiency Based on the Three-Stage DEA</b> . . . . .	289
	Shaowei Shen and Zuiyi Shen	
<b>35</b>	<b>Study of Family Function and Marital Quality of Electric Power Staff in Tangshan</b> . . . . .	299
	Chen Xin, Li Jian-ming and Zhang Ting-sen	
<b>36</b>	<b>Study of Enterprise Organization Management Based on Fractal Theory</b> . . . . .	307
	Daomei Zhang	
<b>37</b>	<b>Analysis on the Factors of Improving Competitiveness in Tourism Management</b> . . . . .	315
	Wenzhuan Yin	
<b>38</b>	<b>Study of Sunshine State Under the Ice Caps Melting</b> . . . . .	323
	Desheng Li	
<b>39</b>	<b>Study on Measure Solution Acidity or Basicity Based on Using Acidity AG</b> . . . . .	331
	Liang Yongfeng	
<b>40</b>	<b>Study on Recycling of Silicate Contained Wastes for Fiber Cement Board</b> . . . . .	341
	Cheng-Kuo Hsieh, T. H. Ueng and Jyh-Herng Chen	
<b>41</b>	<b>Optimization Management Based on Distribution Parameter</b> . . . .	355
	Qun Wang	

**Part V Innovative Education and Applications**

**42 Research on University Physical Education’s Teaching Based on the Theory of Multiple Intelligence. . . . .** 365  
 Meng Xue

**43 Analysis on the Harmonious Development of Sport in University and the Community . . . . .** 373  
 Zemin Xiao

**44 Research on Influence of Physical Exercise Pattern on University Students’ Physique Based on Statistical Regularity . . . . .** 383  
 Yuan Zhang

**45 Research on Taichiquan Teaching Based on Information Technology. . . . .** 391  
 Rui Li and Xiaohong Wang

**46 Study on Origin and Variation of Taekwondo and the Chinese Traditional Martial Arts Based on Function Increment Variation Method . . . . .** 399  
 Xiaoju Han

**47 Statistical Analysis and Influence Research of Shanghai Cheerleading on College Students’ Physical and Psychological Development Based on T-Test Law . . . . .** 407  
 Yuexian Pan

**48 Research on Sports Training Based on Information Technology. . . . .** 415  
 Yanping Tang, Guanghui Li and Hongyan Yu

**49 Study on International Developmentof Chinese Martial Arts Based on SWOT Analysis Method. . . . .** 423  
 Xinmei Chen

**50 Network Propagation Model of Chinese Traditional Sports in Globalization Based on Differential Equation . . . . .** 431  
 Dongsheng Lv

**51 Study on Attacking Foul of Basketball Players in Competition Based on SPSS and U-Theory . . . . .** 439  
 Peng Pu, Sufei Yang and Fenglin Dong

## Part VI Sustainable Education Management

- 52 Research on Cultivation of Higher Engineering Education. . . . .** 449  
Haijuan An, Xue Zhang and Xue Yao
- 53 Research on Traditional Confucian Culture on University  
Students' Mental Health Education Based on the Value  
Analysis Method. . . . .** 457  
Jianxin Ma
- 54 Research on Epistemology of Students' Beliefs and Attitudes  
and in Learning and Teaching Based on T-Test Method . . . . .** 467  
Li Kang
- 55 Study on Influencing Factors of Effectiveness  
in Performance Management . . . . .** 475  
Shaohuan Li
- 56 Analysis on Characteristic and Realization of High  
Performance Enterprise Human Resource Management . . . . .** 483  
Jing Sun
- 57 Study on Social Constructivism Teaching Concept  
and Enlightenments in Curriculum Reform. . . . .** 491  
Xiaoyun Lou
- 58 Ways to Improve the Students Communicative Competence . . . .** 497  
Xianmei Wei and Yiquan Liu
- 59 Improved Teaching Scheme Based  
on Communicative Approach . . . . .** 505  
Wen Zhou
- 60 Exploring Bilingual Uyghur–Chinese Students' Use  
of Language Inside and Outside School. . . . .** 515  
Huaying Chen, Anniwar Rozy, Dilnur Abliz  
and Renaguli Muharemu

## Part VII Knowledge Management Engineering

- 61 Study of Phosphorus Removal Efficiency in Enhanced  
Biological Phosphorus Removal Process . . . . .** 525  
Yanhui Ge, Lin Zhao, Ruochun Zhang and Jiayi Chen



**62 Study on RMB Cross-Border Settlement in China’s Foreign Trade Enterprises . . . . . 533**  
 Hongqin Liu

**63 Research on China’s Service Trade Based on International Competitiveness Perspective . . . . . 543**  
 Fengli Zhuo

**64 Study of Coordinated Development of Logistics Industry and Regional Economic Integration Based on Provincial Data . . . 553**  
 Li Zhao

**65 Study of Educational Products in the Marketing Channels During Upgrading Process . . . . . 561**  
 Xiaojie Tang

**66 Infiltration Characteristics Under Different Land Uses in Yuanmou Dry-Hot Valley Area. . . . . 567**  
 Zhiqin Liu, Nanjun Lang and Keqin Wang

**67 Geological Characteristic and Genesis of YuLu Pb–Sn Deposit Metallogenesis in HuiZe, YunNan . . . . . 573**  
 Chunzhong Ni and Shitao Zhang

**68 Community Care Platform Based on Interviews with Typical Health Care Institutions . . . . . 581**  
 Haiying Wang and Suting Li

**69 Research on Improving the Effectiveness of Blended Learning. . . 589**  
 Shengjian Chen

**70 Study on Model of Industries to Relocate to Less Developed Regions . . . . . 597**  
 An’ning Cai

**Part VIII Green Management Engineering and Applications**

**71 A Locating Approach of Sharing-Resource in Business Collaboration System . . . . . 607**  
 Jing Li

**72 Research of Encodation Schemes Selecting Optimization for Character 2D Barcode . . . . . 615**  
 Fan Jiang, Zhi Liu and Xiaofei Feng

**73 Study on the Relationship Between Social Support and Burnout of Civil Servants in Tangshan . . . . . 625**  
 Xiaotong Zhu, Xue Yao and Xiuqi Hu

**74 Study on Relationship Between Role Type and Job Satisfaction of Student Leaders in University . . . . . 633**  
 Shaoqing Yang, Jianzhu Bo, Xiaotong Zhu, Xiaohong Li, Baoqiang Yang, Chunjuan Niu, Xiaoyi Wang, Ying Zhang and Xiaoyan Li

**75 Study on Innovation of Mandarin Teaching in Universities . . . . . 639**  
 Xue Yao, Haijuan An and Shanhui Lv

**76 Research on Setting of Traffic and Patrol Police Service Platforms . . . . . 647**  
 Qingfeng Song, Yan Yan, Mingyue Zhao and Sha Wang

**77 Forecasting Incidence Age of Coal Workers' Pneumoconiosis Based on BP Neural Networks . . . . . 657**  
 Xiaohong Wang, Jianhui Wu, Sufeng Yin, Guoli Wang and Zhengjun Guo

**78 Study on Tutor Team of Full-time Professional Degree Graduates . . . . . 665**  
 Huilan Li, Chunling Sun, Lei Zhou, Guobin Zhang and Weitao Su

**79 Analysis of Graduates' Professional Maturity . . . . . 673**  
 Huilan Li, Chunling Sun, Lei Zhou and Guobin Zhang

**Part IX Computer Graphics and Image Processing**

**80 A Forward and Reverse Wrapping Depth Image-Based Rendering (FR-DIBR) Method for Arbitrary View Generation . . . . . 683**  
 Haitian Gui, Zhiyong Pang, Diyu Chen, Min Chen and Hongzhou Tan

<b>81</b>	<b>An Improved Low-Cost Adaptive Bilinear Image Interpolation Algorithm . . . . .</b>	<b>691</b>
	Zhiyong Pang, Huimin Dai, Hongzhou Tan and Dihu Chen	
<b>82</b>	<b>EEG Correlation Analysis Under the Condition of +Gz Accelerations . . . . .</b>	<b>701</b>
	Yifeng Li, Tao Zhang, Bei Wang, Lue Deng and Masatoshi Nakamura	
<b>83</b>	<b>Research on the Lossless Image Compression Algorithm Based on Linux Embedded System . . . . .</b>	<b>711</b>
	Liping Hao	
<b>84</b>	<b>Image Processing System Based on the ARM Embedded System Architecture . . . . .</b>	<b>719</b>
	Mingli Yang and Yihui Chen	
<b>85</b>	<b>Design and Implementation of MCU Control Module Based on H.323 Video Conference. . . . .</b>	<b>727</b>
	Fang Wu, Yingying Shen and Zhihua Zhang	
<b>86</b>	<b>Study on Teachers Speech System in Three-Dimensional Perspective . . . . .</b>	<b>735</b>
	Xiuli Xian and You Huang	
<b>87</b>	<b>Analysis of Animation Art Design Based on 3Dmax Technology . . . . .</b>	<b>743</b>
	Jing Wang and Ning Song	
<b>88</b>	<b>Research on Art Teaching Methods Modern of Multimedia Technology Based on SPSS. . . . .</b>	<b>751</b>
	Ning Song and Jing Wang	
<b>89</b>	<b>Art Design Based on Digital Image Processing Software . . . . .</b>	<b>757</b>
	Ning Song and Jing Wang	
<b>90</b>	<b>Acoustic Durational Properties of Sonorant as Syllable Boundaries in Text-to-Speech Synthesis. . . . .</b>	<b>767</b>
	Tian Fang	

**Part X Multimedia Technology and Applications**

**91 Research on Language Ability for English Teaching in Primary and Middle School Under Multimedia Network Environment . . . 777**  
Junying Liu

**92 Research on Application Model of Multimedia Database Based on Computer Network Technology . . . . . 785**  
Boran He

**93 Study on Newspaper Group New Media Strategy . . . . . 793**  
Xiaobin Ding

**94 Research on Traditional Newspaper Multimedia Fusion in the Digital Age . . . . . 801**  
Xiao Bin Ding

**95 Study of the Unique Beauty of Product Forms . . . . . 809**  
Jisheng Chen

**96 Study on Visual Arts Method Based on Music Rules . . . . . 817**  
Yi Lu

**97 Police Wrestling Skills Teaching Based on Multimedia Feedback Method . . . . . 825**  
Lin Yang

**98 Sports Teaching Model Analysis Based on Computer Technology . . . . . 833**  
Haiying Quan

**Author Index . . . . . 841**

**Part I**  
**Web, Engineering and Applications**

# Chapter 1

## Selection Model Based on Trust Domain and Personality Preference of Grid Service

Xiaoxue Ma, Zixian Wang, Fei Liu and Jing Bian

**Abstract** With the continuous development of the grid, we not only take account of the universality of needs of the grid resources but also take account of personal preference. So to find resource, which is trusted and satisfies the personal preference from mass grid resources is an important research content in grid computing area. In this paper, we propose a grid service selection model based on trust domain and personal preference. This model is based on agent platform, introduces the conception of service attributes, and uses the fuzzy clustering technology. We also introduce the trust evaluation mechanism, based on direct trust and domain recommended trust; we can select an entity, which is trusted and satisfies the personal preference. After the transaction, based on the service satisfaction, the model judges this service and updates the trust degree. The simulation results show that the model can effectively improve the services satisfactions of the requestor and has certain resilience to the fraud of the malicious entity.

**Keywords** Grid computing · Trust assessment · Personality preference · Service attributes

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## 1.1 Introduction

As an important network infrastructure, the meaning of grid is using computer networks to mix resources that are widely distributed geographically as a whole, just like a supercomputer to provide a variety of applications for different users. With the continuous development of grid technology, the demand for personalized is becoming increasingly important. Therefore, we not only have a common need of grid resources, but should also take personality preference into consideration. Finding service resources credible and meeting the personality preferences from the vast amounts of resources in the grid based on users' needs have become one of the important research contents in the grid computing field [1].

Resource discovery is a process of seeking resources to meet the requester needs based on the resource requester description of the requested resource, in the grid system. Resource discovery is mainly of three types: centralized, flooding, and distributed hash table DHT [2].

Azzedin [3, 4] first led trust into the grid resource management. Assessing the resource node behavior and calculating the credibility of the resource nodes are the basis for the choice of resources. The literature [5] assesses the relationship between fuzzy trust in the grid environment and a description of the trust information incomplete, and proposes a trust evaluation model of the trust cloud and a measurement method of similarity of in the grid environment. The literature [6] is for the dynamic characteristics of grid entities. By using direct trust, indirect trust, and consolidated trust, it builds a trust model of the evaluation of dynamic entities in a grid environment, and provides an evaluation program for grid system entities. The literature [7] introduces an analytic hierarchy process. By calculating the quality of service of the requester satisfaction and combining with trust in the service satisfaction, the establishment of a global optimal service selection model in a grid environment is set.

Due to many highly dynamic resources in the grid system, if a single entity trust is evaluated, system computing, communications, and storage is too large. The literature [8] puts forward an available autonomous domain approach to management, and the Agent and the trust management framework of trusted domain is consistent with mine [9].

In this paper, we use a management framework of trust based on the level of the agent and trust domain; in virtual environments as a platform, introduce the concept of service attributes, propose a selection model based on trust domain and personality preference of grid service, and classify the grid services in accordance with the personality preferences of the service requester by using fuzzy clustering.

A service selection algorithm is given to identify the closest service requester personality preference to make the classification. With the introduction of the trust evaluation mechanism and by combining direct trust and domain recommendation trust, determining the classification to select entity transactions, which are both safe and reliable and also can meet the personalized preference. After the end of

the transaction, judge the service and update trust according to the satisfaction of the service evaluation, as the judgment basis for future interaction.

## 1.2 Selection Model of Grid Service Based on Trust Domain and Personality Preference

Related Definitions

**Definition 1** Grid resource entities: in a grid environment, define the resources entities for the grid resource entity.

**Definition 2** Resource properties: define the collection of the elements that affect resource quality of service, such as the price of resources in the grid environment, resources speed, resources communication performance, ease of using of resources, resource security, and resource stability. Use  $ATTR = \{attr1, attr2... attrM\}$ , and  $attr_k$  ( $1 \leq k \leq M$ ) represents an attribute of  $k$  entity. Corresponding to different services, its resource properties may be different.

**Definition 3** Personality preferences: the definition of the entity on the subjective views of each attribute in the resource services for resource requests represented by  $\omega$  (Fig. 1.1).

## 1.3 Calculation Methods in the Model

### 1.3.1 Resource Clustering Based on Personality Preferences

According to the method of maximum and minimum:

$$r_{ij}^k = \frac{\min(x_{ik}, x_{jk})}{\max(x_{ik}, x_{jk})} \tag{1.1}$$

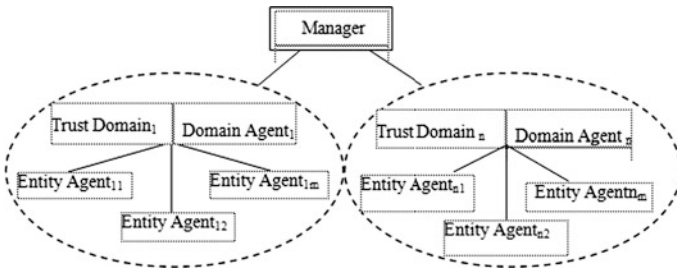


Fig. 1.1 Trust management framework based on agent and the level of trust domain



Establish fuzzy similar matrix  $R^k = (r_{ij}^k)_{N \times N}$  to various service attributes, in which,  $1 \leq i, j \leq N$ , ( $1 \leq k \leq M$ ).

Use various service attributes of the fuzzy similarity matrix which is combined with personality preference, and construct the description of the characteristics of each attribute matrix  $R$  by the following formula. By the front to prove the fuzzy similarity matrix of matrix  $R$  is:

$$R = (r_{ij})_{N \times N} = \sum_{k=1}^M \omega_k \times R^k = \sum_{k=1}^M \omega_k \times r_{ij}^k \quad (1.2)$$

We use a method of transitive closure on the matrix  $R$  to be clustered, and determine an appropriate value of  $\lambda \in [0, 1]$  to get the classification results. The value of  $\lambda$  is determined by using a subjective experience, or  $F$ -statistic method.

### 1.3.2 Direct Trust

If the entity  $x_i$  and the  $x_j$  entity are conducting a total of  $n$  transactions, after the  $k$ -th transaction is completed, combine the transaction service satisfaction evaluation, transaction amount, transaction time, and other factors, and use the following formula to calculate the direct trust value of the  $k$ -th trading.

$$T_d(x_i, x_j) = \begin{cases} 0.5 & n = 0 \\ \alpha \times \frac{\sum_{k=1}^n f(t_k) \times q(m_k) \times S_k}{n} & n > 0 \end{cases} \quad (1.3)$$

Among them,  $\alpha = \sqrt{m/(n+1)}$ , ( $n \geq m > 0$ ) is a function of the number of transactions used to adjust the number of transactions on the evaluation value. The more the number of transactions between the entity  $x_i$  and the entity  $x_j$  are, the more reliable the description of the entity  $x_i$  and the entity  $x_j$  is.  $m$  represents the number of successful transactions (in this paper, we define if transactions satisfaction is  $S_k \geq \tau$ , the transaction is successful, and the value can be defined according to the actual situation),  $n$  represents the total number of transactions the entity  $x_i$  and the entity  $x_j$ .  $f(t_k) = e^{-[(t_0 - t_{k-1})/T]}$ . Is time attenuation coefficient, indicating that the trust has a time decay.

### 1.3.3 Recommended Trust

Based on the range of inter-entity transactions, it can be divided into two kinds: domain entity transactions and inter-domain entity transactions.

Intra- domain entity trading

A domain entity transaction refers to the upcoming transaction service request entity  $x_i$  and the service provider entity  $x_j$  in the same trust domain  $TD\_APd$ .

The results of all transactions within the entity (including transactions with other domain entities) are fed back to the Domain Agent. According to the satisfaction of both sides, after the end of each transaction, the Domain Agent is responsible for updating its trust value. Thus, Domain Agent can accurately evaluate the trust value of the domain entities, which is equivalent to the recommended trust value in the general assessment system. Recommendation trust value:

$$T_r(x_i, x_j) = T_r(TD\_APd, x_j) \quad (1.4)$$

Among them,  $Tr(TD\_APd, x_j)$  represents the trust value of entity  $x_j$  in their own domain  $TD\_APd$ .

Enter-domain entity transactions

Domain Agent only saves the value of trust between the entities of the region. If we want to get the recommended trust values of the other domain service provider entity  $x_j$ , we may adopt the following two methods:

Service request entity  $x_i$  sends a request to Domain Agent to query the direct trading entity transactions with the entity  $x_j$  in the same domain.

Recommendation trust value is calculated as:

$$T_r(x_i, x_j) = \frac{1}{n} \sum_{k=1}^{Num} T_d(x_i, x_j) * T_d(x_k, x_j) \quad (1.5)$$

If this domain entities and  $x_j$  have no direct transactions or few direct transactions, we can use the following method.

By this domain Domain Agent, the entity  $x_i$  request to the domain of the entity  $x_j$  to have access to the intra-domain trust value of  $x_j$ . Combine inter-domain trust relationships, and the recommendation trust value is got.

$$T_r(x_i, x_j) = T_d(TD\_AP_k, TD\_APd) * T_r(TD\_APd, x_j) \quad (1.6)$$

### 1.3.4 Comprehensive Trust

Consolidate the direct trust and recommended trust of entity  $x_i$  to entity  $x_j$ , and we can make the introduction of self-confidence factor  $\beta$  to obtain their comprehensive trust  $T(x_i, x_j)$ :

$$T(x_i, x_j) = \beta T_d(x_i, x_j) + (1 - \beta) T_r(x_i, x_j) \quad (1.7)$$

$\beta$  is defined as the confidence factor. The higher the value of  $\beta$  is, the greater the weight of direct trust is. The confidence factor function is defined as:

$$\beta = 1 - \rho^k, \rho \hat{I}(0, 1) \quad (1.8)$$

Among them,  $k$  is said as the direct transactions of the entity  $x_i$  between the entity  $x_j$ . With the increase in the number of direct transactions, the right to direct trust weight is also increasing, and the entities are increasingly convinced of their own direct judgment. It can not only effectively resist the false recommendation of malicious entities, but also fit human interaction with reality.

## 1.4 Simulation Experiment

In order to verify the effectiveness of the proposed model, we use the simulator GridSim [10] to make a simulation of an example of selecting resources in grid environment. We use open source, Java-extensible development platform Eclipse 3.2, and operating system environments: Windows XP.

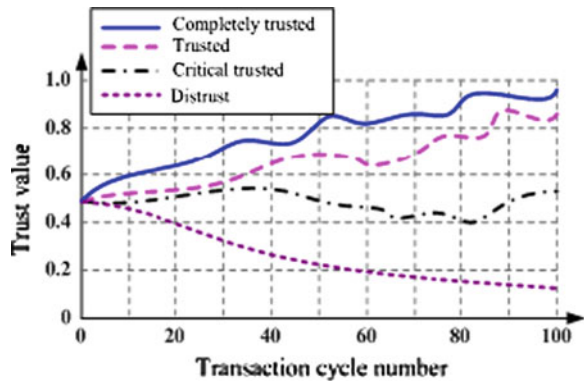
### 1.4.1 The Change of Four Types of Entity Trust Increasing with the Number of Transactions

The system consists of 200 nodes. Among them, the number of service resources is 50, and the number of requested resource is 150, and the initial trust value is 0.5.

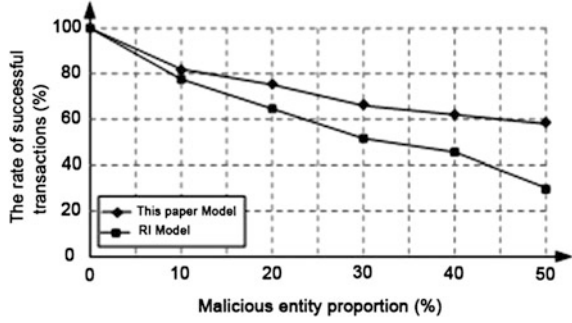
Assume  $T_{\min} = 0.3$ ,  $T_{\text{mid}} = 0.6$ ,  $T_{\max} = 0.9$ . With the change of the trading cycle, the change of the various entities of the trust value is shown in Fig. 1.2.

It can be seen from Fig. 1.2 that complete trust entity and trust entity has been providing authentic service, so the trust value increases with the number of transactions, showing an upward trend. Due to the unstable services provided by critical trust entity, the trust value is wavy. Untrust entity has been providing untrusted services, and the trust values decrease rapidly. Eventually, Entity Agent is removed from the trust domain.

**Fig. 1.2** Is the trust changes of four types of entities with the number of transactions



**Fig. 1.3** Transaction success rate with the increase in the proportion of malicious entities



### 1.4.2 Changes in the Transaction Success Rate Increasing with the Malicious Nodes

In order to validate the ability of model against malicious physical attack, we make the model simulation based on transaction success rate. In addition, we also compare with the RP model [11]. It can be seen from Fig. 1.3 that the two models of successful transaction rate tend to decrease with the increase in the proportion of malicious entities.

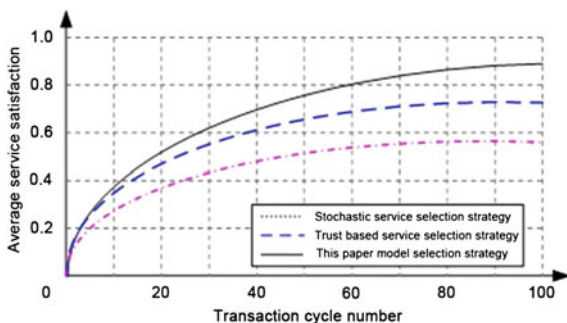
### 1.4.3 The Average of Different Option Strategies of Service Satisfaction Situations

In this paper, we use three services selection strategies, which are random service selection strategy, service selection strategy based on the trusted, and selection strategy based on personality preference and trust services proposed above: random service selection strategy, services selection strategy based on trust, and selection strategy based on personality preference and trust service.

Setting a threshold after the end of each transaction, and doing fuzzy comprehensive evaluation based on the transaction results, we can get the transaction service satisfaction. If  $S_k \geq \delta$ , it indicates that the transaction is satisfied, otherwise it is dissatisfied. The size of the threshold  $\delta$  is different, and the satisfaction of the service is also different. In this article, we do simulation using  $\delta = 0.65$ .

It can be seen in Fig. 1.4 that all entities of the trust value is 0.5 at the beginning, and the three gap little. With the increasing of the trading cycles, the trust value of the entity also dynamically changes with the service satisfaction. Trust-based service selection strategy has been chosen to trust the value of entity transaction, but because of the high trust value of the entity it does not necessarily meet the requesting entity's individual preferences. Therefore, their satisfaction is high, but compared to the present model, there are gaps. Selection strategy based on personality preferences and trust services selects the trust value of transactions

**Fig. 1.4** Average service satisfaction of different selection strategies



meeting the personality preferences of the requesting entity. Therefore, its services are most satisfied.

## 1.5 Conclusions

With the continuous development of the grid, we not only take account of the universality of needs of grid resources but also the personal preference. So to find resource, which is trusted and satisfies the personal preference from mass grid resources is an important research content in the grid computing area.

In the paper, we propose a grid service selection model based on trust domain and personal preference. This model is based on agent platform, introduces the conception of service attributes, and uses the fuzzy clustering technology. We also introduce the trust evaluation mechanism. Based on direct trust and domain recommended trust we can select an entity, which is trusted and satisfies the personal preference. After the transaction, based on the service satisfaction the model judges this service and updates the trust degree; the latest trust degree will be the basis of future judgments.

**Acknowledgments** This work was supported in part by NSFC under Grant Nos. 60873203, 61170254.

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# Chapter 2

## Study on Relationship Between Network Public Opinion and New Function Mode of Ideological Education Based on Equations of Mathematical Physics

Dongchao Jia and Linlin Li

**Abstract** With the rapid progress and development of network and information technology, the network of public opinion monitoring and management technology is constantly being improved and advanced. Implementing management of network public opinion has caused universal concern of the community; at the same time, implementing of the monitoring and dynamic analysis of network public sentiment is currently the focus of attention. Based on the network public opinion formation mode, we empirically analyze the network public opinion situation of college students, and build the college students' ideological and political education mode of network public opinion monitoring. Practice results show that the mode effectively guides the ideological and political education work.

**Keywords** Network opinion • Ideological education • Function mode • Empirical analysis • Equations of mathematical physics

### 2.1 Introduction

With the development of Network information and computer technology, the network is used more and more widely, so it becomes the information storage place and public opinion propaganda broadcasts of people ideological cultural.

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Colleges' ideological political education is the focus on the topic of the educational community and all sectors of society. How to strengthen the colleges' ideological political education, and how to effectively guide the university online education and network management [1, 2]? Today, students are more addicted to the internet, through the network to express their thoughts, attitudes, ideas, their feelings, and so on. University's network public opinion is the key important elements as the thinking, attitude, and behavior of college students. The network not only creates a good learning atmosphere for college students, but also spreads bad information [3, 4]. When the network public sentiment gives ideological political education to create the opportunity, adverse effects and negative effects will also come with it, so the university network public opinion is the focus of our attention, to make it better to guide students' ideological and political education work, to strengthen the management and supervision of network public opinion and improve the ideological political work [5, 6].

## 2.2 The Information Model of Network Public Opinion

The formation mode of network public opinion mainly reflects the main body of network public opinion, its formation process, the carrier, and other information. It can enhance our understanding of the network public opinions and find its formation, which helps to be an effective use to guide its role [7, 8].

At present, the formation mode of the network public opinion mainly has two modes: (1) The accumulation burst mode is that things happen without warning; even the participants are unable to perceive the direction and the process of its development; (2) The smooth progressive mode is from social contradiction accumulates to the network audience emotions, attitudes, and the formation of opinions, then it is from the network interaction and opinion leaders guide to network public opinion formation process [9, 10]. Its mode diagram of the network public opinion is shown in Fig. 2.1.

## 2.3 Empirical Analysis of College Students' Network Public Opinion

Aiming at college students to conduct research, each grade has selected a part of the students to carry on research, network public opinion will combine with college's management to analyze. Questionnaire content mainly includes the school's network construction, network management, network moral, and other aspects [11].

From the Table 2.1 and Fig. 2.2, descriptive statistical analysis can be shown that the largest proportion of junior students is 32.6 %, following by sophomore students that are accounted for 32.1 %, the third is the freshman students that are



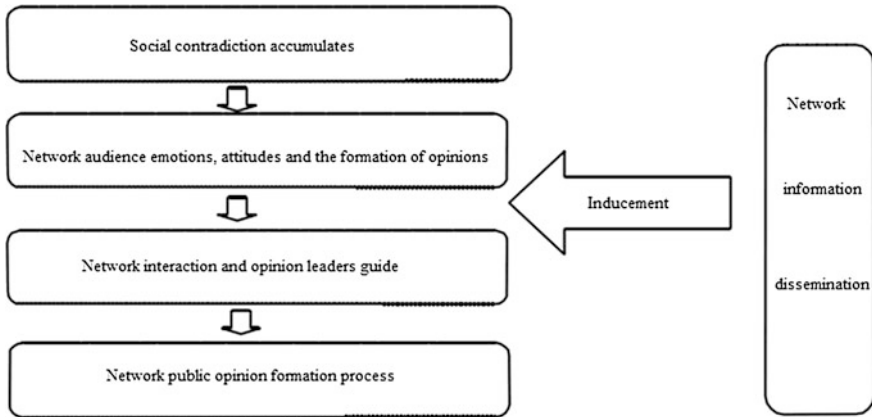


Fig. 2.1 Gentle progressive mode diagram of the network public opinion

Table 2.1 Object questionnaire data table

Sex		Freshman students	Sophomore students	Junior students	Senior students	Table
Male	Student numbers	170	219	211	98	698
	Percentage %	19.1	24.6	23.5	10.8	78.1
Female	Student numbers	36	67	70	25	199
	Percentage %	4.0	7.5	7.9	2.8	21.8
Table	Student numbers	206	286	282	123	897
	Percentage %	23.1	32.1	32.6	13.7	100

accounted for 23.1 %; however, the proportion of male is greater than the proportion of female in each grade. In the sophomore and junior, the proportion of male or female is all greater than the proportion of freshman students and senior students. The chart reflects that students participate in the network public sentiment, the freshman and senior’s attention and thinking analysis ability is not enough or is not taken into consideration.

From the Table 2.2, the network is used by the students, survey shows that students use the network scope in a very broad way, not only they use internet shopping, listen to music, watch TV, movies, online games, entertainment, body mass information, and other entertainment; but also relate to the online personals, chat, online travel, and interpersonal communication; also relate to a webpage, forum browse, read news, e-mail, learning, access to information, and other learning.

In Table 2.2 and Fig. 2.3, they show that using maximum of network learns and access to information, it accounts for 90 %; following by mail that accounts for 85.1 %; watching the news that accounts for 79.8 % is in the third position, it shows students use network effectively and fully. Students are more concerned

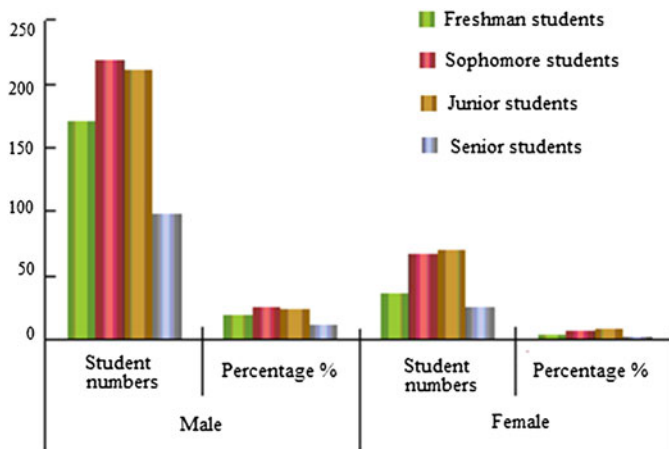


Fig. 2.2 Ideological and political education survey comparison chart of freshman to senior students

Table 2.2 Network usage survey data table in the student

Network usage	Student numbers	Usage proportion
Internet shopping	39	4.3
Listen music, Watching TV, Movies	402	45.2
Online game	30	3.3
Website, Forum browsing	187	21.1
Online dating, Chat	172	19.3
Entertainment television, Body group information	198	22.2
Read news	711	79.8
E-mail	756	85.1
Learning, Data access	802	90.0
Online travel	100	11.2

about the use of the network, so that it is more necessary to strengthen the network public opinion management, and more effectively to guide the students' information acquisition and knowledge learning. Freshmen students and sophomore students are more inclined to entertainment via the Internet. However, junior students and senior students pay more attention to the acquisition of knowledge and learning, in order to enhance themselves and increase employment opportunities and ability.

In Table 2.3, students show moral attitude toward restraint in the network surveys, 5.2 % of the students do not understand network moral attitudes, 60.4 % of the students think Internet morality, but also need to strengthen, 27.2 % of the college students think that the network constraints do not exist, and students who think network constraints are stronger account for 7.2 %.

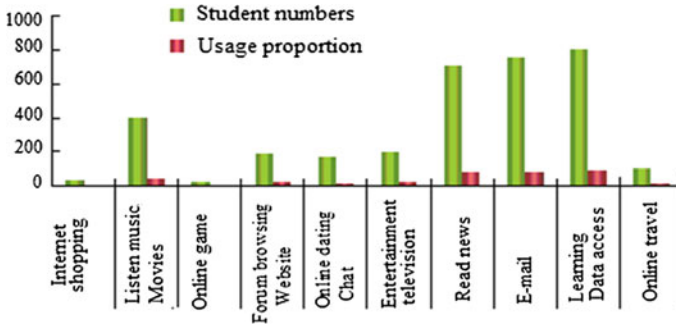
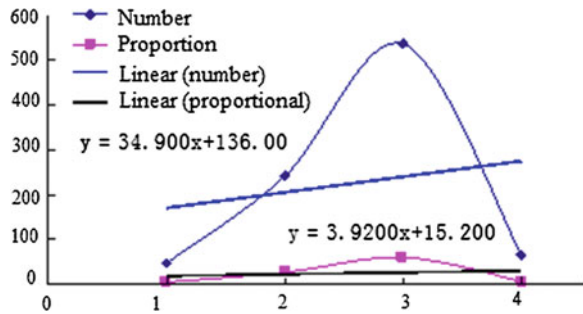


Fig. 2.3 Using the network situation contrast chart

Table 2.3 Students' moral attitude toward restraint questionnaires in the network

Item	Number	Proportion
Not understand	48	5.2
Network constraint not exist	242	27.2
Need to strengthen	537	60.4
Stronger network constraints	66	7.2

Fig. 2.4 Students moral constraints attitude curve in the network



From Fig. 2.4, it can be shown in network moral attitude toward restraint curve, students do not understand and believe that the network does not exist in the number and percentage tend to a low position; however, the network constraints strong student ratio in the lower position, there has been around 30 % students for network moral awareness that is not enough, they reflect that college students in network public opinion and other aspects of the construction have to be strengthened and improved, need to guide the students to pay close attention, in order to regulate the school network construction, use, and management. Due to freshmen students and sophomore students at the subjective understanding respect are quite limited, the negative effect of network opinion easily relates to the students of lower grades, junior students and senior students relatively have independent and self-control, they can effectively restrain themselves for network

operation and management, so the university should strengthen low grade students' education and guidance, however high school students should strengthen its supervision administration.

### 2.4 University Ideological and Political Education Mode Based on Network Public Opinion Monitoring

The test supervision system of network public sentiment is not only helpful to the teachers of college in ideological political education work, but also effectively helps master students in the status of the thinking and dynamics, to achieve target to begin the work, to avoid danger, to provide help against possible trouble, to play the role of prevention. At the same time, it can also throughly use the supervision system of network public opinion to check yourself to strengthen your place in the ideological political education, to carry on appropriate improvement, strengthening the network public opinion, and the ideological political education management, to control and feedback effect.

In Fig. 2.5, University ideological political education element relation model of network public opinion monitoring relates to the object, which not only has education, educated, network space, and real space, this system is interconnected with the closed-loop system of the interactive feedback response. The education information through exchanges and communication is stored in the network space, as well as in real space advocacy and learning, coupled with education in the publicity and feedback of network space, together in the network space, for the real space feedback and coaching. However, the network public opinion monitoring management system will focus on network space information acquisition, through analyzing the realistic space, finally to carry out public opinion report production

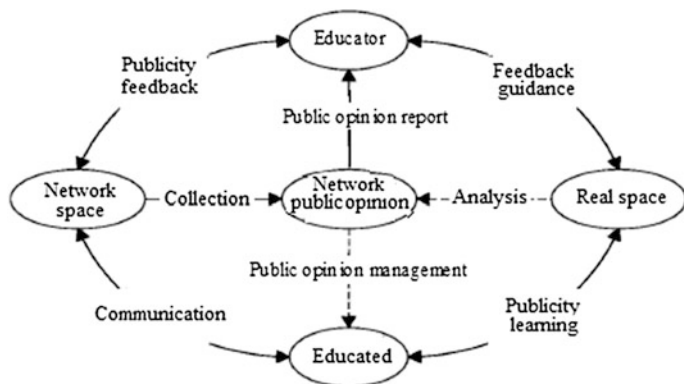


Fig. 2.5 University ideological political education element relation model based on network public opinion

and research, and statistical analysis of the educated public opinion management status, to effectively realize the network public opinion monitoring prevention, monitoring, and feedback and process management.

## 2.5 Conclusion

Effective ideological political education is the focus of social concern, how to network public opinion test system, the supervision technique applied to the ideological political work in universities, it is worth thinking about the field, not only contribute to the ideological political work, but also contribute to the innovation of the ways and means, and also help thought political education to improve efficiency. Through the use of network information technology's communication advantage and network computer processing functions, to continuously strengthen the college political ideological education method and mode, it can effectively improve the undesirable network information for the students' negative effect, to guide students to effectively use the internet, strengthening the management of the ideological political education, and making it more adapted to the development situation of the current network times. Through the network public opinion monitoring system to carry on ideological political education in universities it can quickly understand the students' status and dynamics, and promptly take measures to strengthen the ideological political work and management, improve efficiency; at the same time, it has also carried on the thought and mode innovation, to look for a new type of path. It offers students a more effective ways of strengthening ideological, two-way communication, and to promote the ideological and political work.

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# Chapter 3

## Web-Based Cross-Country E-Pal Enhance Writing Teaching

Shaojuan Zhang, Xitao Gu and Yuanyuan Zhang

**Abstract** This paper examines how the real social context which formed by cross-country E-pal thought internet help students improve second language writing. There is a comparison between three groups so that the function of E-pal may be distinguished. Especially, this paper tries to testify the function of real social meaning audience in writing. In the process we try to do some explorations in the field of CALL.

**Keywords** E-Pal · Call · Writing · International communication

### 3.1 Background

#### 3.1.1 The Development of CALL

Since the 1980s, computer assisted language learning (CALL) has been developing rapidly, and many studies have been conducted in this area. For example, Lun [1] proposed an integrated approach to CALL, emphasizing the importance of pulling linguistics, educational psychology, computer science and information technologies together for the effective design and implementation of CALL applications. In addition, Szendey [2] wrote a practical guide to using computers in language teaching, describing various CALL classroom activities. The advent of the Internet

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has significantly contributed to the boom in educational technology and rapid growth of online education in recent years and language instruction is no exception [3, 4].

### ***3.1.2 The Necessity of International Communication***

In our increasingly global community, it is essential that schools support children in developing productive and meaningful relationships with others at home and around the world. “Getting to know each other requires a personal touch. It is not enough to have knowledge about one’s race, one’s ethnicity, one’s country or region of the world. We must come to know each other person to person” [5]. A productive method for assisting students in developing personal understandings of other peoples is through pen pal friendships [6].

The writing of pen pal letters has been a popular practice for generations. Pen pal relationships are most likely to develop during childhood and adolescence, and they serve the purpose of providing safe arrangements in which children can form close and open relationships with peers [7, 8].

### ***3.1.3 The Concept Changing of Teaching Writing***

Traditionally, the instructional focus for writing is primarily centered on the acquisition of prerequisite skills, often in isolation. Opportunities for students to develop competencies in writing are often contrived and artificial (work-books, worksheets), with little chance for the learner to engage in a natural process of writing. The advent of e-mail and popularity of computer interaction among children and youth provides a natural, “nonacademic” written communication medium.

In addition, a primary aspect of writing often ignored by traditional writing instruction is the social nature of writing. Because writing is communication, it needs to occur within a social context (Schultz) computer correspondence through e-mail and instant messenger services has replaced telephone use for many social interactions conducted by the youth of today.

Basic to the concept of holistic teaching are the tenets that literacy instruction needs to be relevant, serve a real function or purpose, and be meaningful to the language learner [9]. One activity that meets these requirements for literacy growth is writing and receiving personal letters from a pen pal [5]. The traditional description of pen pals as peers who exchange letters is not new. However, recent projects involving pen pals of targeted partners have demonstrated added benefits. For example, projects involving school children and senior citizens [3] and peers



of other races [7] have resulted in positive relationships and increased understanding and respect between partners and groups as a whole. Pen pal projects with students in different countries have been suggested as a way to increase awareness of global issues, ethnic diversity, cultural pluralism, and interdependence (Peters 1985). Electronic mail, another vehicle for written exchange between individuals, has provided students motivation for written communication as well as practice in emerging technological skills [1, 7].

It is believed that written interaction results in comparable benefits for a variety of students [10], including English as a second language students [11]. Both activities potentially provide an atmosphere for learning that incorporates a safe social context, an attentive audience, a meaningful exchange of ideas, and individual and personal response—all of which are situations likely to increase motivation to write better and to write more [2, 8].

## 3.2 Activity Design

### 3.2.1 Groupings

We selected 150 students in the Foreign Language Department of XingTai University and 100 American students from Bixby schools (including high schools and middle schools). In this paper, the Chinese students are the research object. They are divided into three groups, as the following (each group has 50 students):

Pen-pal learners used corresponded by handwritten, hard copy letters to the American students.

E-pal learners used e-mail through the Internet to communicate with American students.

Control group participants wrote to an imaginary correspondent and realized no feedback from their communication [10].

### 3.2.2 Writing Time

Chinese students allocated 1 h a week for pen-pal letter composition. Grouping Chinese students allowed subtle direction for development of writing skills in the less structured environment of friendly written communication. Selected American students from Bixby High schools served as positive writing role models and social setting for correspondents. Participants were considered in the pairing of learners to assure equitable distribution of the different learners in the assorted groups [11].

### 3.2.3 Writing Issues and Challenges

Research indicates that the writing difficulties of English as the second language learners result from problems with basic text-production skills, target language and culture knowledge, negative transfer of mother tongue, and difficulties with planning and revising text. The whole process are under the supervise of teachers both sides [12].

## 3.3 Result Analysis

Of greatest importance in this study was the improvement of all students' writing when involving e-mail, as compared to traditional pen-pal correspondence. The motivational factors were not measured in the study, but noted in feedback given by all students who participated. It indicated an increase in the total words generated in their e-mail correspondence (126.2 words for baseline data; 174 after 6 months).

Pen-pal letters offer students an opportunity to write in a setting that involves a genuine audience. It requires students' use of writing skills in a social context to communicate in an authentic setting for personal reasons as well. In all measurements, the mean of students in the control group, students with similar grade placement as the experimental group who wrote to a fictitious audience, decreased (baseline 116.5 words; after 6 months of writing to the fictitious audience, 85.7).

These data support the social context provided by pen-pals (either traditional or electronic) as a valid means of improving student writing.

The study indicated that the students who wrote to pen-pals wrote longer and more complex letters once they received responses to their letters, leading the authors to suggest the importance of providing real audiences for writing. This study provided further support of pen-pals by measuring the total words generated per sample. A significant difference was found between treatment and time when measuring total words written (see Table 3.1).

Over time, students in the e-mail group generated more words per writing sample than did those in the traditional pen-pal group.

As students participate in responsive letter writing within the framework of an organized pen pal project, they are engaged in a literate activity for the tacit purpose of mutual communication with another individual from whom they expect

**Table 3.1** Total Words Written

	Baseline	Post
E-mail Group	115.6	126.8
Traditional Pen-pal Group	108.3	117.4
Control Group	108.6	87.4

to receive a response [6, 12] established that students learn more effectively through experiences that are meaningful and relevant to them. Through letter exchanges with others, children have an authentic opportunity to develop strategies for determining the meaning of written language [4] and to construct written language in return that reflects their intended meanings (Wells 1996).

### 3.4 Conclusion

Pen-pal relationships afford many learning opportunities, including supporting literacy development and content learning in all of the curricular areas. Furthermore, pen pals provide students with a safe context for forming personal friendships during stages of development in which the desire for close friendships with peers is high. Finally, participation in a letter exchange provides the opportunity for students to learn about and value cultures different from their own.

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# Chapter 4

## Internet Marketing Strategy Based on E-Commerce

Feng Xiao Shun

**Abstract** With the accelerated pace of e-commerce applications, social development has entered the era of the Internet economy. In the situation that the rules of competition in the market, economic growth, and social life have changed profoundly, what strategies companies will use to integrate the resources of the enterprise, improve marketing efficiency, causing the community's attention. By researching on e-commerce network marketing, combining with the problems in the network marketing in China, we put forward China's e-commerce network marketing strategy in this regard. In the twenty-first century, with the rapid development of economic integration, e-commerce came into being, flourished and injected new blood to the survival and development of the modern enterprise.

**Keywords** E-Commerce · Internet marketing · Marketing strategy

### 4.1 The Implications of E-Commerce and Internet Marketing

E-commerce refers to electronic trading activities. There are two kinds of definitions—broad and narrow [1, 2]. Narrow e-commerce refers to the use of the network environment to conduct electronic transactions on the Internet, including online advertising, electronic ordering, online negotiations, electronic payments, and so on. In addition to electronic transactions, Broad e-commerce also includes the use of the network environment for other business activities, including

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commodity management, customer management, market analysis, business decision making and the formation of virtual enterprises. Network marketing is generating and developing with the Internet, is an important part of e-commerce, and a marketing tool to achieve certain marketing objectives with the help of the characteristics of the Internet, including the online market research, online consumer behavior analysis, network marketing strategy, network marketing, price strategy, the channel selection of online marketing and network marketing management and control, being globalization, interactive, personalized, efficient, and economic characteristics [3]. In the Internet era, they put an important impact on enterprise development.

## 4.2 The E-Commerce Impact on the Competitive Situation

1, at the enterprise level, the good interface with customers of e-commerce, and the combination of data exchange standardized and personalized are outward extension of the internal intelligence management system. Such a good and powerful information exchange interface, make easier to express individual needs and enable enterprises to make more flexible production of low-cost customer-centric, which will inevitably form the personality in direction of production from the large-scale mass production to meet the outstanding personalized customer.

2, e-commerce development of information technology-oriented demand to improve the quality of the employees and the cooperation of the enterprises function as the center of the group teamwork, flexible corporation structure, authorization, caring staff, and stressed that the multilevel employees of self-realization will be hi-tech enterprises and knowledge-based enterprises classical management model, will also gradually become the best choice of the ordinary use of e-commerce [4]. The course of development of e-commerce is not only a leap in the process of internal and external means of communication of information and knowledge-based enterprises, but also the information; intelligence process is the sublimation process of the quality of enterprise technology, management, and human quality. In this regard, the management of technology, organizational structure, business philosophy, market management is necessary to make the appropriate knowledge-based information transformation. Strengthening the innovation capacity of enterprises, and strengthening the sense of innovation of employees, initiative, quality, so that enterprises in the healthy growth under the new conditions, will gradually become the only way to business success.

In short, the development of electronic commerce is changing the rules of competition among enterprises, the size of the business and economic characteristics and scope of the economic framework to establish new standards of a corporate competitive efficiency and effectiveness, forming a new corporate mode of competition, business growth model.

Under the new conditions that e-commerce management tool gradually become a critical business management, the competitive advantages and disadvantages of

the combination of enterprises of different sizes, different industries will have the new changes, business competition will become more three-dimensional, enterprise development will be more diverse and business flexibility will be the basic premise of the rapidly varying environment to cope with the new.

The internal organization is the fundamental framework for enterprises to adapt to the environment [5, 6]. A broad strategic alliance of outside enterprise based on maintaining their own characteristics is essentially the same premise, to maintain their basic vitality and meaning of existence under the conditions of borrowing external forces, constructed a powerful tool for competitive advantage. In the state of the Technological development “explosion” and e-commerce as an effective information processing means, independent development of all their survival and advanced technology necessary existence is not economic and does not have the time validity. The cooperation between enterprises, technical and development, technology outsourcing, and package of strategic alliances, are important of the enterprise to solve these problems, effective and viable “win-win” strategy. In fact, strategic alliance companies is developing their own separate technology development to enhance their market power to seize market opportunities, reduce the “lose-lose” an unavoidable choice.

At present, we are in electronic technology, e-commerce development which started late has weak economic foundation; learning other people’s details is the first insurmountable stage. However, our study must have a choice. In the network “bubble” rely on venture capital and moisture to survive or develop the network profit may burst in some financial crisis or even bankruptcy, insolvency, we should not simply imitate the U.S. e-commerce development model as the high-tech model development, this means that we must explore based on China’s national conditions, our management culture for the Chinese e-commerce development model.

### **4.3 The Principles Of Network Marketing**

Network marketing is the use of all recognized by the target user and guide users concerned about the behavior or activities carried out by the Network Service Platform to promote product sales and improve brand image. Therefore, to do network marketing plan, the following four principles are suggested :

#### ***4.3.1 Systemic Principles***

Planners should be based on system theory, integration, and optimization of the various elements of the enterprises network marketing activities, preparing ‘six streams’ (information flow, business flow, flow manufacturing, logistics, capital flow, and service flow) , the overall optimization.

### ***4.3.2 The Principle of Innovative***

Network has brought great convenience to compare the benefits for customers of different companies providing products and services. In the marketing environment of personalized consumer demand, innovation to meet the personalized needs of the customer to adapt the product features and service characteristics, is the key to improve the value-added effectiveness .

### ***4.3.3 The Principle of Economy***

Network marketing plan must be to make the economic efficiency. Network marketing plan not only consume resources, but also through the implementation of the program, changing the configuration state of the enterprise resource using efficiency. The economic benefits of network marketing plan are the ratio between the economic benefits of the planning and program implementation costs. Successful network marketing, planning should be with program implementation costs established to achieve maximum economic benefits, or spend a minimum cost to obtain the target economic benefits.

### ***4.3.4 The Principle of Operational***

Operability, in network marketing programs, is according to the network marketing objectives and environmental factors, what enterprises network marketing activities do, when to do and where to do, how to do, how to carry out a thorough deployment are described in detail and specific arrangements made. So that everything is done and the powers and responsibilities in place.

## **4.4 The Problems of Network Marketing**

The network marketing model is different from traditional marketing, virtual of its products, authenticity, security, etc. so that consumers are prohibitive, and hinders the development of network marketing.

### ***4.4.1 Network Marketing Psychology is Lack***

- (1) Customer network marketing lacks trust. Online shopping makes a long time consumer “seeing, feel with their hands, ears” be tied to the traditional shopping habits, increasing the difficulty of the customer to identify products.

(2) Network marketing does not meet certain psychological needs. Consumers are not able to display the online shopping process to their social status or ability to pay, no shopping attention and respect; therefore, online shopping cannot meet the social needs of individual consumers.

2, the choice of product is limited such as timing, space, etc., for network marketing. For some products is not practical. Under The traditional marketing mix strategy, product strategy is an important part of corporate marketing strategy; however, with the development of social productive forces, as well as network and information technology, the traditional product strategy began to change gradually evolved to meet consumer demand marketing strategy. As part of their product strategy, it can be divided into physical products and information products.

#### **4.4.1.1 Physical Products**

Basic principles of physical products to select in theory on the network marketing in any form of physical products but at this stage by the influence of various factors, network marketing cannot meet this requirement. In general, enterprises in the network marketing, the current can first select the following products:

First, a high-tech or high-tech performance products;

Second, market coverage products;

Third, Special products is not easy to set up shop;

Fourth, Online marketing costs far less than other sales channels, costs of products;

Fifth, the larger the capacity of the network groups in the target market;

Sixth, facilitate the distribution of products;

Seventh, brand-name products.

B, selecting the product should take full account of the performance of their own product range of the area of product marketing and logistics and distribution system and product market life cycle.

#### **4.4.1.2 Information Products**

Three images complemented by programs, sound, etc. to display their products so that consumers, such as its territory in person, feel the existence of the product, a more comprehensive understanding of various aspects of the product. To establish a “virtual showroom” to pass information in a better manner to meet the needs of consumers, enterprises should be established in the “hall” in the display of different products, and the establishment of a navigation system, so that consumers can quickly, find the product information they need.



### **4.4.1.3 Payment Security**

Technically, the core of the development of network marketing system and the key is the security of transactions, such as financial security, information security, and commercial confidentiality: the Internet itself open, virtualization and mobility, making online transactions face various dangers, such as network leaks, network fraud. Businesses are afraid of a commercial leak, as well as false shopping, while consumers worry about the false delivery and goods that does not match the real situation. The online payment security problems to a certain extent affect people's trust in online transactions, which restricts the development of network marketing.

## **4.5 The Network Marketing Strategies**

### ***4.5.1 Product Strategy***

Internet marketing of products and services should be by information technology standardized, and take advantage of the Internet, which has a two-way communication features, customized marketing, making the customer for products and services via the Internet in the enterprises under the guidance of the selection, design. Network to sell the product costs is far less than other marketing channels, so the companies' right choices can be obtained through the network marketing greater profits, you can quickly attract more consumers.

### ***4.5.2 The Pricing Strategy***

First, the enterprises should be acceptable to consumers the cost of pricing: the first customer give acceptable price, then the enterprise according to the organization of the cost products and sales; bargaining will be the most common way of enterprise product pricing. Second, a correct understanding of the characteristics of their own products performance and low cost is compared with the same industry competitors' products. In addition, according to the different marketing purposes, they can be phased pricing, timely adjustment of the price.

### ***4.5.3 The Promotion Strategy***

The most creative way of online advertising is in network marketing strategy, it is different from newspapers, magazines, television, traditional advertising media, taking the characteristics of goods, features, prices, and other information on the

network by the consumer if they need or wish to query. The effect of the use of online advertising can be tapped more potential customers, broaden the level of consumption of products.

#### ***4.5.4 Channel Strategy***

The largest network marketing revolution is in the channel above, the online sales channel is making use of the Internet to move products from producers to consumers of the intermediate links and the starting point is the manufacturer and ending are the consumers and users. In order to facilitate the consumers to buy, we not only should be timely released promotional information on the website, the company dynamic, but also provide a variety of payment methods in order to facilitate the purchase, consumers have more choices in the construction of the company's Web site, set up a network stores to promote sales.

Network marketing as a new marketing methods, is low cost, with large amount of information, spread widely, fast, in no time without geographical restrictions, vivid image, can be two-way communication, feedback quickly show the incomparable superiority of the traditional marketing sex. Due to the rapid development of e-commerce the problems are surfaced. Understanding the network marketing problems and responses and prescribing the right medicine to the development of relevant policies and strategies enable the stable development of China's e-commerce.

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# Chapter 5

## VNA Time-Domain Technology Analysis Based on Virtual Instrument

Ying Liu, Rongyi Duan and Jiayu Xie

**Abstract** In this paper, it focus on the need for setting up a virtual vector network analyzer (VNA), which only has frequency-domain measurement technology. The software model is presented and many simulations are performed within the Lab view software. Using the chirp-Z and inversing chirp-Z transform, after the window function and gating function processed it gets the frequency response, which removes what it does not want, such as impedance discontinuity. A very good agreement among the results of the proposed technique, results available in the literature [1], and experimental results is observed. At the end of the paper, the practical measurement results and late transform results are given. It easily proves that the results are closer to the true parameters of the Device under Test (DUT).

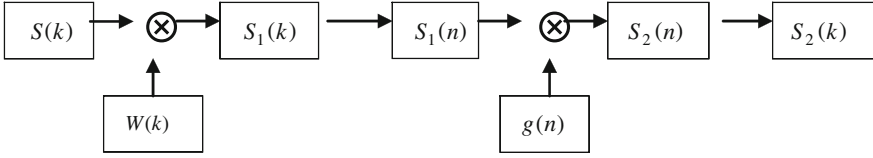
**Keywords** Chirp-Z transform · Time-domain · Virtual instrument · Window function · Gating function

### 5.1 Introduction

At this stage, with the rise of digital communications, RF and microwave applications will be widely used, and their circuits will become increasingly complex. To this end, VNA measurement techniques for performance analysis are particularly important. VNA, which must be calibrated first [2], May reflect the precise performance parameters of DUT. During the processing of measurement, impedance discontinuity, or inevitable interference makes more unwanted reflection or

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**Fig. 5.1** Overall processing block diagram

scattering signals superimpose on frequency responses of the DUT [3, 4]. To alleviate these spurious, time domain function can demonstrate its advantages. But the VNA, used in this article, has not the time-domain function. So, in order to achieve the purpose of extracting parameters correctly, it must rely on some software for data processing.

Establishing a network relationship between the frequency response and time domain response is described by the Fourier transform, just like the chirp Z-transform (CZT). The transformation of measured data from the frequency-domain to the time-domain is obtained by means of the inverse chirp Z-transform (ICZT). However, as the previous say, getting these signals are not simple Fourier transforms but they must be modified. To this end, it uses the following idea or approach to extract the parameters of the DUT: just like Fig. 5.1, responses in frequency domain are first added window function, whose expression is  $W(k)$ , so signals are cut and displayed in limited length. Then, they are transformed to time domain with ICZT. In time domain, many interfering signals or reflection signals can be seen. We can use the gating function,  $g(n)$ , whose function is similar to the filter, to remove unwanted signals. Finally, they are transformed to frequency domain. Then, the precise parameters are gotten.

## 5.2 Principles and Approach

Just like Fig. 5.1, it is known that signals in frequency domain should be embedded window function to process, then transformed to time-domain. Therefore, signals, which were modified, are obtained in time domain. In time domain, signals are processed with the help of gating function, which can remove unwanted signals, and then transform to frequency domain using the chirp-Z transform.

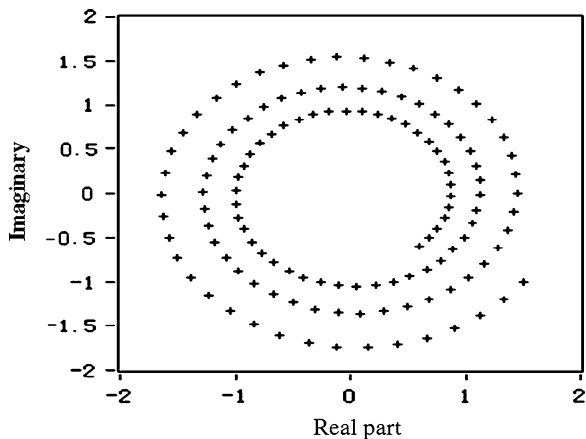
### 5.2.1 Chirp-Z Transforms

The chirp-z transform can be understood as follows:

There are strings of limit numbers sequence  $x(n)$ ,  $0 \leq n \leq N - 1$ .

The article utilizes the following formula for Z transform:

**Fig. 5.2** Sampling points in the Z plane



$$X(z) = \sum_{n=0}^{N-1} x(n)z^{-n} \quad (5.1)$$

It is ordered that: Z sampling point

$$z_k = AW^{-k}, \quad k = 0, 1, \dots, M-1 \quad (2)$$

$$\begin{cases} A = A_0 e^{j\theta_0} \\ W = W_0 e^{-j\varphi_0} \end{cases} \quad (5.2)$$

The  $A_0$  represents length of the radius of the sampling point which is usually no more than one the  $\theta_0$ , is the phase angle of sampling point,  $\varphi_0$  represents equal angle between adjacent corners. And  $W_0$  is the stretching rate of the spiral. When  $A_0$  is equal to one, the circular arc is part of the unit circle.

Jointing formula (5.1), (5.2) and (5.3), we can get  $X(z_k)$  as follows:

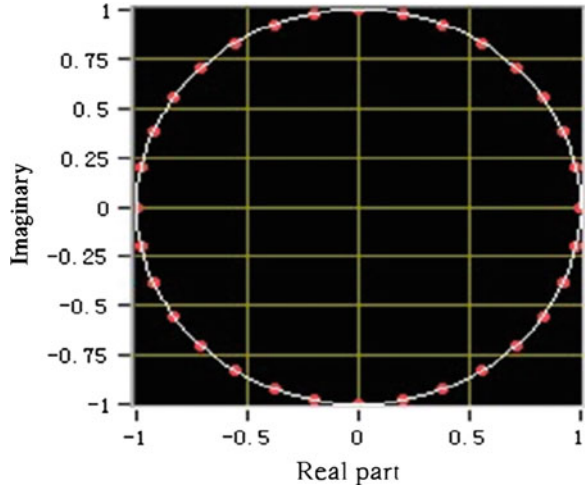
$$X(z_k) = \sum_{n=0}^{N-1} x(n)A^{-n}W^{nk}, \quad 0 \leq k \leq M-1 \quad (5.3)$$

$X(z_k)$ 's simulation in Z plane looks like Helix line (Fig. 5.2). When A is equal to one unit, it is the unit circle (Fig. 5.3).

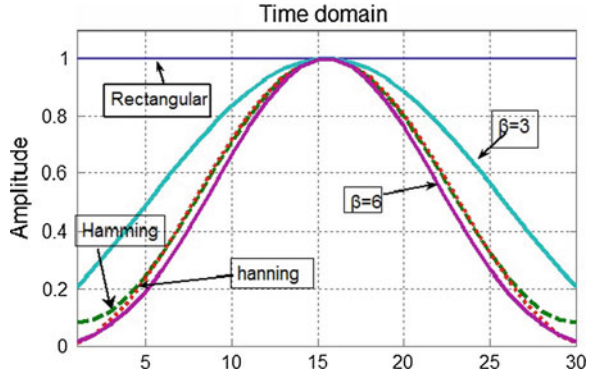
## 5.2.2 Window Function

When a limited response signal in the time domain transforms into the frequency domain after Fourier changes, there will be a wireless frequency response. However, due to hardware problems of the VNA itself, it makes the frequency response limited. So it will produce side lobe during the transform into time domain, and reduce the dynamic range of the test of time domain. This article must look for

**Fig. 5.3** Sampling points when A is equal to one



**Fig. 5.4** Time domain simulation of window functions



another method to solve this problem. Window function can well minimize this distortion. An appropriate window function makes its spectrum have some feature as follows:

Main lobe is narrow and high, so that the transition zone is as steep as possible.

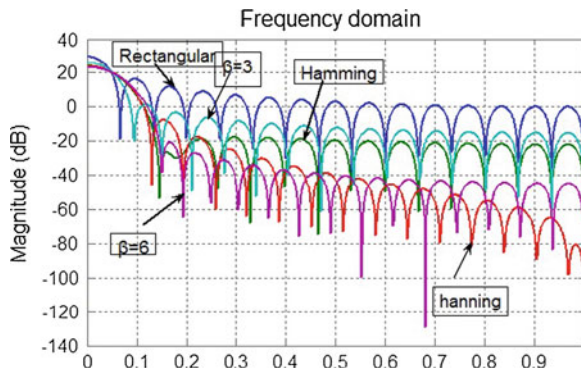
Side lobe is as small as possible relatively to the main lobe, so that the energy can concentrate on the main lobe.

There are many window functions, just like hamming window, hanning window, Kaiser-Bessel window. The time domain simulation (Fig. 5.4) and frequency domain (Fig. 5.5) of several window functions are got in the software Matlab.

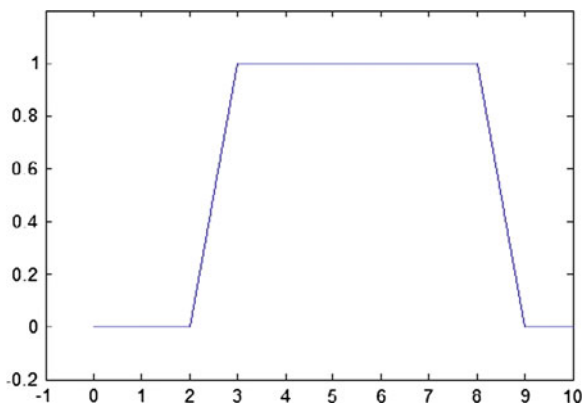
### 5.2.3 Gating Function in Time Domain

Microwave circuits often bring DUT impedance discontinuity and so must decrease the impact of these discontinuities to a minimum. Because of the DUT

**Fig. 5.5** Frequency domain simulation of window functions



**Fig. 5.6** Gating function's simulation in time domain



impedance discontinuity, there must be reflected Microwave circuits discontinuity and it also brings the inaccuracy of the test parameters. So, in order to reduce the impact of these discontinuities to a minimum, there came up with the concept of time-domain gate. This paper use gating function to remove the impact of a variety of mismatch. Usually, there are many discontinuities, such as coaxial connector mismatch, impedance mismatch, a variety of components' connections mismatch.

The gating function selected in time domain can make a reference to the window function, its shape is similar to a filter in frequency domain. Minimum gate makes maximum fluctuation within the pass band and the highest side lobe level, but has the fastest cut-off rate, which can be easy to separate reliably close to the time domain response. Largest gate is almost no fluctuation in the side lobe in the pass band, and the level is also low, but the intercept speed is not fast.

$$h_d(n) = \begin{cases} e^{j\pi n}, & 0 < n1 \leq |n| \leq n2 < N/2 \\ 0, & \text{others} \end{cases} \quad (5.4)$$

In Fig. 5.6, the span time is just 6. However, various DUT and fixtures' gating start and stop time are not the same; therefore, we should choose the reasonable gating to achieve optimal results.

### 5.2.4 Realization of the Virtual Instrument

Traditional machine vision software has C language, VC++ or other high-level languages, but they are still relatively difficult in practical engineering applications. Particularly, the engineers, who are not familiar with the programming language, get to start very slowly. This paper adopts Lab view [5], which is short for Laboratory Virtual Instrument Engineering Workbench, and is developed by NI Corporation. It has the most powerful integrated development environment based on graphical language. And it has a huge library, including data acquisition, GPIB communication, serial control, data analysis, and so on. And it also can realize auto-test.

Based on the above analysis combined with the Lab view programming features, this paper use Kaiser-Bessel window function the Chirp-Z transform and its inverse transform. Taking into account data processing capabilities of Mat lab, gating function is programmed in Mat lab. However, how does Mat lab insert to Lab view? The Math script RT Module in Lab view can be a good solution to this problem by adding the input/output node, without opening the Mat lab program.

### 5.3 Results and Discussion

In order to validate the program, a male to female adapter cable is used to analyze its time-domain performance. In Fig. 5.8, there are two peaks in time domain, which are affected by the coaxial connector mismatch. Giving the rear panel programming (Fig. 5.7) and operation results (Fig. 5.9), it compares to the parameters before removing the discontinuities. The red line is getting the accurate

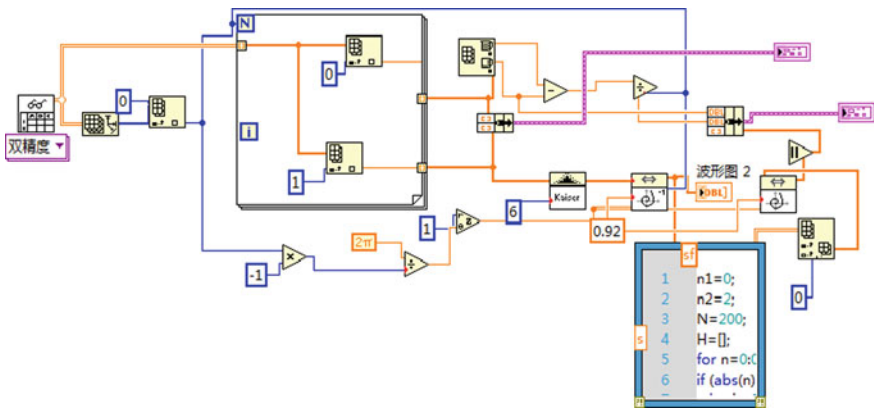


Fig. 5.7 The program in the rear panel



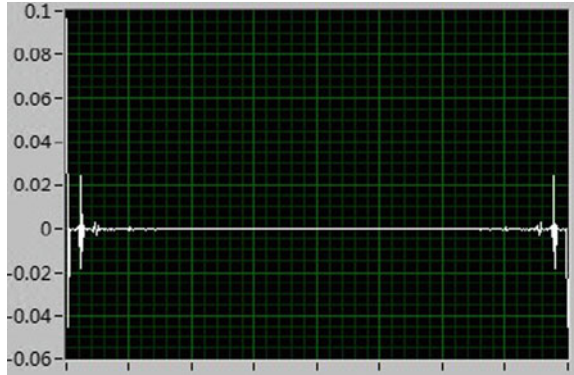


Fig. 5.8 The response in time domain

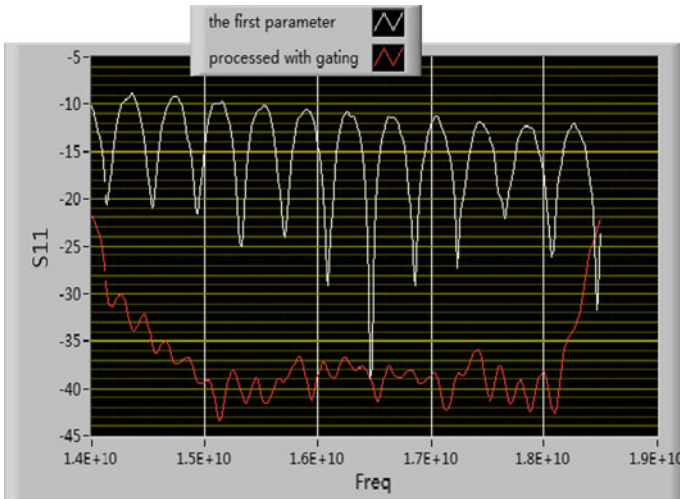


Fig. 5.9 The cable's reflection coefficient

parameters without effects of the coaxial connector mismatch. Thus, it will be better to give reflection properties of the cable.

### 5.4 Conclusion

In conclusion, the virtual instrument software can supply a good measurement method for time domain. All algorithms, programming are integrated into Lab view, which has a good graphical interface, easy operation, fast transform. It plays

an important role in the actual measurement. This article introduces first Fourier transform, then the data processing in the time domain and frequency domain, and finally gets the frequency response, which is close to the true parameters of the DUT. Many experiments proved that the gated center time is different, the measured data is different. The latter part of this thesis work is to be further optimized and the algorithm to be closer to its true parameters.

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# Chapter 6

## Campus Network Data Integration Based on XML

Zhijian Yang, Xianyang Li and Bifeng Liao

**Abstract** With the rapid development of Information Technology, the data storage capacity of the college application system is increasing; the problem of “information silo” has become increasingly prominent. Combining the data sharing demand from colleges, this chapter analyzes the difficulties that colleges have in data integration and puts forward the solution for data integration.

**Keywords** Data integration · XML · Java · Heterogeneous

### 6.1 Introduction

With the rapid development of the construction of campus information, campus network is playing an extremely important role in school’s teaching, researching, and management. According to statistics from related departments, every university has more than ten application systems running stably on campus network. Due to the differences in department business and functional attribution, application systems are developed using different hardware and software environment, and application data is organized and managed differently [1]. These lead to internal data resources of campus network and data services into separate modules, functions, or departments to form only and cannot be shared between “information silos”. With the continuous

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improvement of the Campus Network applications, they continue to put forward the demand for data exchange between applications. For example, the educational systems need to get the basic information of teachers from the personnel system, they also need to learn the work system which provides the standard data of the changes in student enrollment and student status information. The operating system needs to obtain from the logistical information such as address and student Hostel's Hostel telephone [2]. Authorization of data among the application systems becomes more and more; a variety of exchange coexists and forms an intricate network structure, greatly increasing the transparent data access complexity. It is a pressing problem about how to effectively integrate the distribution of a wide range of data sources reasonably, then achieving the exchange of data between different databases and resource sharing, eliminating the phenomenon of the "islands of information".

Data integration of distributed heterogeneous data sources will be connected logically, physically, or organically together, which allows users to access these data sources in a transparent manner, providing comprehensive data sharing for schools or businesses. Before the integration of each heterogeneous data source, it has been presented in various functions or departments of database and has its own independent DBMS. After the integration, each data source still maintains the independence, integrity, security control and application characteristics, and moreover, different functions or departments of data between the database and can be accessed for data sharing and transparency [3, 4].

## **6.2 Difficulties of Heterogeneous Data Integration**

Difficulties of heterogeneous data integration can be summarized as the following.

### **6.2.1 Heterogeneity**

Integrated data source belongs to different databases, and the databases of different functions and departments are usually independent, so the heterogeneous data model brings great difficulties to the integration. These heterogeneities mainly manifested in: same data semantics, semantic expression forms, data sources, the using environment of data, and so on [5].

### **6.2.2 Distribution**

Data source is distributed in an area, there will be a network performance and security issues if we rely on the network's transmit data.

The birth of XML technologies provides a cheap, simple, and efficient technical support for heterogeneous data integration, laying the foundation for data exchange among applications running on different nodes of the system. The external features of XML and network technology promote the development of the database integration. At present, based on XML data integration, the principle of which is the use of intermediate JAVA programs is to store relational database, and convert it to XML format, and bring XML format transfer into the final database [3, 6].

### **6.3 Technical Feasibility of Java and XML**

As a pure object-oriented programming language for the network, compared with other programming languages, JAVA has the significant advantages of security, stability, and heterogeneous environments, which can develop a cross-platform application components and applications to achieve the smooth transplantation of language system, perfectly solving compatibility issues of a few differences caused by operating system platform. However, the XML Extensible Markup Language was released by Internet ISO W3C in February 1998, which is the standard for data semantic information. Its self-description, scalability, and the advantages of openness have also become the standard of information and exchange of information gradually, which can achieve the integration of different platforms, applications between different systems and data exchange. To integrate the Java technology and XML to build heterogeneous database integration system have the characteristic of portability and scalability [7].

### **6.4 Issues of Data Integration and Heterogeneity to be Addressed**

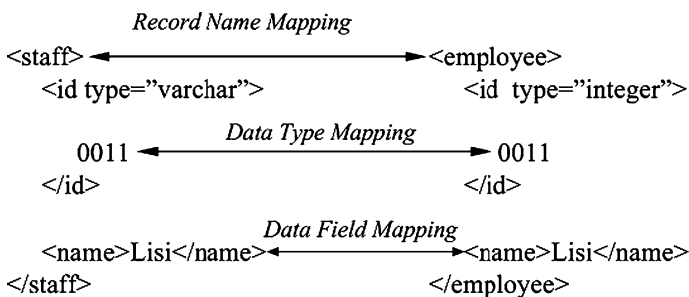
Heterogeneity of data sources is the core problem besetting the data integration system, and is the focus of this paper. The expression of heterogeneous data integration is: in case where the independence of the data source is not affected, the different databases to synthesize new data center, data sources, and data centers can be established to communicate with each other in order to achieve transparent access to data. Build a middleware between the data source and data center to eliminate the heterogeneous data between syntax and semantic, achieving the heterogeneous conversion between relational databases and XML documents. The difficulty of the heterogeneity is mainly manifested in the syntax heterogeneous semantic heterogeneity. Syntax heterogeneity generally means that there are different naming conventions between source data and destination data and data types. For databases, the naming convention refers to the table name and field

name. Syntax isomerization is relatively simple as long as the field to the field, record to record mapping to resolve the name conflict and the conflict of data types. This mapping is very direct and relatively easy to achieve. Therefore, syntax heterogeneity does not care about the content and meaning of the data. We only need to know the data structure information to complete the mapping between the source data structure to the destination data structure. First, analyze the characteristics of the data source syntax and semantics.

It can be seen from Fig. 6.1 that the content of data fields in the source data structure and the target data structure (“0011”, “John Doe”) in the establishment of the mapping process does not change, and keep the original field.

When data integration is going to consider the content and meaning of the data, it enters to the level of semantic heterogeneity. Semantic heterogeneity is much more complex than syntax heterogeneity. It usually needs to destroy the original of the field, which means the need to deal directly with the data content. The common semantic heterogeneity includes the following ways: field split, field merge field data format conversion, and transfer of field. (Figs. 6.2, 6.3, 6.4).

The difference between Syntax heterogeneity and semantic heterogeneity can be traced back to differences in the data source: When a data source is building, only the naming rules are different, but the entity-relationship model is the same, this is called syntax heterogeneity between the data source. When the data source is building a solid model, if we adopt different ways to divide, the different entities with different field data semantics will inevitably result in semantic heterogeneity between data sources, and bring big problems to the data integration. In fact, the syntax of the reality in the data integration system isomerism is common. This syntax heterogeneity mentioned above belongs to grammar heterogeneity of more rules. And specific mapping method can be used to solve these problems. We can use the features of XML Schema build XML Schema according to the relational schema, and preserve the important information of the relationship between relational tables, the data type of the field, numerical restrictions, and some others. Finally, we can achieve the complete transplantation from the relational schema to XML Schema and the elimination of differences in syntax and semantics of the data source. It can not only be used as the test based on the data conversion, but also as the future directly to the XML document to increase the basis of new information.



**Fig. 6.1** Grammar of heterogeneous data source and target data mapping

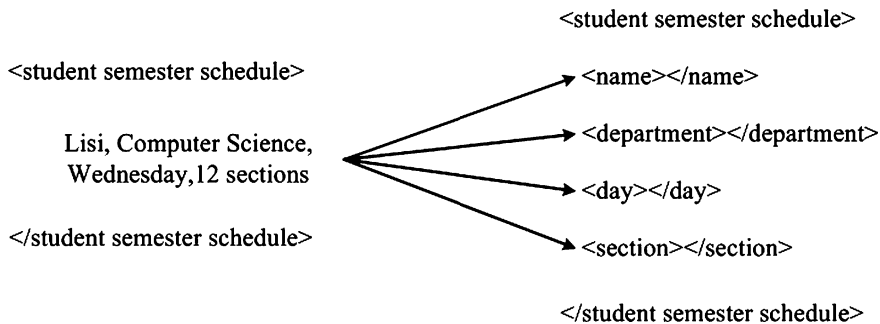


Fig. 6.2 Field splitting

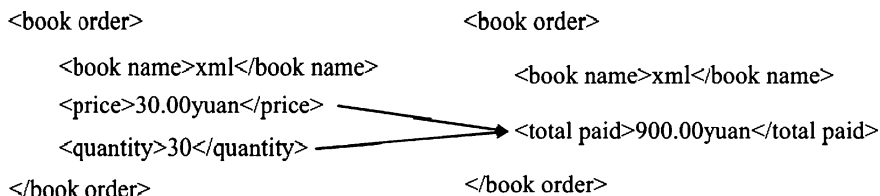


Fig. 6.3 Fields merging

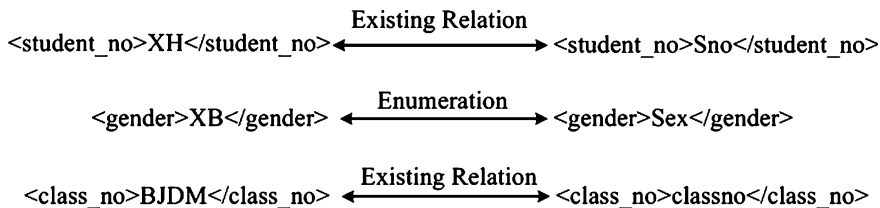
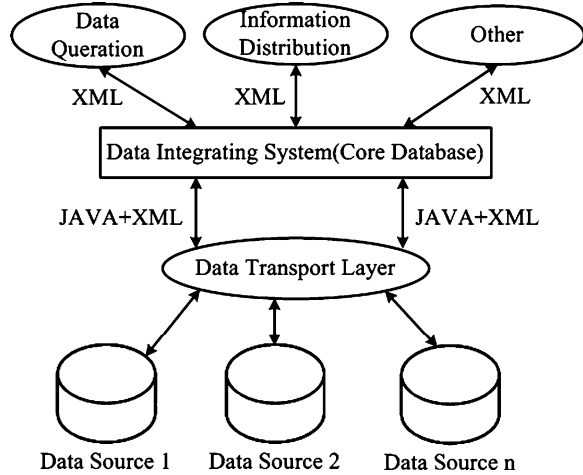


Fig. 6.4 Data format transformation

### 6.5 Systematically Explore on Data Integration

The digital campuses in colleges and universities have the characteristics of the phased construction. In general, each application system is loose and relatively independent. Business data can be divided according to the chunk of application systems, and distributed in the business database. The integration of data between applications can be centrally managed to form a unified database (including the data of the whole school shared the underlying data and business systems). In order to integrate the various subsystems of the original data, and not to affect the normal operation of the various departments in the original management system, the general integrated program should be established as the central database in the university's network center. It is used to integrate the various departments of the data and query data in a central database for information sharing and publishing. In the whole

**Fig. 6.5** Data integrating system model



system, as the data source, the databases of various departments of the management system will integrate the data from heterogeneous databases, and integrate a number of XML documents to one document according to some certain rules, and then upload it to the central database. The system design model is shown in Fig. 6.5.

Of course, to realize the centralized data exchange we also need to consider many aspects of the problem. Such as the problem of data exchange standards, user management mechanism and data rights management, the exchange of data transmission protocols and the issue of encryption, the problem of programming interfaces which provided for each application system, and so on.

## 6.6 Conclusion

College application data integration is mainly to solve the problem of data exchange between heterogeneous platforms and databases. Taking the advantage of the portability of JAVA, establish a middle tier (middleware) between the server and the database, by eliminating the heterogeneity existing in data sources between the syntax and semantics, shielding the heterogeneity of application environment and of the data structure in the data sources, to achieve the integration of heterogeneous data sources. Practice has proven that both uses can solve the heterogeneous platform and heterogeneous database data transfer problem better.

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# Chapter 7

## Design and Research of Embedded Gateway Based on CAN Bus

Ru Xue

**Abstract** Based on the OPC technology and TCP/IP communication protocol, a set of industrial control network with enterprise information network communications technology was designed, the network structure of the program introduced to the CAN bus for example, Interconnection Reference Model, as well as hardware and software design detailed the choice of hardware platform, with a focus on key technologies of the multithreaded software design, buffer. Practice has proved that the program can solve the full dispersion control system, wide open, industrial processes, interoperability issues, and has a good price, and broad application prospects.

**Keywords** TCP/IP protocol · Ethernet · CAN

### 7.1 Introduction

Fieldbus technology in the mid-1980s was a milestone in the development of computer network technology, computer network communications to the extension at the industrial field level, which led directly to the factory floor information collection, integrated for the purpose of the birth of the industrial control networks. Today, the development of new technologies is to establish in Intranet/Internet based on open, transparent business operations, to replace the traditional seller-driven system.

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## 7.2 Fieldbus and Ethernet Interconnect Solutions Development Status

A broad debate triggered around the issue of Fieldbus and Ethernet interconnect solutions, gradually forming the solution of the two most representative: (1) Ethernet fieldbus extension to the factory floor, “network in the end” programs; (2) fieldbus and Ethernet combination of field bus + Ethernet” program. The two programs produce the complex background, the industry trend of network development, openness, higher bandwidth, and integration capabilities with the Internet which is the basic requirements of the future industrial networks. From this perspective, Ethernet undoubtedly has huge, irreplaceable advantages, mainly: (1) Ethernet, with its wide application and advanced technology, gradually monopolized the commercial computer communications and process control field of the top information management and communication [1]. (2) Ethernet has a higher bandwidth. Today, ordinary Ethernet bandwidth 100 Mbps bandwidth of 1 Gbps Ethernet has been around. High-speed fieldbus H2 transfer speed is only 1 or 2.5 Mbps, which in some situations can not meet the requirements of real-time control [2]. (3) Ethernet is easy to integrate with the Internet [3].

Ethernet to meet the basic needs of future industrial networks, but people interested in the implementation of the Ethernet network in the end of the program also encountered great difficulties, mainly in: (1) Ethernet is a nondeterministic nature of network systems in the field of industrial control is absolutely not allowed [4]. (2) Ethernet is not specifically designed for industrial applications, their reliability, for immunity is to be further improved. (3) For the purposes of the present study conditions, the Ethernet is not suitable for all industrial automation equipment. In addition, the Ethernet connection of terminal equipment fail to reflect its superiority, Ethernet is also no program to provide an analog voltage on the transmission medium.

To sum up, the Ethernet as a fieldbus extension to the factory floor, “network” program in the technical field or in the application areas need to be strengthened and improved, and the use of a network of world domination “ideology does not conform to the natural order of things.

## 7.3 Fieldbus and Ethernet Interconnection Network Structure

### 7.3.1 Internet Structure

In summary, the author of the CAN bus design a program: field bus + Ethernet + TCP/IP + the OPC program, the network structure shown in Fig. 7.1.

This control network is characterized by the communication system built on top of the mixed communication protocols of Ethernet, TCP/IP and fieldbus gateway to achieve high-speed computer network—Ethernet and relatively low-speed

fieldbus interconnection to computer systems and field instrumentation, interconnection and interoperability of equipment. When the computer to the field instrument, the device sends information, it is first based on Ethernet and TCP/IP protocol to send information to the appropriate gateway, and then by the gateway based on the fieldbus protocol sent to the appropriate field instruments, equipment. In turn, field instruments, equipment, and information sent to the computer, by the gateway as a proxy, forwarded to the appropriate computer via Ethernet and TCP/IP protocol. At the same time, due to the Ethernet and the Internet can be easily interconnected, the system also supports remote access via the Internet.

### 7.3.2 OPC Technology

OLE for Process Control (OPC) is Microsoft’s Object Linking and Embedding technology in process control applications, connect a hardware device or software, database and other data sources and process control of standardization between the client application interface protocol it can significantly enhance the control system in the field of process control, field devices, interoperability between management applications.

In fact, Ethernet and TCP/IP can handle different protocols that are strong, and therefore cause interoperability issues. Different vendors of application layer protocols are the memory on a small scale, interoperability of different products site. Therefore, we need an open standard application layer protocol. OPC technology is to achieve the control system field device level and process management-level information exchange, control system and open key technology. OPC technology in Ethernet, greatly improving the industrial process control system openness and interoperability.

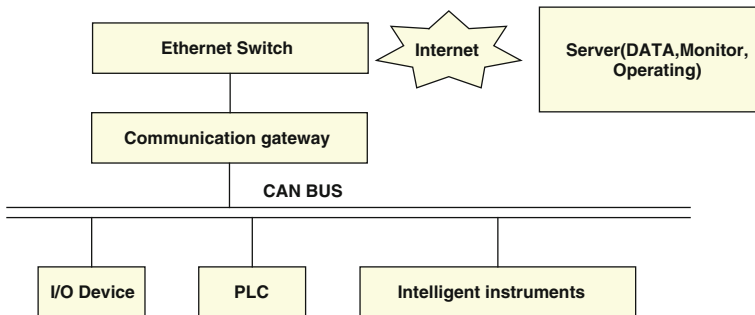


Fig. 7.1 CAN and ethernet interconnection network structure

## 7.4 Design and Implementation of the Communications Gateway

The communication gateway is the core component of the system, complete Fieldbus to Ethernet communication capabilities. As the scene bus protocol standards are not unified, there are eight kinds of on-site buses coexist in that only that the Controller Area the Net-Work (CAN) bus is as an example of the specific design of the gateway and to achieve description .

### 7.4.1 Interconnection Reference Model

Shown in Fig. 7.2, the Interconnection Reference Model, the application layer below the TCP/IP protocol layer, and Ethernet layer of the application is completely transparent, and the application layer is based on the OPC server. The gateway model includes the CAN bus—Ethernet (running T-the CP/IP protocol) protocol conversion, as well as communication management functions.

### 7.4.2 Gateway Hardware Support Platform

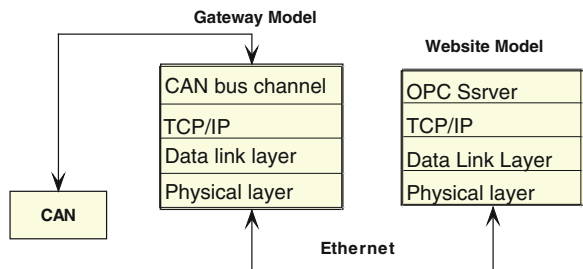
Used in Maxim’s April 2003 launch of the DS80C400 networked microcontroller. Integrated its on-chip bus controller of the CAN2.0B site and complete the TCP/IP protocol stack, peripheral circuits and chip information is available, affordable, and has a good price. DS80C400 supports the C language, assembly language, Java language that are developed to provide users with a great choice.

### 7.4.3 Gateway Software Design

#### 7.4.3.1 The Choice of Development Language

Heavily involved in the design of Ethernet, TCP/IP protocol communications, the development language of choice should take full account of its network capacity. Of course, the hardware platform support is an indispensable condition. Integrated

Fig. 7.2 CAN and ethernet interconnection reference model



the above discussion, the paper selected Java languages, because of: (1) Java is a free, open platform; (2) a large number of available packages; (3) fully object-oriented programming ideas; (4) embedded operation system TINIOS, support. Therefore, using the Java platform to avoid duplication of development, to save manpower and resources to improve the reliability of the system.

### 7.4.3.2 Software Architecture Design

The software architecture is to ensure that overall system performance, reliability, maintainability and scalability of the key, is the core of the entire design. The key technologies used in the paper are summarized as follows:

#### (1) Multithreading technology

Java in terms of data transmission using the “flow” concept, extensive operation in the programming process of the underlying byte stream, when no more data, “blocking” is inevitable. “Blocking” may interfere with the operation of the program modules, the system is temporarily paralyzed. In addition, according to the requirements of reliability, the data uploaded by the CAN bus must be accepted, otherwise you will lose. Multithreading technology can solve the problems encountered in the above programming process and greatly improve the system performance under heavy load conditions. At the same time, the Java language support on the thread to ensure the realization of the design. Figure 7.3 shows the structure diagram of the system thread.

Thread priority setting should be cautious, “full” run approach will result in the other thread is difficult to obtain the CPU due to the high priority thread that will occupy about 90 % of CPU resources, the use of priority to ensure that a thread resources, Therefore, defined the same thread priority.

#### (2) Buffer technology

Opening up the buffer can significantly improve the system of real-time performance, reducing the coupling between the threads, and enhance the program scalability and reusability. Java language, the buffer is essentially two threads share data unit; two threads are independent in their operation. This operation can not be simultaneous for otherwise it will destroy the data of the buffer. The Java language uses the “synchronized” keyword plus “lock” for the buffer. Only “lock” a thread object is only through “lock” to operate buffer,if there is no “lock” the thread must wait to hold the “lock” the thread to finish and release the “lock” in order to achieve “lock”. This method is effective to prevent multithreaded concurrent access and cause damage to the data buffer, Buffer class BufferArea UML static class diagram is shown in Fig. 7.4.

#### (3) Read-write channel separation

Industrial applications have extremely stringent requirements for real-time data, using a single channel read and write data buffer may cause “congestion” in the case of large load, such as the write thread for a long time to wait for the read

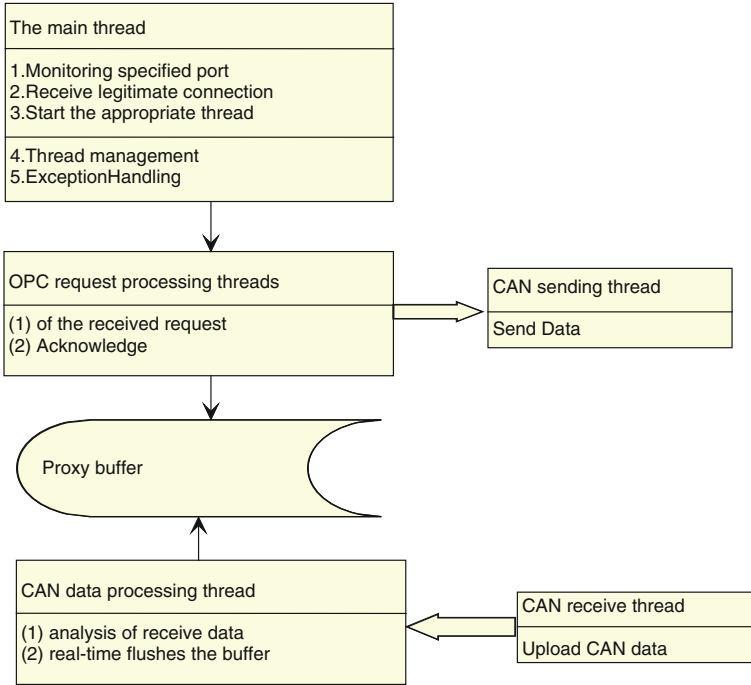


Fig. 7.3 Systems thread design

thread to release the “lock” resulting from a long write delay;at the same next bit machine data changes faster when the write thread hold the “lock” that will hinder the fast write, and in severe data loss. Read-write channel separation, read and write operations, uses a dedicated channel that can solve the above problem, the maximum to avoid thread “congestion” and improve the system real-time, respectively.

```

classDiagram
    class BufferArea {
        + volatile isTransmit : boolean
        - floatintcoilsdata: byte[]
        - buffer : byte[]
        + synchronized getfloat intcoils ( int opcaddress, int quantity ) : byte[]
        < update >
        + synchronized void writefloatintcoils ( byte [] data, int canaddress )
        + addressconvertor ( byte address0, byte address1 ) : int
    }
  
```

Fig. 7.4 Bufferarea class UML static class diagram

## 7.5 Conclusions

Communication gateway design has been successfully used in a pharmaceutical company production plant monitoring system, a total of 67 sites analog collection point, switch acquisition point 12. Among them, the site part of of SHCAN2000 intelligent measurement and control components to the CAN bus network to complete data acquisition and CAN baud rate of 125 kbps. Monitoring host computer through a switch Ethernet running TCP/IP protocol, the monitoring software LabVIEW Showed good real-time and stability in the application system, especially the write operation can ensure fast, even in the amount of data upload to meet the requirements of the general industrial applications.

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# Chapter 8

## Study on Mobile Internet in the Integration of Tourism Industrial Chain

Gefen Zhou

**Abstract** Mobile Internet, in which the advantages of mobile communication and traditional Internet technology are combined, has proven to be a trend of the development of the information industry, and simultaneously has brought about a revolutionary change to the traditional industries. In this paper, on the basis of comparing the characteristics of different information ages, the distortion, slow speed, poor flexibility, and unhandy problems of the information transfer in the traditional tourism industry chain are shown clearly, and also the renovation of the mobile Internet on the tourism industrial chain is discussed. Through the construction of the mobile Internet, tourism business platforms for enterprises, the information flow is communicated and interacted by the intelligent terminals in the tourism industrial chain through the mobile telecommunication network, and also the groups in the industrial chain are closely connected by the multifunctional tourism business platforms together. Thus, the mobile Internet is realized in a real sense.

**Keywords** Mobile Internet · Tourism industrial chain · Integration

### 8.1 Introduction

Mobile Internet (MI) is an emerging industry which develops from the mobile communication and the Internet undergoing a high-speed development and a constant improvement, also gradually matures [1]. In mobile Internet, the goal is to

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acquire the real-time information by accessing to the Internet with high speed and complete a secured real-time interaction. With the improvement of the Internet infrastructures and the promotion of the mature technologies such as 4G and mobile addressing, the mobile Internet will meet its development peak, the Internet access service has changed into the largest profit growth point of all large operators in the world after the traditional voice service, and simultaneously a great number of outstanding Internet products and services have been also applied in the mobile terminals such as Tencent IM and microblog.

Tourism, as an industry having a close tie with the mobile applications, is a comprehensive industry, which is composed by many industries and departments. In comparison with the traditional Internet, the mobile Internet features flexibility, convenience, high efficiency, and also can meet the individual needs of users and is not limited by time and space. In the meantime, it can coordinate the linkage inside and outside the tourism industry, bring about innovations to the tourism industrial chain, improve the competitiveness of the tourism industry, and promote the sustainable development of the tourism industry.

## **8.2 Tourism Industrial Chain**

### ***8.2.1 Concept of Tourism Industrial Chain***

Industrial chain refers to a relevant relationship like a link chain, which is objectively formed among various industrial departments according to specific logic relationship and time and space distribution relationship based on a certain economic and technological relevance. At present, there are more literatures in which the tourism industrial chain is defined mainly from the perspective of industry; research perspectives include six factors of tourism [2, 3], value chain [4, 5], basic form of industrial chain [6, 7], etc. Although the perspectives are different, it is thought by all that the tourism industrial chain is a complex system that is formed because of the interaction between subsystems of multiple elements and levels [8].

### ***8.2.2 Composition of the Tourism Industrial Chain***

The tourism industrial chain is mainly composed by tourism products, tourism sales, and tourism consumers. Tourism products comprise of the planning and development of core resources and the deployment of supporting products. Core resources include tourist attractions, tourist entertainment places, resorts, etc. Supporting products mainly include the food, accommodation, walking, shopping, and entertainment in the travelling process, and are the production carriers

(tourism products manufacturers) of the tourism products. Tourism sales comprise of tourist route design and sales. Tourist route design is to design different combinations of tourism products by accepting the reservation of tourists and following the needs, preferences, or requirement of tourists. Sales are to transfer the designed combinations of tourism products to the tourists through certain channel. Tourism wholesalers, middlemen, and retailers , including the travel agency and other tourism products dealers, which is a connection between tourism products manufacturers with tourism consumers are the carriers of tourism sales.

### 8.3 Comparison on the Features of Information Technologies in Different Ages

The development of information technology has undergone the age of non-internet, the age of Internet, and the age of mobile Internet. Its features are as shown in Table 8.1. From Table 8.1, the information transfer and user experience in the age of mobile Internet own greater advantages.

### 8.4 Optimization and Integration of Tourism Industrial Chain in the Age of Mobile Internet

The integration of industrial chain is a process of adjusting and collaborating industrial chain and its essence is to make adjustment, combination, and integration on the current situation of industrial separation state. The core of integrating tourism industrial chain is to integrate the speed and depth of the information interaction between upstream and downstream subjects. Because the development of information technology is different, the tourism industrial chain in the ages of preinternet and Internet had some disadvantages.

**Table 8.1** Comparison on the features of information technologies in different ages

Age	Features
Non-internet	Scattered information; difficult to transfer
Internet	Interconnected information; easy to transfer; fast information transfer; flexible
Mobile Internet	Interconnected information; easy to transfer; real-time information transfer; high efficiency; high convenience; respecting privacy; handy application

### ***8.4.1 Disadvantages of the Traditional Tourism Industrial Chain***

In the age of the non-internet, the information transfer in the tourism industrial chain is fixed, in which a hierarchical transfer model is implemented, as shown in Fig. 8.1. This transfer way has some disadvantages, which can be reflected from the following aspects.

First, tourism information transfer is of distortion. Tourism products manufacturers transfer the relevant information of tourism products to tourism middlemen (travel agencies), and then middlemen design tourist routes through combining various tourism products and also transfer the designed tourist routes information to the tourists. Therefore, tourism products manufacturers cannot transfer the complete designed tourist routes information to the tourists finally.

Second, tourism information transfer is slow. For purchasing, the tourists have to search a large amount of tourism advertisement information before purchasing and determine tourism products and travel agencies, and then pay the cost and handle relevant procedures in travel agencies. Therefore, it can be seen that the purchasing process of the tourist is very long.

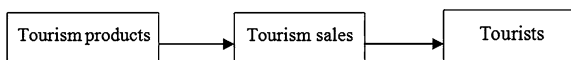
Third, tourism information transfer is with poor flexibility. The implementations of all activities in the travelling process are completed only by relying on the mutual cooperation between the enterprises in the industrial chain (i.e., tourism products providers-tourism middlemen-tourists). Also, the whole process has a fixed order to be followed. Therefore, if there is a fault in any node of the industrial chain, the whole industrial chain will be spoiled.

In the age of Internet, the transfer of tourism industrial chain information can overcome the disadvantages of the tourism industrial chain of the preinternet age, but has to rely on PS terminal. Therefore, information transfer is not real-time, and also is not handy in application.

### ***8.4.2 Optimization and Integration of Tourism Industrial Chain in the Age of Mobile Internet***

#### **8.4.2.1 Enterprise Mobile Internet Tourism Business Platform (Emitbp)**

In the background of mobile Internet, an enterprise mobile Internet tourism business platform (EMITBP) is constructed as shown in Fig. 8.2, for realizing the timely transfer and feedback of tourism information in the tourism industrial chain,



**Fig. 8.1** The hierarchical transfer of tourism information in the pre-internet age

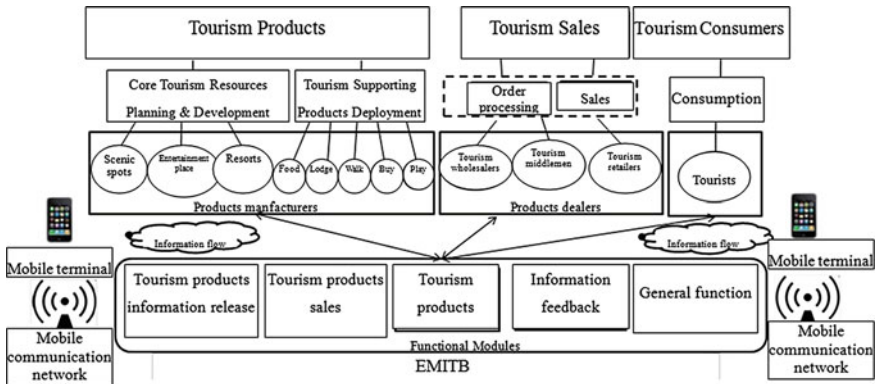


Fig. 8.2 Enterprise mobile Internet tourism business platform (EMITBP)

getting rid of the limitations in time and space and breaking the disadvantages of the information hierarchical transfer in the traditional industrial chain. EMITBP is a mobile terminal application product. It can ensure the sharing of information resources of every node in the tourism industrial chain to the maximum, can help the subjects in all nodes to acquire the real-time information and release, sell, trade and inquire products, and also make decisions and exchanges. Therefore, all nodes in the industrial chain can be promoted to be cross-linking, and also information transfer can be faster. Meanwhile, all subjects in the industrial chain can access EMITBP through mobile equipments. Therefore, it can serve customers with more flexibility and greater convenience.

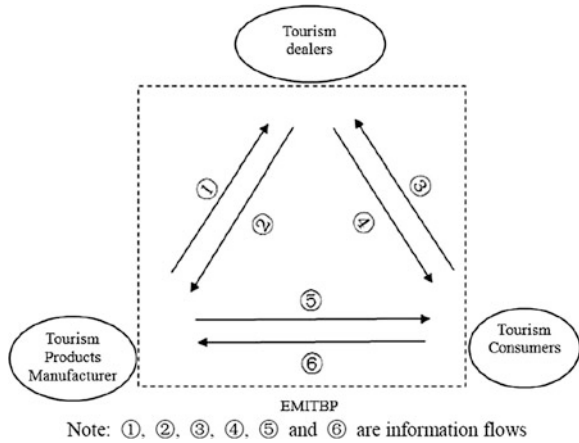
EMITBP has the following functions.

- (1) Tourism product information release: tourism core resources and supporting products information can be released by product providers on EMITBP
- (2) Tourism product sales: The reservation of tourists can be received by tourism dealers on EMITBP, and also relevant tourism products are combined and released on EMITBP
- (3) Tourism product consumption: The tourism products information released by tourism manufacturers and dealers can be acquired by tourism consumers on the platform, and thus online electronic trading can be complete
- (4) Information feedback
- (5) General function: It can be used by all subjects in the tourism industrial chain

### 8.4.2.2 Optimization and Integration of Tourism Industrial Chain

In the mobile Internet tourism industrial chain mode, the construction of EMITBP can make the information flow in the whole industrial chain communicated high efficiently and in real time through mobile telecommunication. Thus, the fast speed and authenticity of tourism information transfer, and also the transaction cost and

**Fig. 8.3** Information interaction on enterprise mobile Internet tourism business platform (EMITBP)



time of the whole industrial chain are saved. Meanwhile, enterprise mobile Internet tourism business platform provides corresponding service subsystems for all nodes in the industrial chain. On EMITBP, the subjects in all nodes of the industrial chain have an interactive relationship, as shown in Fig. 8.3.

Tourism products manufacturers need to investigate and research tourism market first, and also conduct a business intelligence analysis on investigation and research results. Thus develop the tourism products with market potentials. All the information can be timely released on EMITBP. Simultaneously, the purchase of individual tourism products by tourism consumers can be received, and the feedback information from tourism consumers can be analyzed. Thus, the products meeting the market demands can be produced.

Tourism dealers can acquire the information released by tourism product manufacturers in real-time through EMITBP, effectively combine these individual products, and then sell the combined tourism products to tourism consumers. At the same time, the feedback from the tourism consumers on the individual products among combined tourism products can be provided for tourism products manufacturers.

Through EMITBP, tourism dealers can receive the reservations of tourism consumers on tourism products, realize the tourism sale through the customization of products and services, and analyze the tourism consumers' purchase behaviors and response to different marketing methods through the establishment of their files or databases, so as to please tourism consumers by adjusting the marketing methods.

### 8.5 Conclusion

Through the establishment of enterprise mobile Internet tourism business platform, intelligent terminal makes information flows transferred and interacts in the tourism industrial chain through mobile telecommunication network. Also, the

multifunctional business platform makes the group in the industrial chain connected together, realizing in a real sense the mobile Internet .

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# Chapter 9

## An Improved Routing Algorithm Based on End-to-End Packet Reception Rate in Wireless Sensor Networks

Zou Wensheng

**Abstract** This paper puts forward a kind of reliable end-to-end path routing protocol consideration, uses PRR (packet acceptance rates) as a link performance estimate. The agreement is with the highest value PRR search path and the end-to-end data transmission of data packets. Reducing the cost control group, this chapter puts forward a new mechanism where only a few suitable deployment RREQ nodes can be rebroadcast back again and not all of the node.

**Keywords** Wireless sensor networks · Routing algorithm · End-to-end packet reception rate

### 9.1 Introduction

Recently, there have been many research wireless sensor network (WSANs) application in industrial network control system [1]. Based on the network control system, sensor is the material world, and regularizes the collected data through the communication network to actuators, which execute action from the sensor on the basis of the data that they receive. Communication network, however, because in the packet transmission error-prone links or crowded network, wireless network to more severe [2], the most common way is to provide wireless network reliability link-level retransmissions, blacklisting, and use reliable routing measure [3]. These link-level retransmissions are widely used in general for reliable packet transmission, but the flower of extra packet delay, because inappropriate industrial

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WSANs retransmissions need real-time package delivery [4]. Blacklist technology to prevent low quality links is considered path selection [5]. By avoiding links in the routing decisions with low quality, blacklist can improve the end-to-end reliability, but ignoring connection on the network can cause partition. Many researchers suggested the reliable routing protocol using a single path, the article from a source and destination as AODV [6], [7] domain, MSR [8], [9] AOMDV, MAODV-SIM [10], etc.

This chapter puts forward a kind of reliable transmission packet routing protocol cyclical industry wireless sensor network. The agreement first set up an e2e-PRR as the highest. After that, the source node sent packets through periodic path. Use less control packets, and a mechanical device is the use of such a, only a specific set of nodes can be rebroadcast again RREQ bag rather than node. So the number of RREQ packages can be significantly reduced. The agreement performance is analyzed using Qualnet simulator. The simulation results show that the AODV agreement and MAODV-SIM are better than the reliability of the terms and energy consumption.

## 9.2 Reliable Packet Transmission of Periodic Traffic Flows on Industrial Wsans

This section describes routing protocol that was put forward. The agreement with packet receiving rate (PRR) as a link performance estimator, have a mechanism to reduce digital control packets.

The PRR value can be calculated at the receiver by passive monitoring of packets transmitted by senders. It changes over time and it is updated at a regular interval ( $\Delta\text{updatePRR}$ ) as follows:

$$\text{PRR}[t] = \alpha * \text{PRR}[t - 1] + (1 - \alpha) * \text{sampledPRR}[\Delta t], 0 \leq \alpha \leq 1$$

where  $\text{PRR}[t]$  is the PRR value of link  $(x, y)$  at time  $t$ , and  $\text{sampledPRR}[\Delta t]$  is the PRR value of link  $(x, y)$  monitored during time interval  $\Delta t$ . It is calculated as follows:

$$\text{sampledPRR}(x, y)[\Delta t] = \frac{\#\text{Packets\_Successfully\_Received\_On\_}(x, y) \text{ during } \Delta t}{\#\text{Packets\_Transmitted\_On\_}(x, y)\Delta t} \quad (9.1)$$

Then, the end-to-end PRR of a path from a source  $S$  to destination  $D$ , e2e-PRR( $S, D$ ), is defined as follows:

$$e2e\_PRR(S, D) = \prod_{(x,y) \in \text{path}(S,D)} \text{PRR}(x, y) \quad (9.2)$$

Which  $\text{path}(S, D) = \{(S, X_1) (X_1, X_2) \dots (X_{k-1}, X_k) (X_k, D)\}$

A path that has high e2e-PRR value is considered as reliable path.

Therefore, in a group of adjacent node, if it is possible to select the most appropriate point, which was awarded the RREQ and broadcast, not on this node, then dial the number RREQ transmit packets that can be significantly reduced. For this, we put forward a mechanism to a limited number of radio RREQ packets. (Fig. 9.1)

This means that in adjacent node of the delay time RREQ can again broadcast if have not received any RREQ bag from another adjacent node answer: so, node with low delay time before broadcast RREQ package will those people have higher delay time. Do RREQ package will reduce the amount of the number of transmission (see chart 2). In fact, delay time set up different nodes. The most suitable for rebroadcasting nodes should have smallest delay times compared with remaining ones. In the proposed protocol, the delay time is defined like that:

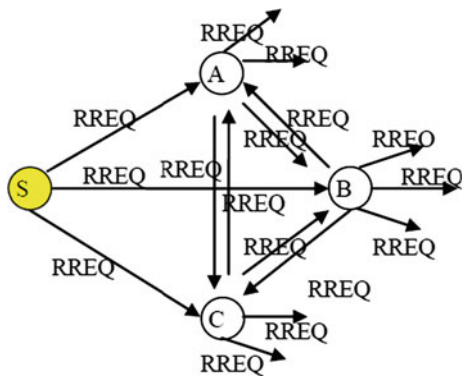
$$T_{DELAY} = T_{MAX} * (\beta \frac{rssi}{RSSI\_MAX} + (1 - \beta)(1 - prr)) \tag{9.3}$$

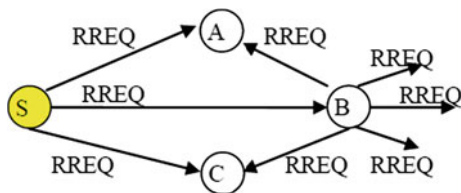
where  $T_{MAX}$  is the maximum delay time which is predetermined value; rssi is the Received Signal Strength Indicator value of link, which is the representative distance between two nodes and is got from the PHY layer;  $RSSI\_MAX$  is the maximum value of rssi; prr is the PRR of this link;  $\beta$  is the weighting factor.

The problem here is that how a node B can realizes a node C is also a neighboring node of A? To solve this problem, each node stores a field named prevID which is the id of the previous node such that the current node receives RREQ from. (Fig. 9.2)

Then, this field is added in the header of the RREQ packet for broadcasting. For example, if node B and C receive RREQ packet from node A, they set prevID is A. When B re-broadcasts RREQ packet, the prevID in the header of this packet is also set to A. So, if C receives RREQ packet from B, it checks whether the prevID it stores with the prevID in the RREQ is the same or not. If that, C ignore re-broadcasting RREQ packet. Otherwise, the prevID of node C is whether be updated to B or not depend on the prr value the RREQ packet carrying compared with current prr value node C holds.

**Fig. 9.1** The broadcast storming problem Nodes A, B, C rebroadcast RREQ packet again





**Fig. 9.2** When overhearing RREQ packet sent from node B, node A and C stop rebroadcasting RREQ packet again

The route establishment mechanism in the proposed protocol is the same with AODV. It is based on the exchanging RREQ–RREP–DATA packets between the source and destination. The difference, however, between proposed protocol and AODV can be described as follows:

Each node maintains a prr value, which is the product of prr values of links composed the reverse path from this node to the source. The source node has prr value is 1.

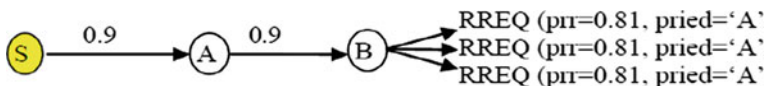
Each RREQ packets contains prr value and prevId, which is the prr value of node and id of previous node of node that sends out the RREQ (Fig. 9.3).

Each node calculates the delay time as formula (\*) when receiving a RREQ from its neighboring.

### 9.3 Performance Evaluation

Performance of the proposed protocol has been evaluated using Qualnet simulator [11]. We compared the performance of the proposed protocol with AODV [6] and MAODV-SIM [10] protocols in terms of the average packet delivery ratio at the destination, the average delay jitter of packets, and total number of forwarded RREQ packets by each node. Three scenarios with different levels of contention have been deployed: light contention (one flow), medium contention (five flows), and high contention (ten flows). Higher the number of flows deployed, the higher is the level of contention . Each flow is started one after the other, the interval between two consecutive flows is set to 400 ms. The mobility model follows random waypoint model. The minimum and maximum speeds were set to 0 and 10 m/s, respectively. We have done the simulation while increasing the number of nodes in the network from 75 to 200. The following table shows some parameters used in our simulation.

In our simulation, each network link is assigned as an initial PRR value at the beginning of the simulation, after that, PRR value of the link is measured and



**Fig. 9.3** Node B broadcasts the RREQ (prp = 0.81, prevId = ‘A’)

**Table 9.1** Simulation parameters

Parameter	Value
Simulation time	30 min
Dimension	600 m <sup>2</sup>
Transmission range	100 m
Packets transmitted	1,000
Waiting time of RREQ ( $\Delta_{\text{waitRREQ}}$ )	250 ms
Link PRR update interval ( $\Delta_{\text{updatePRR}}$ )	4 s
MAC protocol	802.11 DCF
Value of $(\alpha, \beta)$	(0.1, 0.5)
Mobility pattern	Random-waypoint
Speed	0–10 m/s

updated periodically at a regular interval of  $\Delta_{\text{updatePRR}}$  as described above. To initialize the PRR of each link, we conducted the following experiment: 108 nodes are put in line topology along four lines in an area  $300 \times 300$  m. The distance between two adjacent nodes is 5 m. The central node broadcasts 1,000 packets and the others count the number of successfully received packets. Then the average PRR value according to the Received Signal Strength Indicator (RSSI) value of the link is recorded. Based on this experiment, we initialized the PRR of a link  $(X, Y)$  whose RSSI value is  $\text{rssi}$  as  $\text{PRR}(\text{rssi})$ . (Table 9.1).

## 9.4 Conclusion

The simulation results show that the AODV agreement and MAODV-SIM is better than the reliability of the terms and control the cost of the packet.

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# Chapter 10

## Study on Networking of Internet of Things

Feng Zhang

**Abstract** Internet of things is called the network computer and Internet information industry after the world's third wave, because of the international and domestic attention, its development, and the construction; the research has been increased to the height of the national strategy that can capture the vertices of core technology of networking, directly relates to the economy of the masters of science and technology, This paper is mainly for RFID technology's working principle, process RFID as brief summary, probe into the wireless networks, and Internet local fusion.

**Keywords** Internet of things · RFID · Network integration

### 10.1 Introduction

Internet of things is called the network computer and Internet information industry after the world's third wave, and gradually increased to national strategy, Eposes in the Internet of the things in 2020 "report, content analysis and prediction of the future development of the network" will experience four stages, before 2010 RFID is widely used in logistics, retail and pharmaceutical field, 2010–2015 years for the stage, will be the object of 2015–2020 objects will enter half intelligent stage, and after 2020 objects into the intelligent stage.

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## **10.2 Things Networking**

### ***10.2.1 Content Networking Concept***

The Internet of things networking-things, or IOT, just as its name implies is to make all items through. The Internet connection up, achieve any goods, anybody, any time, any place (4 A). The intelligent recognition, information exchange and management. Domestic generally accepted things are defined through networking, radiofrequency identification (RFID), infrared sensors, global positioning system, laser scanner sensing equipment, the information such as the agreement in accordance with the contract, the goods and Internet connected to exchange information and communication, to realize intelligent identification, location, tracking and monitoring, and management of a network.

Networking is “the thing-that the Internet”, has combined the two meanings, one is the core and foundation of the network that the Internet is still in the Internet, based on the existed and expand a network; the second is its clients to extend and expand any goods and articles, the exchange of information between and communication.

### ***10.2.2 Content Networking Hierarchical Structure Research***

Things networking is a very complex and various forms of system technology, according to the information generation, transmission, processing, application of the principle will content networking from low to high are divided into four layers, respectively, network construction of perception recognition layer, management service layer, comprehensive application layer [1, 2].

Perception recognition is the core technology of the thing, is network linking physical world with information world bond, and the main use radiofrequency identification (RFID), wireless sensor (WSN), global positioning system (GPS), and other information automatic acquisition, generating equipment realize the items “speak” technology.

The network construction layer is the main purpose of the lower level (perception recognition layer) through the Internet, data transmission for its upper management (service layer) use (currently the main application, and includes wireless wan (3 G, 4 G wireless communication technology), ice Weimar technology (802.16 (series)), the wireless local area network (Wife technology (802.11 series)), a domain (Bluetooth wireless network technology (802.15.1 series)), and so on.

Management service layer is in high-performance computing and mass storage technology, realize the support large-scale data more efficient and reliable organization, for the upper (comprehensive application layer) provides intelligence support platform, currently involves field including data center, search engines, intelligent decision, information security, data mining, etc. And comprehensive

application layer through the middleware, achieves the specific function application platform, by the original computer-computer interconnected experienced people-people hazards are connected, and to achieve the material things Internet, let objects have the “wisdom”, complete perception, Internet, the superposition of wisdom, at present the main applications include intelligent logistics, intelligence of grid, intelligent transportation, environment monitoring, green building and so on several lots [3].

## **10.3 RFID Technology**

### ***10.3.1 The System Structure of the RFID***

Radiofrequency Identification (RFID), have Identification using raff signal through the space coupling (alternating magnetic field or electromagnetic fields) contact information transfer is realized through of the message to achieve the purpose of the automatic recognition.

RFID technology in the twenty-first century will be starting a new technology revolution, at present the application field of RFID include manufacturing, retail, logistics, medical treatment, identification, military and tamper-resistant security, asset management, transportation, food, books, and animals. As the different application systems will be different regarding the basic composition including electronic tag, reading and writing, and most of the top three systems.

Electronic tag composed by chip and antenna, adhere to the object identification target, every electronic labels have only electronic coding and storage is the identity of the objects of the relevant information.

The reading and writing is to use of rift tag information literacy electronic equipment. The RFID system work, generally by the first reading launch a specific ask signal, when electronic label induction to this signal, it will give response signal; response signal contains tags carrying data information. The reading and writing to receive the response signal, and carries on the processing, and then will process after the response signal back to the external host, carries on the corresponding operation.

System top is computer network system, data exchange, and management by computer network, the finish reading through standard interface and computer network connection, and computer network to complete the data processing, explaining, and communication function.

### ***10.3.2 The Working Process of the RFID***

RFID uses wireless raff way, in reading, and electronic tag no contact between the two-way data transmission, in order to achieve target recognition and data exchange, the purpose of the work flow roughly as follows:



The reading and writing by antenna send some radiofrequency. When electronic label into the antenna work area, reading, and writing electronic tag antenna to produce enough induction current, electronic tags get energy is activated. The tags will own information through the built-in antenna send out. The reading and writing the antenna to send electronic label from the carrier signal. The reading and writing antenna will carry signal to the reading and writing. The reading and writing of received signal demodulation and decoding, and then to the system related treatment top system according to the logic operation judge the top electronic tag legitimacy [4]. In view of the different set top system makes the corresponding processing, issued a directive signal control actuator action.

## **10.4 Things Networking the RFID System Working Principle**

Things in the Internet's networking based on RFID technology, constructing a global items of information share real-time network, including five basic things networking components, electronic product coding EPC, respectively, the recognition system ID, middleware, network name that resolution services IOT-NS and physical network information service IOT-IS released.

In each item in all things networking is given an electronic product coding EPC, EPC used to goods unique identity. Electronic product code in the electronic tag storage items, the reading and writing of electronic tags for speaking, reading, and writing, electronic tag and the reading and writing form a recognition system ID. The reading and writing of electronic tag scan, electronic product coding will send middleware. Middleware through the Internet to name resolution services IOT-NS sent a inquires the instructions, name resolution services according to check the IP address of the store information, and according to the IP address guide middleware visit-IS ITO. Things networking information release service IOT-IS stored in the item of detailed information, which it received the inquiries and requirements, will the detailed information on the website items in the form of middleware for inquires send back.

## **10.5 Summary**

Owing to space constraints, in this chapter, only thing networking and RFID technology macro fusion problem in the general review of in higher, not that the application layer are analyzed, the next research direction will focus on the application layer of concrete realization.

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# Chapter 11

## Study on the Risk Management of Floodwater Utilization Based on the Internet of Water Affairs

Wen An and Jing Yu

**Abstract** This paper introduces the structure and the key technologies of the Internet of Water Affairs (IoWA) as well as the significance and the conditions of the floodwater utilization in the north of Jiangsu province first, and then discusses how to use the technologies of IoWA to strengthen the functions of the risk management of floodwater utilization in the north of Jiangsu province. At last, it puts forward several suggestions regarding the building and perfecting of IoWA.

**Keywords** Internet of water affairs (IoWA) · Risk management · Floodwater utilization · North of Jiangsu province

### 11.1 Introduction

The poor circulation of the water resource's usage of pumping water to control the droughts just after releasing the floodwaters, is very normal in China, especially in the north of Jiangsu province, so making use of the floodwater become a very important practical need. Floodwater utilization is comprehensive use of system theory, risk management, information technology, modern science, technology, and engineering measures, overall planning the flood control, and disaster alleviation and economical, implement effective risk management of floodwater, under the premise of ensuring the flood security, make effort to increase effective water supply and sustain good ecology. The major bottleneck of floodwater utilization is

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the scientific and technological innovation of risk management. Jiangsu province set up 86 fixed, buoy automatic monitoring stations in succession in the treatment of Tai Lake in 2009 to monitor the changes of the water quality in Tai Lake all-weather and on-line and in real-time through wireless network, which inspires us to explore the topic of risk management of floodwater utilization in the north of Jiangsu province based on the IoWA technologies.

## 11.2 The Network Structure and Key Technologies of IoWA

### 11.2.1 The Network Structure of IoWA

Internet of Water Affairs (IoWA) is using water quality, water quantity, water level, water flow amount, and other various kinds of water monitoring sensors to equip the development, utilization, protection, and other fields of water resources, linking up each sensor node of water information using the wireless network and Internet, integrating the characters of the natural water with the needs of the human society, forming a huge sensor network, managing water resources with a detailed and dynamic way, realizing water management, especially the intelligence of risk identification and control, improving the using efficiency of water resources, and promoting the harmony of human and water. The IoWA system consists of four subsystems systems, see Fig. 11.1.

### 11.2.2 The Key Technologies of the Remote Sensing Subsystem

If the communication system is the “nervous system” to transfer information, the computer is a “brain” to recognize and process information, then the sensor is the “sense organs”, the combination of these can achieve kinds of intelligent characteristics that are similar to human. At present, wireless sensor can only obtain a few simple information like water quantity, water quality, and water level, cannot depict the colorful water world. In the future, not only it will obtain not only the scalar

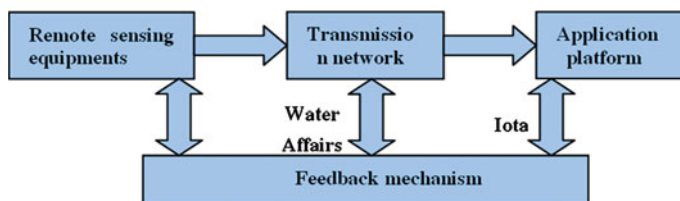


Fig. 11.1 The network structure of IoWA

information, but also the vector information like video, audio, and image, and the wireless multimedia sensor network with functions of compression, identification, fusion, reconstruction, and other information processing will emerge, and produce the information recognizing and processing effects similar to the site.

### **11.3 The Key Technologies of the Transmission Subsystems**

The collecting dots of the water information are mainly distributed in the wild; the structure of the wireless network which is to transmit information is mainly based on the center-control structure of the cellular networks, such as the CDMA network of China telecommunication, the GPRS network of China mobile [1]. In recent years, China telecommunication, China mobile, and other operators have launched Machine-to-Machine (M2M) platform business and related standards about wireless terminal, the wireless sensor network nodes can connect to the M2M platform through the qualified terminal registrations, the application units can just login into the M2M platform according to their authority, then can manage their nodes such as terminal management, sensor control, and digital service. The operation of the system is more stable and reliable, and the application units can pay more attention to their core application services.

### **11.4 The Key Technologies of the Application Platform Subsystem**

The business application platform is the “brain” of the whole IoWA, gathers the public logic in various business or the reusable business processing logic, forms the software source with standardization and open. The development of the application system based on the application support platform, can constantly enrich the sharing software resources collection on the one hand, on the other hand, can continually share the existing software resources, realize the sharing of software resources, and reduce the repetitive developments and the operational and maintenance costs. The Fig. 11.2 shows the data transmission process.

### **11.5 The Key Technologies of the Feedback Mechanism Subsystem**

The feedback mechanism mainly comprises two modules: the operational quality information collecting and processing of IoWA. Its structure, function, and implementing procedure are as shown in Fig. 11.3.

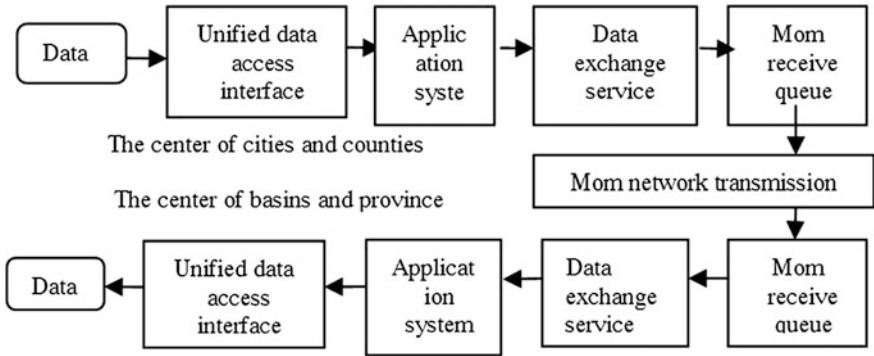


Fig. 11.2 Data transmission process

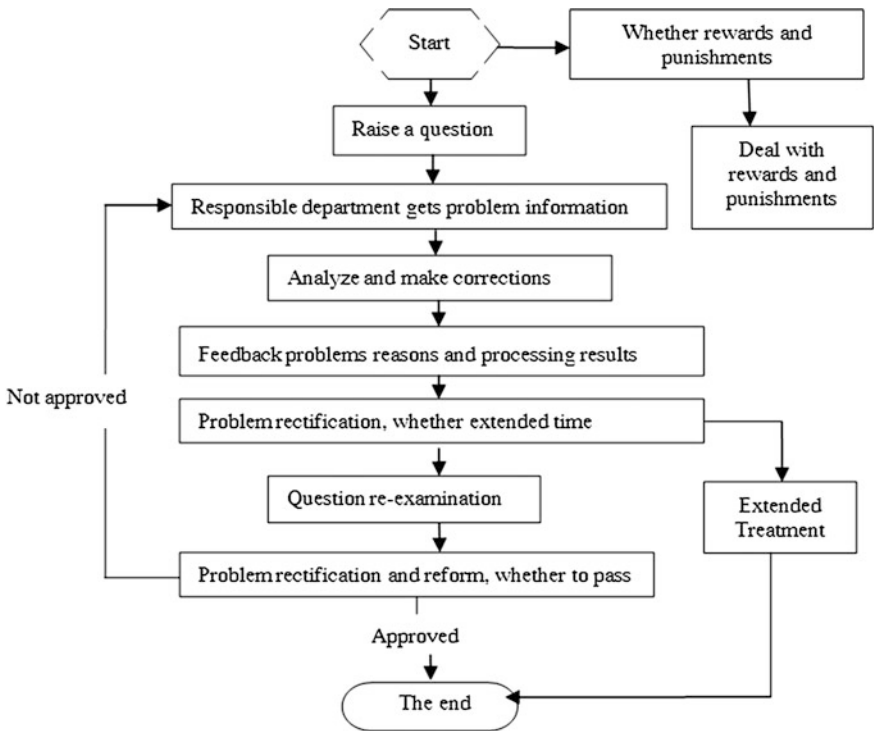


Fig. 11.3 The procedure of the feedback subsystem of IoWA

## **11.6 The Significance and Conditions of Floodwater Utilization in the North of Jiangsu Province**

### ***11.6.1 The Necessity***

The characteristics of the geographical location, climate, population, high-density of economic capacity decide that there are water resource problems like more water and less water, water task like flood control and drought control in the north of Jiangsu province. First, the local water resources are seriously insufficient. Second, the water resources are uneven in the space and time. Third, the plain region has lower ability to allocate water storage. Finally, the water pollution threatens the safety of the water supply.

### ***11.6.2 The Effectiveness***

Above problems require that in the basis of conventional water supply, not only to save water, but also increase the environmental and ecological water, increase the water environmental capacity of rivers and reservoirs, and improve the water flowing and water environment as far as possible. Scientific and reasonable floodwater management can create significant social, economic, and ecological comprehensive benefits. First, increase the water supply, save a lot of overhaul costs of large water stations, and reduce the cost of water supply. Second, promote the water flowing, improve the water quality in the water source area; ensure the safety of drinking water. Third, the intermodulation and interhelp between floodwater resources alleviate the contradiction between water supply and water demand in water-deficient areas, and improve the water environment. Fourth, increase the income of the water management units.

### ***11.6.3 The Favorable Conditions***

There are many favorable conditions such as passing-by water quantity, engineering foundation and so on for the north of Jiangsu province to implement floodwater utilization. First, the passing-by water quantity in the north of Jiangsu province is rich, having natural resources condition. Second, the hydraulic engineering system in the north of Jiangsu province is complete, which is a good engineering foundation for floodwater utilization.

## **11.7 Enhance the Risk Management Function of Floodwater Utilization in the North of Jiangsu Province with IoWA Technologies**

The experience of Tai Hu Lake treatment has shown that IoWA can technically support the intelligent of water quantity, water quality, water level, flow amount, and other water management, thus strengthen the risk management of floodwater utilization.

### ***11.7.1 Support the Time Risk Management of Floodwater Utilization through Smart Metering***

The flood season of the north of Jiangsu province is May–September, and May–June is the water peak for the rice seedlings, requires a large amount of water. If we control the lake water level to the flood control level from May 1, cannot guarantee the completion of the large area of rice planting; at the same time, there is a lower odd to have flood after September, if mechanically began to store water in October, the lake will face the risk of no storage. The smart water meter of IoWA adopts the RS-485 communication standard, coordinate with other sensors and wireless network communications equipment, realize the bidirection communication between the managers and water units, accurately percept the supply and demand conditions of water resources in real-time, detect and eliminate the anomalies of water amount in time, make the flood water be used during the dried weather. Divide the flood season of the north of Jiangsu province into three stages, and implement the time risk management of flood utilization.

The first phase in May–June is the pre-flood season. Based on years of analysis of hydrological data, the current period is the later period of the spring flood season (March–May), there were big changes for the floodwater each year, so we need to prepare flood discharge and draining water to prevent the large spring flood, and also pay attention to little or no spring floodwater, make lake storage to ensure the shipping and spring irrigation water.

The third phase in August (Yishusi region is in August 15 to September) is the post-flood season. According to the water characteristics of the area, should raise the water lever gradually by IoWA in advance and transfer to the normal water level.

### ***11.7.2 Support the Space Risk Management of Floodwater Utilization by Intelligent Scheduling***

The cross-river basin water environmental intelligent monitoring system based on IoWA, in complete control of the river water quality, quantity, and other basic



information and real-time underground water level data, combined with the water consumption situation of all water points, analyze and calculate with the real-time data transferred back by the remote monitoring network, control the water quality information and supply and demand situation in real-time based on the calculated results, achieve the unified inter-basin water transfer of the floodwater resources, improve flood resource utilization, and provide services for water resources development, utilization, allocation, and protection. For example, when the Huaihe River flooding and the Yishusi River lacks water, it can implement “Transfer water from Huaihe to Yishusi”; when the Yishusi River is abundant and the Huaihe River is dry, it can implement “Transfer water from Yishusi to Huaihe”; and when both the Huaihe River and the Yishusi River are having droughts, can open the “River Water Transfer to the North Project”.

### ***11.7.3 Support the Risk Management Capacity of Floodwater Utilization by Intelligent Management***

In order to improve the risk management level of floodwater utilization in the north of Jiangsu province, should improve the normal water storage capacity of “three lakes and one reservoir” by IoWA. Early in the 1950s, Jiangsu proposed that the normal water level of Hongze Lake is 13.50 m which approved by the Central Government to solve the problem of inadequate water resources in the lower reaches of Huaihe River. However, the normal water level of Hongze Lake was not achieved due to various reasons. Currently if we can construct and improve the IoWA, the normal water level of Hongze Lake could be entirely possible to be raised by 0.50 m and achieve the 13.50 m goal ahead of schedule, and greatly enhance the risk management capability of floodwater utilization in the north of Jiangsu province [2].

With the rapid economic development in the north of Jiangsu province, businesses and residences let out overweight sewage. The water ecological environment is getting worse; enhance the water environment monitoring by IoWA, implement the automatic monitoring and real-time monitoring to the water quality, water quantity, and other hydrological indicators of the key water functional areas in rivers and lakes, the drinking water source protected areas, and especially the rivers’ outfalls and key polluted reaches.

## **11.8 Suggestions on the Building and Perfecting of IoWA**

Although IoT technology has transferred from the concept to the practical application, and also achieved initial success in the Taihu Lake treatment, it still needs to solve many problems to form a true sense of IoT.

### ***11.8.1 Establish the Standardization System of Water Management Information***

Any technology needs a unified standard. At present, IoT in the application of water management is still in the initial stage, there is no unified IoWA standard system all over the world, which will greatly restrict the development of IoWA, and the R&D applications of smart metering facilities, water quality sensors, application software, and other related products. Jiangsu province has established related standards for water resources management information, but to establish a national unity, interbasin common standardized system of IoWA, the Ministry of Water Resources should take the lead to absorb the management agencies in the major river basins, and fully absorb the latest results of IoT R&D applications by relevant units.

### ***11.8.2 Accelerate in the Breakthroughs of the Core Technologies of Related Water Information Sensors***

With the application and promotion of IoT, the sensor's meaning has went through the development process from the traditional Dumb Sensor to Smart Sensor to Embedded Web Sensor, and progressively realize the miniature, smart, information and network. It is particularly important to percept the state of the natural water by all the achievements [3]. Speed up the science and technology research of microelectronics, optoelectronics materials, nanotechnology, and other fields, form the water information sensor manufacturing system with the world advanced level as soon as possible, and arm the IoWA with more accurate "sense organs".

### ***11.8.3 Break the Industrial, Regional and Department Barriers***

There are cross-relationships between water management and construction, environmental protection, and a lot of functional divisions, which currently all have built their own wireless networks of water sources, use water, sewage disposal, and so on, all regions are also setting up their own information networks of water resources. To build IoWA based on the sensing technology, we must work together with an open mind, strengthen the coordination and interaction between all regions and the departments of all industries to protect the information sharing effectively, and improve the social network of the risk management of floodwater utilization together.

The technology of IoWA is effective for the risk management of floodwater utilization, but it is not a panacea. In view of the dual nature of flood resources, the implementation of flood utilization must rely on the science and technology, administrative, economic, and other means to provide security, and control the flood risk within an acceptable range.

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# Chapter 12

## Feature of Gender in Computer-Mediated Communication

Xiaoyi Zheng

**Abstract** My study aims to see what the communication between women and men in online chat room will be like; whether it will remain the same as that of the face-to-face interaction; whether the new way of communication under the anonymity provided by computer-mediated communication (CMC) will neutralize distinctions of gender and whether the Internet really provides escape from gender differences. By examining the messages posted by women and men when chatting online, the language features of women and men under investigation will be analyzed.

**Keywords** Feature of gender • Computer mediated • Communication

### 12.1 Introduction

Nowadays, computer-mediated communication (CMC) is rapidly turning our world into a global village. We are able to talk to each other in online chat rooms, mediated by nothing but computers. And we are increasingly seeing the benefit of the Internet which empowers women, who are considered less powerful in the traditional patterns of male dominated communication, not only participate in the CMC “equally” but also find community to pursue their own interests. Thus, the Internet is said to eradicate gender prejudice in communication, leading to greater gender equality, and gender becomes a lesser issue than it has been in previous times [1].

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And according to previous researches on gender and language, women and men do talk differently, adopting different styles in face-to-face communication due to the different cultural myths they have absorbed [2].

My study aims to see what the communication between women and men in online chat room will be like; whether it will remain the same as that of the face-to-face interaction; whether the new way of communication under the anonymity provided by CMC will neutralize distinctions of gender and whether the Internet really provides escape from gender differences. By examining the messages posted by women and men when chatting online, the language features of women and men under investigation will be analyzed [3].

## 12.2 Background

Early studies about CMC suggested that cyberspace was a democratic utopian where opportunities are equal for each gender [4]. As Danet (1998) claims that CMC makes the gender of online communication invisible thus allows women and men to participate equally in contrast with traditional communications patterns of male dominance observed in face-to-face conversations [5].

To investigate the impact that the Internet is making on language, in his 2001 book *Language and the Internet*, Crystal [6] discusses how the language used in various Internet communities has developed in separate chapters: on the language of email, “chat-groups”, virtual worlds (MODS and MUDS) and the World Wide Web [7]. It give answers to the questions “Is the Internet bad for the future of language?” and “Will creativity be lost? Are standards diminishing?”. Crystal argues positively, that the “Net speak” will change fundamentally the way we think about language.

As more women begin to venture online and more research being done in this area, the findings of studies with respect to gender and CMC tend to problematize claims that the cyberspace is gender-free and the notion that the CMC improves communication between women and men [8]. Susan Herring (1993) in one of her article ‘Participation in electronic discourse in a “feminist” field.’ presents results about activity on two academic emailing lists, claiming that instead of women and men participating equally, the discourse and choice of topic are still dominated by men. She concludes that it was “because of social conditioning that makes women uncomfortable with direct conflict thus they tend to be more intimidated by these practices and to avoid participation” [9].

In book *Nattering on the Net* which is largely devoted to women online, Spender (1996) points out that there are many other barriers to women’s participation, for example the money to purchase a computer, to get training, and the time spent on the net. Women are disadvantaged as they have on average less money than men and they usually spend more time on housework. In a word, all the problems women face on the net are versions of real everyday problems—as Spender declares: “That’s a problem in the wider society too; you can’t expect us to fix it”.

Later, in article ‘Gender and power in on-line communication’ Herring (2003) firstly presents evidence regarding gender in relation to online access, CMC and the World Wide Web. Then Herring brings together research findings on gender and the Internet to answer whether and how gender and power relations are affected in and through Internet communication. The idealistic notion that the Internet would create a gender-free environment receives little support from this study. Herring finally concludes that the Internet neither alters the social gender stereotypes nor has it redistributed power equally to women and men [10].

To explore current representations of gender identities in cyberspace, Louise Mullany (2004) conducted a linguistic analysis of the strategies advertisers use to address their targeted subjects via email in her article ‘become the man woman desire: gender identities and dominant discourses in email advertising language’. The inbox of a email account which is of a nongender-specific username was monitored for 9 weeks to get messages, then the advertising messages collected were analyzed through the quantitative survey, and in the qualitative survey the subject lines, senders, and what is inside the message were all examined. Finally, she comes to the conclusion that the binary opposition between male and female is still firmly in reality, and are being drawn upon by advertisers to sell their products. Instead of breaking down the boundaries of gender identities, the advertising language using email helps to foster dichotomies, questioning the utopian gender-free cyberspace what Haraway depicted [11].

Some other researchers have argued that women and men in CMC tend to use different discourse styles [12]. In ‘Gender and democracy in computer-mediated communication’ Herring (1993) analyzes a bulletin board and generalizes woman’s language and men’s language as recognizably two different styles. She describes women’s language as “attenuated assertions, apologies, questions, personal orientation and support”, whereas men’s language is full of “strong assertions, self-promotion, rhetorical questions, authoritative orientation, challenges and humor”.

However, it seems that relatively little work has been done on how women and men communicate with each other in online chat rooms. And that is where my idea of doing this research stemmed from [13].

### 12.3 Methodology

I randomly joined in an online chat room named “Parenting” offered by the world famous Yahoo Messenger with a randomly chosen username [14]. The conversation shown on the screen was monitored and recorded for one randomly selected week. Three periods of day: 9–11 am, 14–16 pm, and 20–22 pm were chosen, thus the different “timetable” adopted by different gender would not affect the results. And since I was not supposed to post any message—I set the status of myself always to be “away” so as not to get involved in the conversation, which would also affect the result of the survey. While 1 week is not statistically significant, I feel that the data collected are representative of women and men chatting online.

Presumably, most of the participants chatting in this room should be “parents” according to the name of the chat room. The survey was based on the assumption that the participants reveal their real identity by choosing a cartoon picture of male or female face to represent their gender, which was shown in front of their username. In addition, I also made the editorial decision to correct some spelling mistakes in the messages, unless the speaker purposely did so.

The project will then commence by a quantitative survey which comprise all the messages collected related to the research during that randomly selected period.

## **12.4 Results**

The results found are a large body of evidence, showing that language features of online chatting between women and men are a version of the face-to-face conversation, which are to the contrary of the claim that CMC neutralizes distinctions of gender.

### ***12.4.1 A Quantitative Survey***

During this period, some 28,000 messages were collected totally, among which men contributed nearly 66 % messages, with contrast to 34 % from women. Moreover, message posted by men is on average longer than that from women. From this result it was clear that the chat room under investigation was dominated by the male participants. Though female did take part in the communication, the voices from two genders are still unequal. Another explanation could be made to response to this result is that men use the Internet far more frequently than women.

### ***12.4.2 A Qualitative Survey***

The qualitative section of the results will focus on the analysis of the different features represented by women and men when chatting online by examining the content of the recorded messages. And the results found will be compared with the face-to-face communication counterparts.

#### **12.4.2.1 Different “Facial Expressions and Body Language”**

At first glance, this title might looks odd, keeping you wondering how these differences could be found when women and men chatting by typing into the screen. As Lillian Glass (1992) argues, women provide more facial expressions

and display smiling and head-nodding when listening, while men provide fewer facial expression and display frowning and squinting when listening. What is found in this aspect turns out to be exactly the same as what Lillian mentioned in face-to-face communication, and all these are vividly realized by the cartoon and flash representations provided by the chatting system. In my study, women are found to use more representations such as smile and laughter than man, and they “kiss” and “hug” others more. In addition to this, the results also agree with what Cherny (1994) points out that women tend to use more neutral and affectionate verbs (such as ‘hugs’ and ‘whuggles’). For example:

Littlemiss (female): ☺ I am back.

Tweaky (female): Okay, I gotta go, see you later...hugsssss.

Punkin (female): My stomach aches from laughing lololol. (lol means laugh loudly).

#### 12.4.2.2 Different “Voice, Loudness and Tones”

Lakoff (1975) illustrates the differences between how girls and boys are taught to communicate—girls are taught a more passive voice and boys emerge from their “rough talk” stage with a more forceful, active voice. And as Lillian Glass (1992) argues, men usually speak in a louder voice, using it to emphasize their points and they sound more monotonous in speech, using approximately 3 tones when talking. While women speak in a soft voice, using pitch and inflection to emphasize points and they sound more emotional in using more tone tones. These are all replicated in online communication: men in this chat room resort to capitalize every letter in their sentence to “speak loudly” and even using more exclamatory marks to be “heard” more clearly. While women there are more likely to type words in different fonts, different colors and using all kinds of marks to indicate their emotional tones. For example:

BI@ck P@nther (male): ANY GIRLS WANNA CHAT PM ME!!!!!!

Hailed13jeep (male): OH, I SEE LADY!!!!

Hermit (male): NOOOOOOOOOO!!!!

Ladycat (female): Merry Christmas Everyone!

Coolrain (female): ~ ~ ~\*\*\*I love snow \*\*\*~ ~ ~

#### 12.4.2.3 Different Language Features

Table 12.1 below generalizes the different language features between women and men when chatting online. In a whole, the results found again turn out to be a reduplication of the face-to-face communication between women and men.

In this study women are found to make more tentative statements, try to qualify and justify their assertions by adding tag questions such as “isn’t it”, pragmatic



**Table 12.1** Different language features between women and men when chatting online

Women	Men
Make more tentative statements	Make more declarative statements
Make more indirect accusations	Make more direct accusations
Ask more questions	Ask fewer questions
More expressions of thank, compliment, and apology	More verbal aggressiveness
Disclose more personal information	Disclose less personal information

particles “I think”, “sort of” and modal verbs “maybe”, which as Coates mentions (1996), have the effect of damping down the force of what they say. However, men assert opinions strongly and directly as “facts”, what are much the same as those have been previously described for face-to-face interaction. For example:

- Linda2004 (female): That is better, isn’t it?
- merryl\_d2000 (female): It seems to me that he would love it.
- Lucky 317(female): I’m afraid you might be wrong...
- Dead-bird (male): You are too tight to give anyone anything!
- Egg breaker (male): Noooo, it is completely nonsense!

Women use more embedded imperative to make accusation, while men tend to use more direct accusations. For example:

- Amityant (female): Could you please show me how to clean the feeding-bottle?
- Sinppedforlife (male): Listen, tell me your reason!
- Dusty3006 (male): Change your setting so they need permission to view!

In this study, women asks nearly triple as many questions as men. Men always make themselves appear to be expert, dashing along the latest news in sports politics and business. However, women are more humble to raise information-seeking questions and to stimulate the conversation by asking questions. Here are examples of questions asked by women:

- Jessika loves David (female): how old is our baby?
- Funny sweet (female): I am planning a family anyone else?
- Giggelady (female): What r u doing there?

And in this study, the women participants appear to be much politer than men which agree with what Mills (2003) demonstrates, that at a stereotypical level, politeness is often consider to be a woman’s choice. In addition to the tentative statements and indirect accusation women made so as to be polite, greetings, compliments, and apologies, which according to Holmes (1995)—linguistic devices expressing politeness, are post mostly by the female participants. In general, women are more considerate, attentive and protective of the participant’s want to be liked, supported, and accepted. The conversation took place among women aims to create a supportive atmosphere. However, men carry on their conversation by making fun of each other and they do not mind offending others

by using aggressive and rude remarks. And they prefer anarchy, regarding conflict full of hostility inevitable. For example:

Fredrica (male): Fuck off, do not chat naked here!

Mango (male): Your wife must weigh more than a truck lololol

Virginiawolf (male): Shit, god damned it!

Though the text only CMC is less revealing of personal information than face-to-face communication, gender is often visible on the Internet on the basis of features of a participant's discourse style as I have analyzed above. However in addition to this, participants themselves also "give off" information about their life, especially gender, directly and unconsciously in interaction. Among which, women disclose more personal information when chatting. It agrees with what happens in face-to-face conversation, just as Coates (1996) points out that women talk predominantly about people and draw heavily on personal experience, and Coates (1986) found that all women conversations are therapeutic, they share their own experience, offering reassurance, and advice. For men, the discussion of personal problems is relatively rare, instead of responding by bringing up their own problems, they take on the role of expert, and lecturing others. Thus in this way, in spite of the anonymity the Internet provides, there are still cues to reveal the real gender identities of the participants. For example:

Pretty mama (female): I got a freezer full of meat gift from friend, wow pretty mama gonna put on weight ☹.

Tweaky (female): I gotta go, seeing Harry Potter tonight with hubby.

Savea Turkey Eata Bunny (female): Sorry what did I miss? hubby called lol.

#### **12.4.2.4 What is Different from Face-to-Face Communication**

All the results found above show that the interaction between women and men is a reduplication of the real-life face-to-face communication. But I still find one phenomenon which is opposite to the real-life situation that is the response and attitude of women in responding to sexual harassment. As we know, in real-life women are more likely to keep silent when they are faced by sexual harassment.

However, thanks to the anonymity provided by the Internet, this time women tend to be much braver to beat back the offensive action from men by using even more dirty and profane language in reply. The lack of physical appearance in communication can allow them to make bold statements without having to worry about how their gestures or voice might falsely render them.

## 12.5 Discussion

It is clear from the analysis of the messages posted by women and men when communicating online that the Internet has not managed to neutralize gender; on the contrary, it appears to be a version of which exists in real life—the language features of women and men and still “gendered”. The previous “old” theories of gender styles in face-to-face communication can be still applied to the online communication based on the new media Internet, which also has component of gender and is not a completely egalitarian space.

The results presented indicate that it is impossible to create an identity in cyberspace without having one’s true identity, and it unavoidably duplicates what currently take place in everyday life. Since it reflects our social values a whole, and as gender bias does exist in the broader culture, the gender bias surely exists in cyberspace. So it just reflects both the negative and positive qualities within the individuals and cultures.

As we know, women and men have different “culture” of communication which they learned as they grow up. They are taught to behave appropriately what suit their gender. They naturally value different kinds of online interactions as appropriate and desirable when they communicate with each other online. So when it comes to chat online, they just use the already given culture to “run” the new way of communication in this territory. Understandably, what emerges in online communication is just the continuation of what take place in the present practices of communication in everyday real life. The language features of the two genders are formed gradually in the thousands of daily conversations, and at the mean time it also gradually shaping the new culture of cyberspace.

In chat room, the feature of women’s language remains less direct, avoiding arguments, while men are focusing on exhibition of their knowledge and skill. It is also because of their different concept and purpose of communication, as Holmes (1995) states most women regard talking as an important means of keeping in touch with friends and them use language to establish, nurture, and develop personal relationships. Men tend to see language more as a tool for obtaining and conveying information. Thus, when it comes to communicate online, women still seek to share their own experience, they reveal a lot of their personal information, and they still speak a language of intimacy and stress support within their specific online community.

However, we should admit that besides being a version of face-to-face communication, to a certain extent, Internet does help to make women more “powerful”. As analyzed above in “what is different from face-to-face communication”, sexual harassment also exists in cyberspace, which could be seen as a tactic used by some men to drive women away from the chance of being in the favorable position in communication, to draw back from the Internet affairs. But women failed this plan by posting similar insulting words in reply. The anonymous communication of Internet can play an important role of protecting women from violation of politeness from men in a profoundly new way.

## 12.6 Conclusion

After the analysis and discussion of women's and men's language features when chatting online, I may safely come to a conclusion that though the Internet is absent of physical and social status cues, which is supposed to improve the state of gender issues, gender does not really disappear. In my study, the language features and the way of communication between women and men turn to be a version of the face-to-face communication. In other word, it duplicates what currently take place in conversations of real life.

Up until now, the expectations for sudden changes of the binary opposition of two genders in communication are just wishful thinking. The social status of women cannot be changed overnight, and the possibilities of reverse the phenomenon described above may depend on the further development of education and emancipation of women. I believe that as more women utilizing the Internet, the Internet will be instrumental in creating greater equality through online communication.

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# Chapter 13

## Concurrency Control of Real-Time Distributed Web Applications Based on J2EE Multi-Tier Architecture

Chang-e Dong

**Abstract** In this chapter, we presented strategy and method to design and analyze resource-oriented concurrency control in the Web application systems, so as to improve the correctness and performance of concurrent systems through resource-oriented interface programming. The approach mainly contains three steps: first, business extraction is implemented to provide the resource for concurrency control; second, the resources that related to the business process need to be classified and registered, so as to be recognized by the control system; third, a dynamic link between the registered resource and strategy warehouse should be established, and then the concurrent resource and concurrency mechanism can be connected together to solve the conflict in using the resources between different users.

**Keywords** Concurrency control · J2EE · Resources registration

### 13.1 Introduction

As Web application systems with J2EE-based multi-tier architecture usually run in concurrent environment during the developing process or applied by different networked users. When some operations relate to database are made by different system roles or users without reasonable concurrency control might cause data temporal consistency and logical consistency, and the complexity for implementing, testing, and tracking these systems is significantly increased when there are resource concurrency problems. But in fact, currently, most concurrency

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control strategies and programs mainly focus on databases, while lack the effective and integrated concurrency control strategies to manage and allocate different resource types, and therefore cannot solve the concurrency and operational issues between the various resources in the Web application and development for servicing the business systems. And modern software development projects that concurrency control and transactions are not simply the domain of databases, instead there are issues that are potentially pertinent to all of the architectural tiers and resources.

## **13.2 Related Background Knowledge**

### ***13.2.1 Resource-Oriented Concurrency Control***

Concurrency control deals with the issues involved with allowing multiple people simultaneously access to shared entities, objects, data records, or some other representation. In computer science, especially in the fields of computer programming, operating systems, and concurrency control ensures that correct results for concurrent operations are generated, while getting those results as quickly as possible [1]. Concurrency control in database management systems (DBMS), other transactional objects, and related distributed applications ensures that database transactions are performed concurrently without the concurrency violating the data integrity of a database. The main categories of concurrency control mechanisms are optimistic and pessimistic [2]. Besides, many methods for concurrency control exist; include two phase locking, conflict, graph checking, timestamp ordering, commitment ordering, multi-version concurrency control, and index concurrency control [3].

### ***13.2.2 J2EE-Based Multi-Tier Architecture***

J2EE-based multi-tier architecture technology can also be utilized for resource-oriented concurrency control programming. And in this chapter, we use multi-tiered structure in applications: presentation layer, business logic layer, persistence layer, and domain layer. A well-architected application is crafted into distinct layers, each of which encapsulates a particular role and has its own functions as different independent layers, so we can build a effectively combination framework, that is, the presentation layer, based on Model View Controller (MVC) design pattern, is implemented by Web Work framework, while the business layer is implemented by Spring framework, which is an IOC/AOP container [4]. Each layer maintains a clear separation to make them independent existence with different functions. Multi-tier architecture is shown as Fig. 13.1.

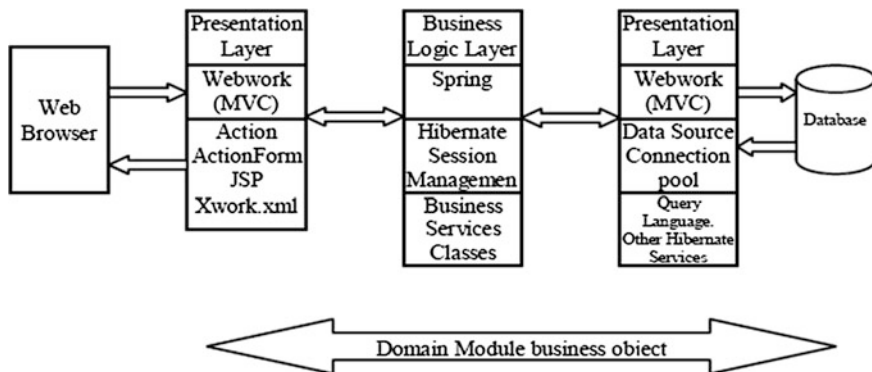


Fig. 13.1 Multi-tier architecture framework

### 13.2.3 Improved Multi-Tier Architecture

The problem of the traditional multi-tier architecture above is: Web presentation layer depends on the concrete realization of business process logic, while business process logic depends on the concrete realization of data access operations [5]. So the chapter introduces “interface-oriented” design concept to solve the resource-oriented concurrency control, puts forward a type of new Web application framework, its structure is shown in Fig. 13.2.

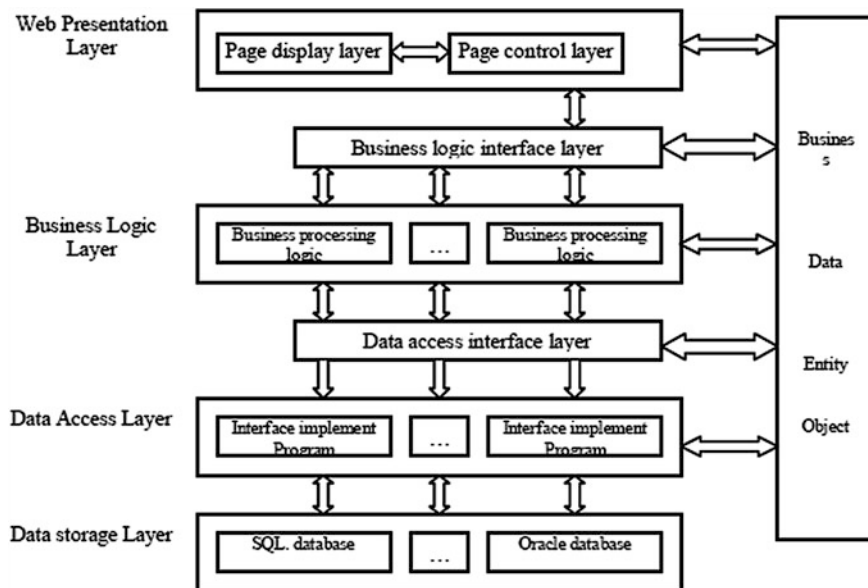


Fig. 13.2 Improved multi-tier architecture

## **13.3 Overall Analysis and Design of Resource-Oriented Concurrency Control**

### ***13.3.1 Business Extraction***

Business extraction is the first step of constructing the resource-oriented concurrency control, which is the discipline of identifying business needs and determining solutions to business problems. Solutions often include a systems development component, but may also consist of process improvement or organizational change or strategic planning and policy development. Through business process analysis, we can extract critical business. In this chapter, we take Web content management system (WCMS) as an example, which describes the basic steps and methods of business process analysis, utilizes use case diagram to analyze the main business processes by UML, then build functional structure, and extract the main functions and processes to prepare for the resource registration.

#### **13.3.1.1 Use Case Diagram**

Use case diagram: it is the description of system functionality from the user's point of view and points out that each function of the operator and the dynamic description of system behavior [6]. The use case diagram of the content distribution management is shown as follows (Fig. 13.3).

#### **13.3.1.2 Functional Structure Chart**

A complete content management system should have four major functions: content draft management, content edit management, content audit management, and content publish management. According to the use case diagram of content management system described above, we can attain function structure diagram of Web content management system, after optimizing and optimal decomposing the functional structure to satisfy the relevant principles, an optimized functional structure has been acquired and shown as below in Fig. 13.4.

### ***13.3.2 Resource Classification and Registration***

The main purpose of resources registration is to find suitable concurrency control strategies according to registered resource when such kind of resource concurrency issues occurs [7]. Before registration resources, we need to classify the resources into different types which have been contained in the development and



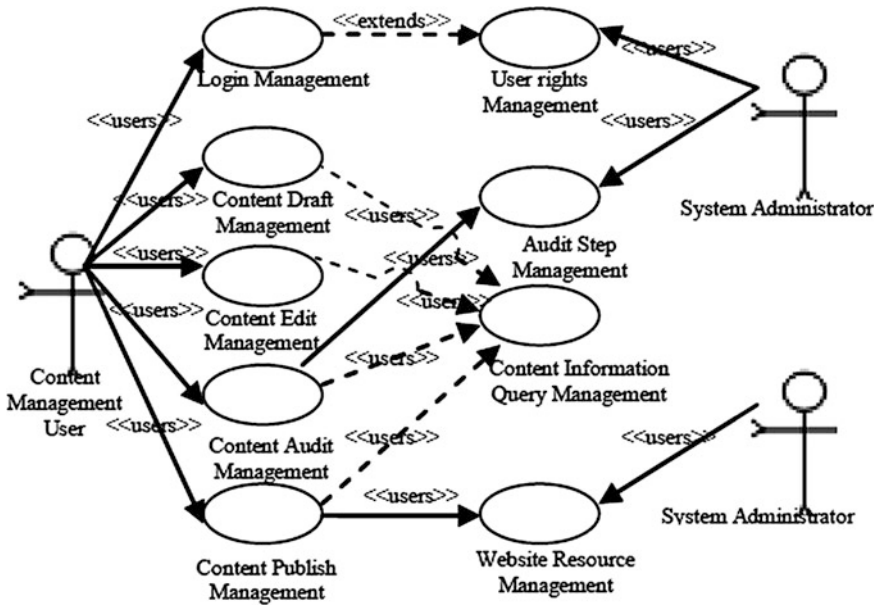


Fig. 13.3 Use case diagrams of WCMS

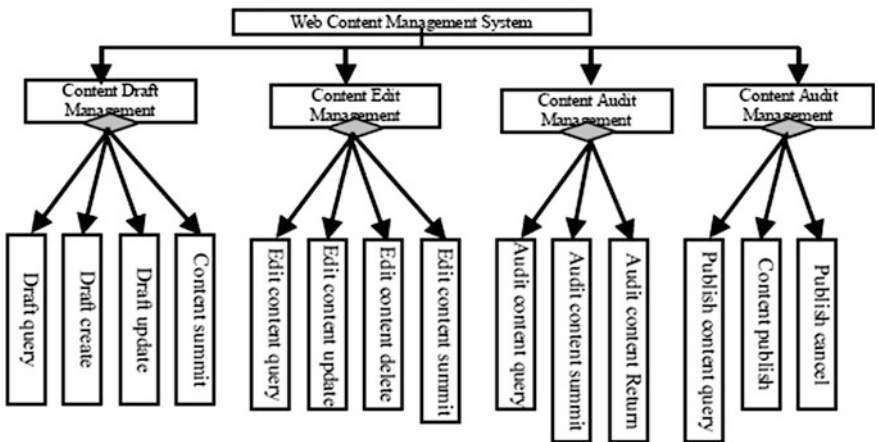


Fig. 13.4 WCMS functional structure chart

implementation process of Web application. In this chapter, first, we acquire a basic resource collection by business extraction and functional analysis, then the resource collection can be separated into different resource types; second, the classification method that applied here primarily bases on the resources access

actions that led to concurrency issues and the form and location that the resources have storage; finally, we can use resource classification flow chart to give a detail of how to categorize the initial resource collection, and as Fig. 13.5 below shows that there are totally five categories of resources: database resources, upload or download resources, program code resources, interface display resources, and other resources.

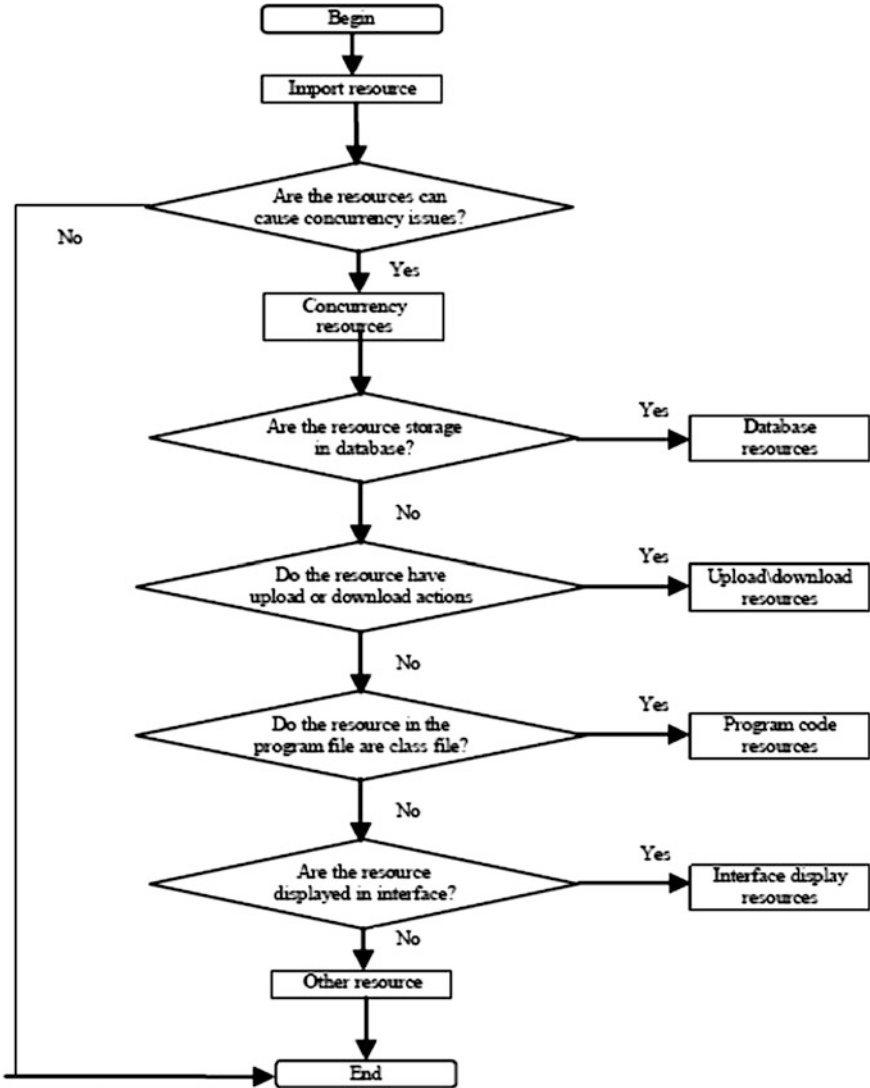


Fig. 13.5 Resource classification flow chart

**Table 13.1** Project selection matrix rules

Resource types	Concurrency actions
Web pages	Publish, update, search, and delete
Data records	Update, search, and delete
Document files	Download, upload, update, search, and delete
Images or pictures	Download, upload, update, search, and delete
Program codes	Call, update, search, and delete
Java classes	Call, update, search, and delete
Variables	Access, update, search, and delete

After the resources have been classified into different types, we can realize resources registration primarily on the business logic layer, according to the classified resources, we can list the concurrency actions of different resource types in Table 13.1, the table shows that when more than one actions work on the same resource simultaneously, which may probably cause the resource concurrency problems, thus beforehand, we should register the resources, so that the control system can recognize the resource types and take corresponding control mechanisms to solve the concurrency issues.

### 13.3.3 Establishment of a Dynamic Link

A dynamic link between the registered resources and the strategy warehouse has been utilized to support the requirement of different resources concurrency. When we establish the dynamic link, the strategy warehouse should be encapsulated in java package. Besides, encapsulated strategy warehouse can be described as a protective barrier that prevents the code and data being randomly accessed by other code defined outside the class. An interface is used to control the access to the data and code tightly.

The main benefit of encapsulated strategy warehouse is the ability to modify the system's implemented code without breaking the code of others. With this feature, different kinds of users should take part in the process of the establishment of dynamic link, so as to link the extensive concurrency resources to its corresponding strategy warehouse together between different users to choose the concurrency control strategy. And in the article, we utilize business flow chart to analyze the resource process, so as to create a dynamic link between registered resource and warehouse strategy, the detail process is shown as follows by Fig. 13.6.

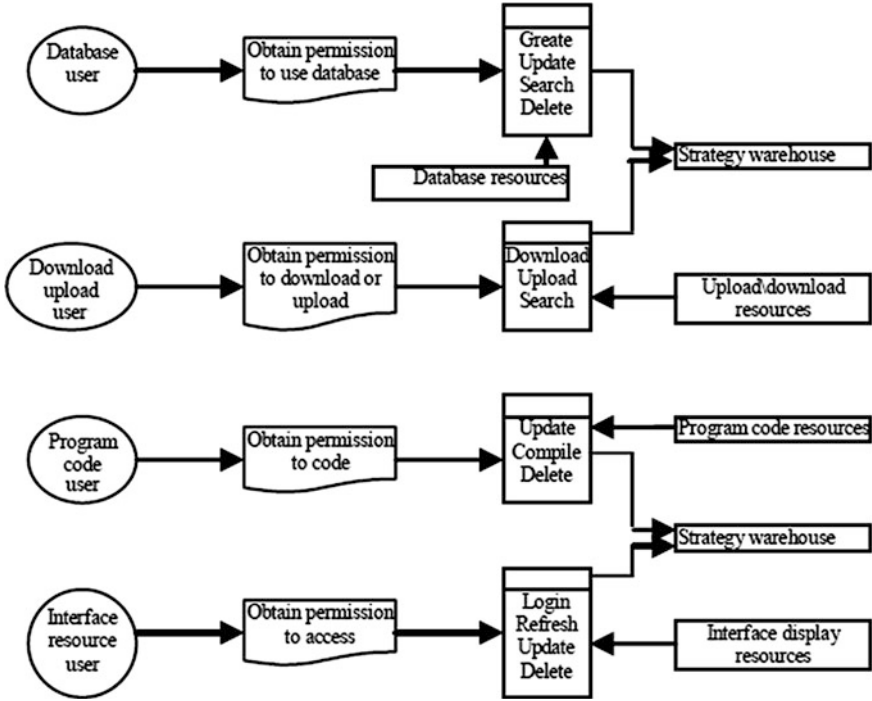


Fig. 13.6 Class diagram for caching simulator using FIFO, LRU and LRU with related content

### 13.4 Implementation Process and Related Key Technologies

#### 13.4.1 Resource-Oriented Concurrency Control Interface

In this part, we will define a resource-oriented interface allowing a resource class to become more formal about the behavior it promises to provide [8]. Interfaces form a contract between the class and the outside users that want to access resource, and this contract is enforced at build time by the compiler. The lock and unlock resource interface which has been defined below is in the business layer, so as to improve the flexibility and simplicity of resource concurrency control. By implementing this interface, we can implement some basic method and measures for the resource-oriented concurrency control and resource management. Specific interface code is as follows by Fig. 13.7.

```

//Lock and unlock resource interface for concurrency
public interface ILockService {}
/** Function user applies for the resource lock
 * @ param resourceName; resourceId; userId
 * @ return Boolean */
public Boolean applyLock( String resourceName, Long resourceId,
                        Long userId);
/** Function acquire the locked resource list
 * @ param resourceName; resourceId
 * @ return xmlnode list */
public List getLockListByResourceNameAndId (String
resourceName, Long resourceId);
/** Function judge the resource lock is valid or not
 * @ param lockElement
 * @ return true or false */
public boolean isLockValid ( Element lockElement)
/** Function lock the resource
 * @ param resourceName; resourceId; userId
 * @ return true or false */
public boolean isLockResource ( String resourceName; Long
resourceId; Long userId)
/** Function unlock the resource
 * @ param lockElement Xml node
 * @ return true or false */
public boolean unlockResource ( Element lockElement)
 * @ param userId
 * @ return true or false */

```

Fig. 13.7 Interface code by eclipse platform

## 13.4.2 Key Technologies

### 13.4.2.1 Multi-Tiered Implementation

In practical application, WCMS adopt J2EE-based multi-tier technical architecture to design and analyze concurrency control strategy, which consists of presentation layer, business logic layer, persistence layer, and domain layer; the presentation layer is responsible to display the interface resources to users, and input database resources, interface display resources can be transmitted through this layer to the business layer. Such frameworks can be utilized to reduce the coupling of control system [9]. The benefits of multi-tier architecture are that it has lowered coupling problems for the whole program structure to implement a validity and simplicity concurrency control mechanism. And the maintainability and flexibility have also been improved, thus eliminating the deficiency while using each separate framework to develop a concurrency control program.

### 13.4.2.2 Locking Mechanism

Pessimistic locking is an approach usually used to lock the entity in the database for the entire time that it is in application memory. But for the resource-oriented concurrency control, we can also utilize the pessimistic locking mechanism to limits or prevents other users from working with the resource in the system, and the write lock indicates that the holder of the lock intends to update the resource and disallows anyone from reading, updating, or deleting the resource. A read lock indicates that the holder of the lock does not want the resource to change while he holds the lock, allowing others to read the resource but not update or delete it. The advantages of pessimistic locking are that it is easy to implement and guarantees that your changes to the resources are made consistently and safely.

## 13.5 Conclusions and Future Work

The main contributions of this chapter are summarized below:

- Method to establish dynamic link between registered resource and strategies warehouse for resource-oriented concurrency control issues.
- Design and analysis strategy to implement resource-oriented concurrency control.
- Propose a J2EE-based multi-tier architecture that can be used in Web applications for resource oriented.
- Examples of concurrency control strategy that can be used as resource-oriented concurrency control strategy, and related key technologies.

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# Chapter 14

## Petri Net-Based Workflow Technology in Office Automation

Cuiping Wang

**Abstract** Based on Petri nets and role modeling, Petri nets and the role will combine not only a good description of the relationship between activities and can also describe the activities of the main roles and the interaction between the roles, this method can enhance model of comprehensive, and has a good flexibility.

**Keywords** Petri net · Role · Workflow

### 14.1 Introduction

Workflow management technology is capable to plan workflow better and considerably shorten the time to handle the office businesses by reducing the unnecessary intermediate states in the documentation transfer process, speeding up the workflow processing and enhancing people's work efficiency and management standardization.

Workflow management technology itself is an abstract and highly complex technology [1, 2], and aims to extract an all-purpose model from various businesses of enterprises [3], expecting to describe the consistency of all kinds of businesses through this model. However, it is an extremely difficult task to gather numerous and complicated businesses on such a model. Fortunately, people have come to realize that it is relatively easy to start from general and simple businesses. Therefore, this chapter is devoted to the application of Petri net and role modeling to establish a workflow model applicable to office automation (OA) [4].

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## 14.2 Workflow Model Based on Petri Net and Role

Petri net combines the two aspects of rigorous semantics and graphic language, which is an ideal workflow modeling method and able to intuitively describe a workflow [5, 6]. Traditional workflow model attaches importance to the activities and relation description workflow and carries on management focusing on activities, ignoring the main roles of activities and the interaction between roles. However, the modeling based on Petri net and roles organically integrates Petri net with roles, describing not merely the activities as well as their relation but also the main roles of activities and the interaction between roles, and thus the comprehensiveness of model is intensified with fairly excellent flexibility.

**Definition 1** The model based on Petri net and roles can be defined as a 7-tuple  $(PR = \{N, P, T, M, R, U, F\})$ , where

- N is a name of procedure
- P is a set of place
- T is a set of transition and  $P \cap T = \text{null}$
- M0  $P \rightarrow N$  is initial marking (N here is a set of natural numbers); the distribution of token in place is the marking of Petri net (i.e.,  $M: P \rightarrow N$ )
- R is a set of roles
- U is a set of users
- F is a set of relation.

Besides,  $PT_{-}(P \times T) \cup (T \times P)$  is a set of directed arc or relation of linking place to transition or transition to place.

$R\_Roles \times Transitions$  is a set of relation between transition and role;  $RU\_Roles \times Users$  is a set of relation between role and user;  $UT\_Users \times Transitions$  is a set of relation between transition and user.

In the workflow model based on Petri net and role, the transition node represents task and each task has its corresponding role carrier. Place node represents the system state or task execution condition, and arc is the relation between transition node and place node.

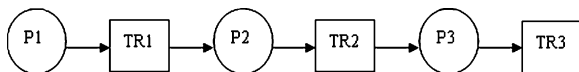
A simple ordinal relation model is taken as an example to describe the elements of workflow model based on Petri net and role [7]. The workflow structure is as shown in Fig. 14.1.

In the structure chart, P1, P2, and P3 are places; T1, T2, and T3 are transitions; and R1, R2, and R3 are roles. In order to draw up the workflow structure chart more conveniently, a simplification is made for the above chart, TR are merged into TR [8]. The simplified model is as shown in Fig. 14.2.



Fig. 14.1 Ordinal relation model

**Fig. 14.2** The simplified ordinal relation model



### 14.3 Case Analysis on the Dispatching Management

In the office management information system, the primary processing object is document. The cooperation, taking document as medium, is completed through the flow of document in different originations. The dispatching management Petri net model based on Petri net and role theory will be established and analyzed in the following.

Document dispatching is one of the nucleus modules in the office management information system and also the management reflected the most explicitly in workflow. The dispatching management undergoes a series of operation starting from drafting to countersign, check, issuance, document processing (compiling number, registration, seal, and sending), and archiving [9].

**Drafting** (i.e., the drafting of the document to be sent): In the process of drafting document, not only the document content but also the information of words, countersign units, main sending object, copy object, and so on.

**Countersign**: The document, involving in the information of other departments in addition to the host unit, needs the agreement of relevant departments and also the signature of their leaders on its draft. The countersign is a process which can be repeated. The host unit and countersign unit can conduct discussion concerning about the document content until a consensus is accomplished between each other.

**Check**: The purpose of the step lies in the improvement of document words. Checking the draft is to verify the words correctness and the countersign suggestion consistency. After the checking personnel revise and sign the draft, the document can be sent to the issuer for document approval.

**Countersign**: This is to allow the document issuer to countersign the relevant documents within his power. The issuer of a certain document is appointed by the competent departments.

**Document processing**: The documents at different levels are handled by different personnel. The document processing here contains the document number and itself generations, sealing, and sending (to the main sending unit and copy sending unit set up in the document draft).

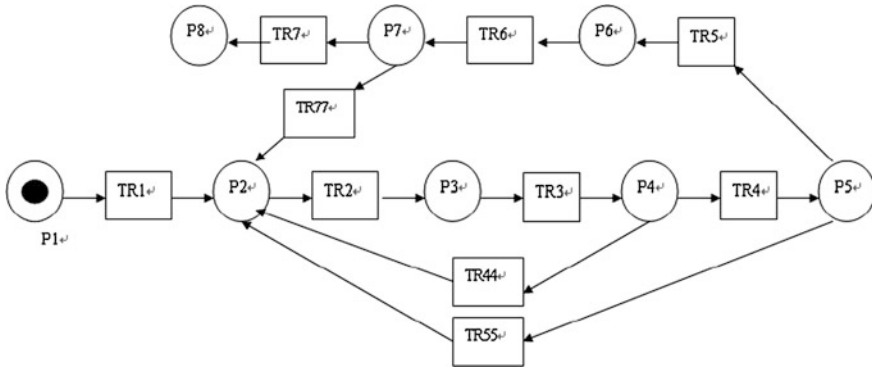
**Archiving**: This is necessary after document processing for the sake of reference service.

### 14.4 Dispatching Management Workflow Model Based on Petric Net and Role

The meanings of all roles and tasks in the Fig. 14.3 are shown below:

TR1 Host department makes new draft.

TR2 Host department sends a countersign request.



**Fig. 14.3** Dispatching management workflow model based on petric net and role

- TR3 Relevant departments countersign the draft and return results.
- TR44 Host department revises draft, which needs to be re-countersigned or countersigned by other departments.
- TR4 The competent department checks the draft.
- TR55 The draft does not pass the check of competent department and is sent back to host department for re-negotiation.
- TR5 Host department sends a countersign request.
- TR6 Countersign department signs the document
- TR7 Host department agrees to send document and gives it to the dispatching department.
- TR77 Host department does not agree to send document and returns it to host department.

## 14.5 Dynamic Role Allocation

If abnormal situations such as sick leave force some role carriers are unable to perform their corresponding activities, it is necessary to search other role carriers which are capable of performing the roles needed by the activity, and combine the allocation principle to select an appropriate role carrier to replace it. If no appropriate role carrier is searched, the system needs to assign or add new role carrier to perform this activity and update the set of role carrier as well as the set of role. The performer through dynamic allocation activities can enhance the flexibility and agility of software. It can be seen that role is the bridge between activity and performer. It is worth noting that the needed role is determined by activity attributes but not the task.

**Definition 2** The role assignment relation  $A$  is to give a role carrier to own the role of an activity, namely the corresponding relation among activity, role and role player can be marked as  $G(a, r, u)$  where  $a$  is activity;  $r$  is the role of activity;  $u$  is the carrier of role “ $r$ ”.

**Definition 3**  $A(a, r, u)$  is the set of the activity, role and role player which currently have corresponding relation.

**Definition 4**  $E(a, r, u)$  means that a role carrier owns the making “ $f$ ” to perform an activity and return to the performing state. “ $f$ ” indicates whether  $A$  is successfully performed or not,  $f = \{Y/N\}$ .

**Definition 5**  $C(u, a)$  means whether a role carrier “ $u$ ” can perform a activity “ $a$ ”.

Some role carriers unable to perform their corresponding activities owing to abnormal situations are shown in the following.

```

For each  $A_i$  in  $A$  //  $A$  is a set of role assignment relation
If  $E(A_i) == N$  and  $C(A_i.u, A_i.a) == N$  //  $A_i$  cannot be executed and results from
the role carrier
 $P_u = \text{Null}$  // may replace the carrier set  $P_u$ 
For each  $U_j$  in  $S_u$  //  $S_u$  is the set of all possible role carriers
If  $C(U_j, A_i.a)$  // role carrier can execute a  $P_u = P_u + U_j$  // add  $U_j$  into the carrier
set  $P_u$  which may be replaced
If( $P_u! = \text{Null}$ )
 $u = \text{ChooseUser}(P_u)$  // allocate principle based on role
// select appropriate role replacer
 $A(a, r, u)$ 
Else
 $A(a, r, nu)$  // add new role carrier

```

## 14.6 Conclusion

This model can achieve interaction between roles in workflow model and provides the dynamic allocation algorithm. The model is of great value to the practical application, and possesses the guidance and reference significance for the discussions on the application of Petri net-based workflow technology to the office automation system. Also, it has good practical significance for the construction and development of office automatic system.

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**Part II**  
**Control Engineering and Applications**

# Chapter 15

## Study of Partition Speed Method in Stock Forecasting

Guobin Chen and Nanying Luo

**Abstract** Effective analysis and processing of stock trading data to find the internal relations is of great significance to the guidance on investment decisions. With the stock trading data as research object, this chapter proposes a stock forecasting parallel method with Partition Speed Method and Multithreading parallel computation method. This method conducts acceleration computation with Partition Speed Method of apriority algorithm, equally distributes the computation quantity to all participant computers with Multithreading parallel computation method, and recovers the results in a real time and synchronous manner with network programming technology. The experimental results show that this method can effectively shorten the computation time for stock association rules, improve mining efficiency and further offer powerful help for stock investment.

**Keywords** Partition speed method · Multithreading · Stock forecasting · Network programming technology

### 15.1 Introduction

Effective analysis and processing of stock trading data to find their internal relations has always been a research nodes and also a hotspot in the stock forecasting field, which is also the primary task in the mining of stock trading data [1]. Currently, there are many stock forecasting methods, such as the forecasting

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method based on neural network, the forecasting method based on fractal theory, the forecasting method based on Grey-Markov, the forecasting method based on trading volume transfer, and the forecasting method based on rough set attribute reduction method. In addition, there is also the method which establishes complex mathematical formula to forecast the value change of the coming day, the method which analyzes the similar isolated points of the time period, the method which makes forecasting with support and confidence, and the searching method based on sequence matching which helps investors look for stocks [2]. Different research methods have different priorities, but these methods have a common disadvantage, that is, the computation of time complexity is huge, and it is also time consuming to repeatedly scan database and insert.

## 15.2 Proposal of the Target Rule

There is always some relationship between stocks; for example, the rising or falling in the price of international crude oil stocks will have some impact on the prices of some airline stocks, and the rising or falling in the price of coal stocks will have some impact on the stocks of iron and steel manufacturing industry and coal and electricity industry [3]. In the stock market in China, there is often alternating rising and falling between different plates. However, what investors care more is that when a stock rises or falls, which stocks will also rise in the coming day, or when two stocks consecutively fall, which stocks will rise in the coming day. This can help them search for stocks, rather than observe stocks one by one. According to this rule, we offer the mathematical form of target rule:  $P(X1, T1) \wedge P(X2, T2) = > P(X3, T3)$  where the predication P refers to the “up” or “down” in the stock price in some day. After using the OLAP technology, the result sets from this forecasting model can help the users inquire the stocks needed in a better way [4].

## 15.3 Proposal of the Method

Since the data of each stock are relatively large and the memory of computers is limited, the computers cannot read all stock data at a time, and thus the FP-tree method cannot be used for processing. And throughout the processing process, the most time-consuming operation is the repeated access to the database. In the design process of this method in this chapter, due to the forecasting of the rising and falling of stocks and each stock averagely with nearly 2,000 trading records, if too few stocks are selected for computation, the computed results will be of no guidance significance, and if all stocks in a given country are selected for computation, it will take more than 1 year to compute with single-thread method in a computer [5]. To solve this problem, this chapter conducts acceleration



computation by using Partition Speed Method with apriority algorithm, recovers the results in a real time and synchronous manner with socket programming technology and concurrently produces frequent item sets with Multithreading parallel programming method and distributes the sets to each server terminal, so as to make several servers compute the needed results simultaneously.

### 15.3.1 Architecture of the Method

The architecture is as shown in Fig. 15.1.

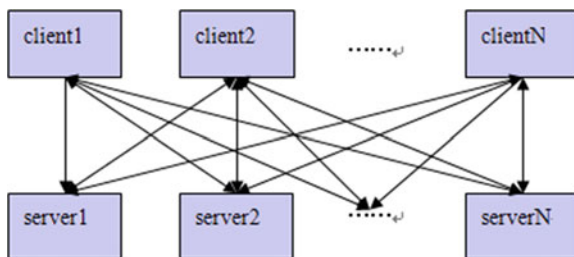
The main words in all headings (even run-in headings) begin with a capital letter. Articles, conjunctions, and prepositions are the only words which should begin with a lower case letter.

### 15.3.2 Partition Speed Method

The repeated scan of the database and a large number of the candidate sets produced make the apriority algorithm time consuming. In the stock forecasting, the time complexity of apriority algorithm computation program is  $(N^3)$  or  $(N^2)$  where N is the trading days of the stocks selected, the number of which can be free to set, a year or many years. Such huge time complexity greatly reduces the performance of the algorithm [6].

According to the study, Partition Speed Method can reduce the time complexity of the algorithm to a certain extent, and improves the performance of the algorithm. The basic idea of the method is: divide the entire computation quantity into different terminals to cut down the computation quantity of a single terminal. The whole computation process is divided into two parts: the first part is used to generate the stock code combinations and the second part is to compute the association rules with the stocks in the combination. This chapter takes the combinations of three stocks for instance, in which the program which generates stock codes will produce three ids, which will be transformed into the associated computation programs as the parameter. After receiving the parameters of stock

Fig. 15.1 Server and client structure



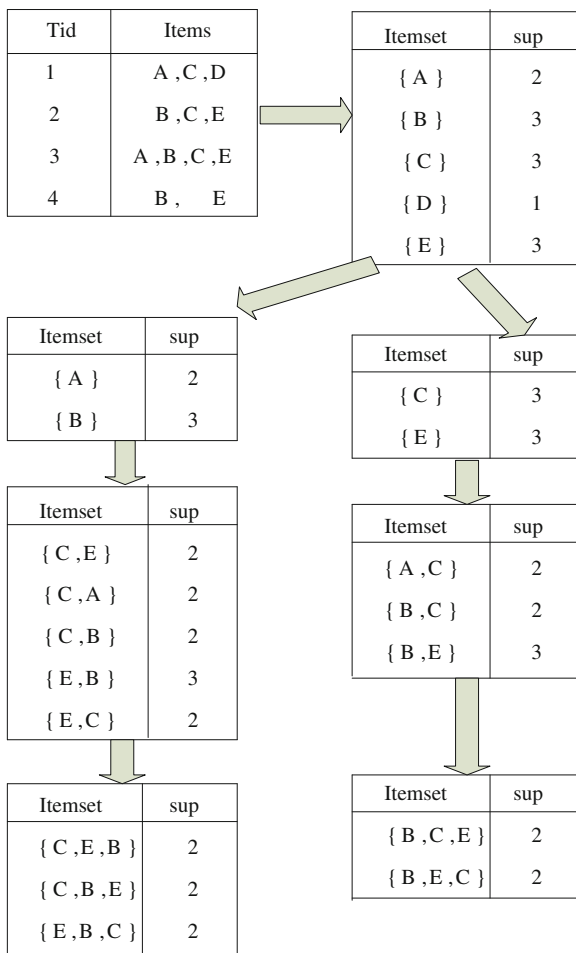
ids, the associated computation program will compute their support and confidence, and then return the results to the first program. Here, the first part is equivalent to the client terminals and the second part is equivalent to the server terminals. The method in this chapter equally separates the stock id combinations, and then equally distributes the computation quantity to each terminal. Figure 15.2 demonstrates the speed-raising process of Partition Speed Method with armory algorithm. When the first layer of frequent item sets is produced, partition begins, from which the final results of frequent item sets partitioned are derived, with minimal support 2 [7, 8].

Algorithm in the client terminal: Equally distributes stock code combinations to each computation server terminal.

Input: IP address, port number, and the number of stock partition of each server.

Output: Arrays of stock codes.

**Fig. 15.2** The process of partition speed method with apriority algorithm



Step 1: Initialize Multithreading instance and input parameters (IP address, port number, and the number of stock partition P);

Step 2: Use apriority algorithm in the thread group to create arbitrary arrays of P stocks;

Step 3: Send the arrays of P stocks in the thread group to the server terminals;

Step 4: Receive computed results in the server terminals and store the results into the database.

Generate stock combinations with apriority algorithm:

Input: All stock codes.

Output: Stock code combinations in line with minimal support.

$L1 = \text{find\_frequent\_1\_itemsets}(D)$ ;

For  $(k = 2; L[k-1] \neq \Phi; k++) C[k] = \text{apriori\_gen}(L[k-1], \text{min\_sup})$

For each transaction  $t \in D$  { // scan D for count  $C[t] = \text{subset}(C[k], t)$ ;

For each candidate  $c \in C[t]$

$c, \text{count}++;$ }

$L[k] = \{c \in C[k] | c.\text{count} \geq \text{min\_sup}\}$ }

Return  $L = \cup [k] L[k]$ ;

Procedure:  $\text{apriori\_gen}(L[k-1]: \text{frequent}(k-1)\text{-item set}; \text{min\_sup}: \text{support})$

For each item set  $l1 \in L[k-1]$ ;

For each item set  $l2 \in L[k-1]$ ;

If  $(l1[1] = l2[1]) \wedge \dots \wedge (l1[k-2] = l2[k-2]) \wedge (l1[k-1] < l2[k-2])$  then {

$c = l1$  connect  $l2$ ; // join step: generate candidate

If  $\text{has\_infrequent\_subset}(c, L[k-1])$  then

elate  $c$ ; // prune step; remove infrequent candidate

else add  $c$  to  $C[k]$ ;

return  $C[k]$ ;

Procedure:  $\text{has\_infrequent\_subset}(c: \text{candidatek-itemset}; L[k-1]: \text{frequent}(k-1)\text{-itemset})$

// use apriori knowledge

for each  $(k-1)$  subset  $s$  of  $c$

if  $c \notin L[k-1]$  then

return TRUE;

return FALSE;

Algorithm in the server terminal: Compute support and confidence between stocks (with three stocks as example).

Input: Codes of three stocks.

Output: Support and confidence among the three stocks.

Step 1: Receive the codes of three stocks;

Step 2: Check whether the status of the first stock on the first day exists and meets the need to rise or fall, and if it exists and meets the need, perform Step 3, otherwise change the date.

Step 3: Check whether the status of the second stock on the second day exists and meets the need to rise or fall and if it exists and meets the need, Two Counter plus 1 will co-occur in the first two stocks and then perform Step 4.

Step 4: Check whether the status of the third stock on the second day exists and meets the need to rise or fall and if it exists and meets the need, Three Counter plus 1 will co-occur in the three stocks.

Step 5: If there is no iteration on the date of the first stock, perform Step 2 after the change.

Step 6: Send the values of Two Counter and Three Counter to the client terminal.

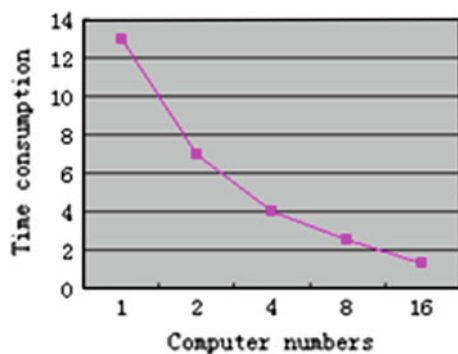
## 15.4 Experimental Verification

### 15.4.1 Results of Time Consumption and its Analysis

The experiment uses LAN which is composed of 16 computers with the operating system Microsoft Windows XP Professional (SP2), the CPU specification Intel (r) Celeron (r) CPU 2.40 GHz, memory 512 M and hard disk 80G to conduct simulation with Java platform and MySQL database. The 2010 trading records in the 100 blue chip stocks in the Indian A stock are used as the experimental data, which will take about 13 days to compute with single thread method. If the computation quantity is divided into 2 computers, 4 computers, 8 computers, and 16 computers, the statistic results of the approximate computation time required are as shown in Fig. 15.3.

What can be found by analyzing Fig. 15.3 is that operation time is approximately in inverse proportion to computer numbers, and there are still some gaps, the reason for which is that a client terminal has to undertake the task of the generation of stock combinations by several server terminals, the sending and recovery and storage of the results, the computation capacity of CPU of the client terminals are limited notwithstanding the computation with the Multithreading parallel method, after reaching saturated operations state, the computation time will still be increased if the number of threads for computation is increased. The algorithm in this chapter also has better scalability with very low error rate under the lower branches.

**Fig. 15.3** Approximate time consumption of the algorithm with different computer numbers



### 15.4.2 Mined Results and Their Analysis

After computing their association, the results of three arrays of all stocks are obtained, some of which are as follows in Table 15.1 by screenshot.

According to the results of the datasets, all stocks which may rise in the coming day may be inquired by SQL inquiry sentences and the top 10 stocks may be inquired according to the descending order of support or confidence, which will greatly help investors filter out relatively good stocks. Since the result sets of all stock combinations are here, it is fast and convenient to inquiry the stocks. After arranging the confidence by descending order, the results of partial top stocks are as follows in Table 15.2.

The data in the first line of the results show that if the stocks of Unitdspr Company rise today, so will the stock of SBI Company in the coming day, then the probability of the stocks of Glaxocon Company which also rise on the day after tomorrow is 100 %. The data fully explain the close relationship between Glaxocon Company and the former two companies. This result might be able to explain why there is often a pharmacy beside a liquor store in India. After arranging the support by descending order, the results of partial forward rankings are as follows in Table 15.3.

From the results, there are many times when the stocks of India Siemens and HDIL and JETATREAWS companies jointly rise, so more attention can be paid to these three stocks when making investment. From the results, there are many times when the stocks of India Siemens and HDIL and JETATREAWS companies jointly rise, so more attention can be paid to these three stocks when making investment.

**Table 15.1** Partial results of three arrays of the stocks

Stock id one	Stock id two	Stock id three	Support	Confidence
Fortis.bo	Ibrealst.bo	Ranbaxy.bo	0.084291188	0.511627907
Ibrealst.bo	Ranbaxy.bo	Axisbank.bo	0.057471264	0.267857143
Hdil.bo	Tcs.bo	Fortis.bo	0.030651341	0.296296296
Tatapower.bo	Tcs.bo	Dlf.bo	0.01532567	0.307692308
Jindalsteel.bo	Tatastl.bo	Exideind.bo	0.026819923	0.259259259
Jetairways.bo	Rtl.bo	Tatapower.bo	0.022988506	0.176470588
Coreproject.bo	Dishtv.bo	Icicibank.bo	0.042145594	0.22

**Table 15.2** Stock data arranged by confidence

Stock id one	Stock id two	Stock id three	Support	Confidence
Unitdspr.bo	Sbi.bo	Glaxocon.bo	0.015326	1
Irb.bo	Recltd.bo	Coreproject.bo	0.034483	0.9
Unitdspr.bo	Godrejcp.bo	Jetatrways.bo	0.030651	0.889
Unitdspr.bo	Godrejcp.bo	Adaniente.bo	0.030651	0.889

**Table 15.3** Stock data arranged by support

Stock id one	Stock id two	Stock id three	Support	Confidence
Siemens.bo	Hdil.bo	Jetatrways.bo	0.103448	0.642857
Rcom.bo	Rpower.bo	Jetatrways.bo	0.099617	0.619048
Axisbank.bo	Jetatrways.bo	Ranbaxy.bo	0.099617	0.604651

## 15.5 Conclusion

By using Multithreading technology and apriori Partition Speed Method, this chapter proposes a stock forecasting parallel method, which uses the framework with single mining of client terminals and multi mining of server terminals and places the computation of the time consumption on several server terminals, thereby effectively partitioning the computation quantity and reducing the computation time. From the experimental results, the method in this chapter both greatly reduces the processing time of stock trading data and makes stock forecasting results clear and understandable.

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# Chapter 16

## Topic Information Collection Based on the Hidden Markov Model

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**Abstract** The topic information collection algorithm is widely used for its accuracy. The Hidden Markov Model (HMM) is used to learn and judge the relevance between the Uniform Resource Locator and the topic information. The Rocchio method is used to construct the prototype vectors relevant to the topic information, and the HMM is used to learn the preferred browsing paths. The concept maps including the semantics of the webpage are constructed and the web's link structures can be decided. The validity of the algorithm is proved by the experiment at last. Comparing with the Best-First algorithm, this algorithm can get more information pages and has higher precision ratio.

**Keywords** Topic information collection · Hidden markov model · Crawler · Uniform resource locator (URL) · Prototype vector · Precision ratio · Recall ratio

### 16.1 Introduction

At present, the search engine has become the most effective means for people to obtain information in Internet, such as Google, Baidu, etc. To further improve the recall ratio and precision ratio in vast amounts of information in Internet becomes

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the most important thing in the coming search engine design [1]. Vertical search engine emerged for the collection of information aiming at specific industries and fields, which can obtain more accurate and effective results in the related fields. The key factor in the design of vertical search engine is to improve the accuracy of topic information collection. The Best-First algorithm, a traditional web crawler, will cause the lack of information because of a nondirect mutual link among the relevant topic pages, that is, the tunnel [2]. To obtain the optimal sequence through a Hidden Markov Model (HMM) fits the pages' access sequence obtained in the topic information collection. We will make models about the identification of the collection paths to further improve the precision ratio of information collection.

We simulate users' access to create the table of the topic keyword through the design of topic information of expression in this chapter, calculate the content similarity of the pages, establish the topic relevance of the uniform resource locators (URLs), and simulate users' access sequence to construct a HMM model. The model learns through multiuser access sequences, and determines the topic relevance of the URLs and the access sequences ultimately during the procedure of collection.

## 16.2 The System Architecture

The system constructs a priority URL queue at first, then guides the paths of the crawler to collect information using HMM, which is constructed by the algorithm of the topic relevance of prediction. In the initial, the main tasks are selecting the training data set, pre-treating the pages, and configuring the relevant control parameters etc. In the learning phase, the main tasks include the operation of the discriminant of topic relevance correlation, clustering processing of the topic features of pages, the construction of topic context map, and training and optimizing the model using algorithms of HMM. In the operating phase, we will download the topic relevant pages to the local using HMM algorithm, analyze and process the downloaded pages, and then store the relevant pages and link information in the corresponding table. The algorithm designs and builds a system prototype based on real web environment.

## 16.3 Determination of the Information Collection Topic

Generally speaking, the definition of the topic is not very clear, but after the expansion of the agent more topic pages can be collected [3]. The prototype vectors related to the topic are constructed using the Rocchio method, which can implement the topic selection. Given an unclassified text, vector space model (VSM) is used to represent the text information. The TFC method is used to calculate the weight of the keywords in the document. We can calculate the



distance between unclassified text and the prototype vector to determine the relevance of the text and topic. Weight is calculated as follows:

$$W = \frac{tf_{ij} \times \log(N/n_i)}{\sqrt{\sum_{t \in D_j} [tf_{ij} \times \log(N/n_i)]^2}} \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (16.1)$$

Here,  $tf_{ij}$  shows the frequency of the feature word  $t$  in the training text  $D_j$ ;  $n_i$  shows the number of the documents that the feature word  $t$  appears in the training set;  $N$  is the total number of the documents in the training set.

The main task of the discrimination of topic relativity is to transfer the pre-processed data from the web to the relativity calculation module. In the module, we can calculate if the data is relative with the established topic, as well as the values of relevant index.

We construct the topic prototype vectors with the method of Rocchio to predict the relativity of a certain URL with the topic. Rocchio is a method of batch learning, which generates a new weight vector  $w$  from an existing weight vector  $w_1$  and a training set. The value of the  $j$ th dimension of the new weight vector  $w$  is equal to as following, where  $\alpha = 0$ ,  $\beta = 1$ ,  $\gamma = 1$ :

$$w_j = \alpha w_{1,j} + \beta \frac{\sum_{i \in C} x_{i,j}}{nc} - \gamma \frac{\sum_{i \notin C} x_{i,j}}{n - nc} \quad (16.2)$$

And  $w_j$  represents the value of the  $j$ th element of the vector,  $nc$  is the number of documents related to the topic in the training samples,  $x_{i,j}$  is the  $j$ th element of the  $i$ -th text feature vector.

Different parts in the pages express different topics. We use the method of extended metadata to mark the important information in the page with the tags of `<meta>` `<title>` `<a href>` together to determine a page's topic. We define the following formula:

$$W_P(k) = \begin{cases} 1 & \text{extended metadata tags} \\ 0.7 & \text{regular text} \end{cases} \quad (16.3)$$

Among which,  $W_P(k)$  represents the corresponding weights that the keyword  $k$  appears in different locations in the page  $P$ .

Finally, we calculate the topic relativity index  $\text{Sim}(P)$  between each page  $P$  and the specific topic with the measurement of cosine similarity. It is calculated as follows:

$$\text{Sim}(P) = \frac{\sum (W_T(k) * \sum W_P(k))}{\sqrt{\sum (W_T(k)^2) * \sum (\sum W_P(k)^2)}}, k \in T \quad (16.4)$$

among which,  $W_T(k)$  shows the weight that the keyword  $k$  in the topic weight table  $T$ , and  $\sum W_P(k)$  shows the weight that the keyword  $k$  in the current page  $P$ . After

the normalization, the value of  $\text{Sim}(P)$  lies between 0 and 1. The greater the value, the topic relativity between the page  $P$  and the topic is higher. In the experiment, we download the data of 1000 risk-related web pages as positive examples, and 1000 pages of other topics as negative examples, including art, history, and science etc.

## 16.4 Construction and Learning of HMM

For each website in the set of the similar topic that has the seeds' URLs in advance with the metasearch engine tool, we will start from the root URL of the website using the Viterbi algorithm, forecast the maximum probability link to get the similar topic pages on the basis of the root URL of each similar website and the trained HMM, and guide the crawler to crawl the target information to be collected [4]. We can obtain the most likely state sequence using the current observations and related parameters in HMM. If the number of pages in the similar websites and the target number of pages exceed the certain thresholds, they need a certain degree of control to improve the efficiency of collection by topic crawlers.

### 16.4.1 Construct HMM Using Network Diagram of Users' Access Sequence

The topic learning process of the web crawler can be constructed well using HMM model, because the process of links from page to page is a hidden and unknown process, and distinguish the properties of a concrete web page is the dominant process which can be observed [5]. Constructing the HMM through simulating users' access sequences and analyzing the users' browsing mode, you can get the link structures between pages. According to the number of the pages access sequence, the topic-related pages are marked with hollow circles and the non-topic-related pages are marked with solid circles. The network diagram is constructed as following:

We can see from the definition of the HMM that the HMM is usually composed of two parts: state transfer model, and the model from the state set to the observed sequences [6]. State transfer set and status observation set in the web crawl process can be expressed as follows (Figs. 16.1, 16.2 and 16.3):

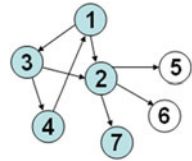
1. State transfer set  $S = \{T_0, T_1, T_2, \dots, T_n\}$ :

First, we select the topic-related pages set  $T_0$  as the target page set from the training set.  $T_i$  is the shortest distance that the page  $i$  from the target page  $T_0$ . As shown in Fig. 16.4, "5" and "6" are the target pages.  $T_0$  to  $T_3$  are defined as following:

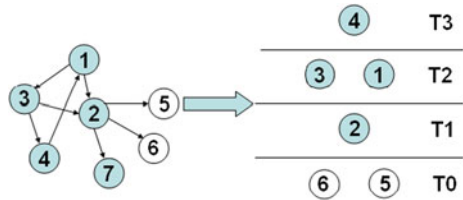
**Fig. 16.1** Web pages users accessed



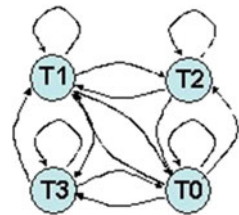
**Fig. 16.2** Constructed network graph



**Fig. 16.3** Network graph to state-relation diagram



**Fig. 16.4** State transfer diagram



Second, Observation set  $O = \{O_1, O_2, \dots, O_m\}$ :

For all pages we use the  $k$ -means algorithm for automatic clustering. Each category  $i$  am observed is corresponding to the observed value  $O_i$ .

Third, Parameter model of HMM with the known parameters of  $\lambda = (\pi, A, B)$ .

The initial probability distribution matrix is  $\pi = \{P(T_0), P(T_1), \dots, P(T_n)\}$ , among which  $P(T_i)$  represents the probability that the distance to the target topic page equals  $i$  in the initial state, where the initial values are generally evenly distributed. The transfer matrix is  $A = \{a_{ij}\}$ , among which  $a_{ij}$  indicates the probability that transferred from state  $T_i$  to state  $T_j$ . For example, if  $a_{41}$  equals 0,  $T_4$  cannot be transferred from  $T_1$  by only one step, and it is required at least three clicks to achieve the transformation. But when there are cross-links in pages,  $a_{ij}$  may be not equal to zero.

The emission probability matrix is  $B = \{b_i(j)\}$ , among which  $b_i(j)$  indicate the probability in state  $T_j$  when the observed value  $O_i$  is known. Each emission probability  $b_{ij}$  indicate the probability from state  $S_i$  encountered the observed value  $j$ . The symbols used in the following are as the standards in HMM.

### 16.4.2 Topic Model Training

On the basis of the above training set model, we use the Baurn–Welch algorithm [7]. According to the estimated values of the initial given parameters, we keep on continuous iteration so that the various parameters tend to obtain more reasonable values. The algorithm is as following:

Initialization

$\pi_i = r_1(i)$  shows the probability value of  $S_i$  when  $t$  equals 1. In the model, it means the probability to reach the target pages when it step 1.

Iterative calculation  $\xi(i, j)$  shows the probability at time  $t$  and  $t + 1$  with the state of  $S_i$  and  $S_j$ .  $r_t(i) = \sum_{j=1}^N \xi(i, j)$  shows the probability at time  $t$  with the state of  $S_i$ .

$$\xi(i, j) = \frac{P(q_t = i, q_{t+1} = j, O|\lambda)}{P(O|\lambda)} \quad (16.5)$$

shows the probability of the state of  $S_j$  at time  $t$  with the step of  $i$  and time  $t + 1$ .

Iterative revaluation

$$a_{ij} = \frac{\sum_{t=1}^{T-1} \xi_t(i, j)}{\sum_{t=1}^{T-1} r_t(i)}, b_j(k) = \frac{\sum_{t=1}^T r_t(j)}{\sum_{t=1}^T r_t(j)} \quad (16.6)$$

We correct continuously for the state transition matrix and emission state matrix according to the values.  $\sum_{t=1}^{T-1} r_t(i)$  indicates the number of times transferred from state  $S_i$ .  $\sum_{t=1}^{T-1} \xi(i, j)$  indicates the number of times that jumps from state  $S_i$  to state  $S_j$ .

Termination condition

$$|\log P(O|\lambda) - \log P(O|\lambda_o)| < \varepsilon \quad (16.7)$$

Here,  $\varepsilon$  is the selected threshold in advance.  $\log P(O|\lambda_0)$  is the maximum probability of state sequence  $O$  after the reassessment of parameters iteration. In the HMM, it is the maximum probability of access paths of a URL.

Continuous optimal correction of the parameters of the model makes the output parameters of the final training gradually move toward more optimum values.

### 16.4.3 Topic Learning Mode

After the training of HMM, we can use the trained model to guide the topic crawler to collect information at the appropriate path. In accordance with the observed sequence  $O = \{O_1, O_2, O_3 \dots O_m\}$  and the trained model  $\lambda = \{\pi, A, B\}$ , we can recognize the most optimal collection path sequence of internal topic target pages  $Q^* = \{q_1^*, q_2^*, q_3^*, \dots, q_T^*\}$ . Define  $\delta_t(i) = \max_{1 \leq i \leq n} P[q_1, q_2 \dots q_{t-1}, q_t = i, o_1, o_2 \dots o_t | \lambda]$ , then we can find the state sequence at the state of  $T$  expressed by the most optimal values of  $\delta_T(i)$  [8]. The algorithm of web pages paths recognition with the use of HMM model in this chapter is as following:

Initialize a URLs queue. Each page depends on the observed state of its parent node, the probability of the parent node, and the current state of itself. Each URL and the observed state of its parent node and the probability of its parent node are stored in the initialized URLs queue when initializing the queue.

Obtain the URL according to the priority of the URLs, download the page to the local, determine the category of the parent node of the current page, and calculate the maximum probability of the current parent node in the current state.

Determine the category of the current node: If the current node is related to the topic, store the current URL to the related to the topic URL queue, and calculate the weight of the child nodes of the current page.

Inherit the weight of the current page and calculate the weight of its child node. If the current node is the initial URL, calculate  $\delta_1(i) = \pi_i b_i(O_1)$ ,  $1 \leq i \leq N$  according to the initialization matrix, otherwise calculate according to the parent node and the current observations (the category of the topic feature vectors).

Calculate the probability of the current node in state  $j$  according to the formula

$$\delta_t(j) = \max_{1 \leq i \leq n} [\delta_{t-1}(i) a_{ij}] b_j(o_t), 2 \leq t \leq T, 1 \leq j \leq N \quad (16.8)$$

Parse out all the URLs of the current node. Insert all URLs as well as its priority, the observed state of the current node as well as the probability of the current state into the queue until the queue is empty.

## 16.5 Experiments and the Analysis

The foreground of the user interface of the vertical search system is the entrance for the users to the web documents. Users can retrieve the related data about natural disasters in the users' interface. The system returns the relevant pages according to the keywords entered by the users. Before the retrieval pages return to the users, the system will preprocess the pages and filter out irrelevant web documents, rearrange the web documents according to the similarity, and finally return to display the results in the users' interface. Fig. 16.5 shows the sorting results



Fig. 16.5 Retrieval results

after the retrieval of “earthquake in Wenchuan”. Figure 16.6 shows the retrieval interface of foreground when a user retrieves “earthquake in Wenchuan”.

Topic-based information retrieval is primarily evaluated through the recall ratio and precision ratio. Recall ratio is the proportion of collection number in the total



Fig. 16.6 User interface of vertical search system on disasters

number on this topic in the entire web during the process of topic information collection, but this cannot calculate crawl coverage of the topic information collection. Thus, precision ratio is adopted to evaluate the collection efficiency. Precision ratio is the proportion of the number of pages collected on focused crawler collection related to the topic in the number of the total collected pages. Therefore, in this chapter we build 200 URL sequence data using the information collection system, and obtain data under different information acquisition strategies. In the early stages of system acquisition, the acquisition accuracy on focused crawler does not show a very prominent advantage, but with the growing number of the collection pages, the focused crawler's precision has shown the advantages and exceeds other acquisition strategies largely.

## 16.6 Conclusion

Overall, it is effective to guide the focused crawling based on the user path in HMM. The accuracy of data acquisition will be higher if the recognition model that the topic relies on can continue to iterate optimization in theory. In addition, in the subsequent acquisition of some of the topics showed in the experiment, the collection number of pages is still growing, while the precision ratio is no longer rising and shows a downward trend. The reason maybe the number of seeds related to the topic in the web site is rare, and the number of collected topic relevant pages has been saturated.

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# Chapter 17

## AMI Information Fusion Based on MAS

Xianji Jin, Lei Lu and Weiming Tong

**Abstract** With the rapid development of smart grid, multi-source information fusion of advanced metering infrastructure (AMI) has become as one of the key problems, because AMI components are always distributed and heterogeneous. On the basis of requirement analysis, this paper proposes an open AMI information integration platform based on multi-agent system(MAS). The platform is composed of three layers: data layer, business layer, and interface layer. The function and structure of each agent in the platform are presented, and the software implementation scheme based on JADE is given. The proposed platform can effectively integrate and highly share the heterogeneous information in AMI system.

**Keywords** Multi-agent system (MAS) · Advanced metering infrastructure (AMI) · Information fusion · JADE

### 17.1 Introduction

Smart grid has become “hype” during the recent years [1]. Advanced metering infrastructure (AMI) is considered to be the first step in building smart grid. AMI provides information platform and technical support for the two-way interaction

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between end users and smart grid [2]. It also provides fundamental facilities for other advanced applications in smart grid.

AMI is not singular but integrated technology, which requires high openness, extendibility, and interoperability [3]. However, there are amounts of intelligent devices/meters from different manufacturers in AMI, many of which are not interoperable for the reason of discordant communication protocol and data format. Meanwhile, the business process systems in AMI are usually developed independently, resulting in the heterogeneous data/structure/platform/network problem. It is difficult to fuse the multi-source and heterogeneous information and construct effective knowledge management system. Thus, how to realize the information fusion and comprehensive interaction is one of the key problems in AMI deployment.

Multi-agent system (MAS) is an effective method for distributed system integration, which can easily solve the distributed problem. MAS has very strong scalability, and it allows interconnection and interoperability among the legacy systems. The application condition of MAS properly fits the architectural features of AMI. This paper researches the application of MAS in AMI information fusion, and proposes an open AMI information integration platform that makes the information resources highly shared inside AMI and between AMI and other power automation systems in smart grid.

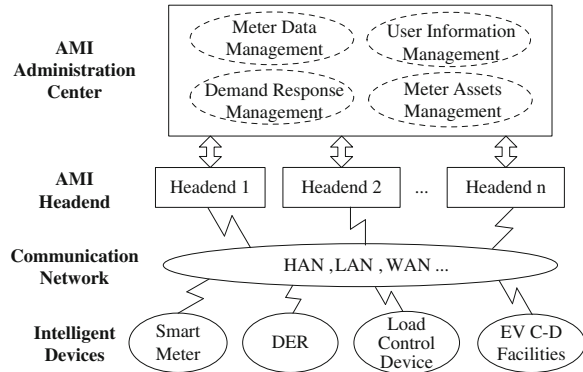
This paper is organized as follows. [Section 17.2](#) analyzes the challenges and requirements of AMI information fusion. [Section 17.3](#) proposes an open AMI information integration platform based on MAS. [Section 17.4](#) states the function and structure of each agent unit in the platform. [Section 17.5](#) gives a software implementation scheme based on JADE. [Section 17.6](#) presents the final conclusion of this paper.

## 17.2 Requirement Analysis

AMI is two-way network processing systems that used to meter/retrieve/store/analyze/apply the electricity utility information and remotely control the intelligent devices at the user end. Generally, AMI is composed of user end intelligent devices, communication network, AMI head end, and AMI administration center. The structure of a typical AMI system is shown in [Fig. 17.1](#).

AMI user end intelligent devices contain smart meters, distributed energy resources (DERs), load control devices, and electric vehicle charging and discharging facilities, etc., that are always distributed and heterogeneous. AMI communication network covers multiple networks, e.g. optical fiber, 230 MHz private network, wireless network, and so on. The communication protocol is also not unified. AMI head end is responsible for two-way communications between AMI administration center and user end devices to retrieve data and execute commands. The head end devices are usually provided by different manufacturers.

**Fig. 17.1** AMI system structure



AMI administration center contains several business process systems, used to manage meter data, demand response, user information, and meter assets information.

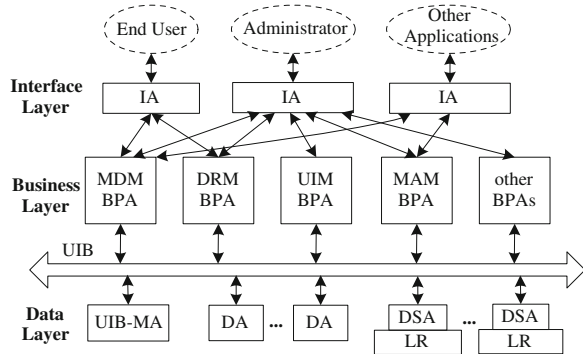
From the information fusion perspective, AMI needs a “Plug and Play” software framework, with which the administration center can retrieve and store the power consumption information. On the one hand, the information should be shared with the distribution management system (DMS)/dispatch automation system (DAS) through the utility integration bus. Power enterprise needs to use these data to gather statistics and analysis of the user needs and integrate the marketing business, customer service, and production management during power system operation. On the other hand, end users can also promptly get the power network dynamics, and participate in real-time demand response for better energy management and optimization. Therefore, an effective information fusion scheme is urgently required to facilitate the information sharing among the power automation systems and ensure the two-way interaction in AMI network.

### 17.3 AMI Information Integration Platform Based on MAS

Agent is a software entity that can perceive environment, solve problems, and operate autonomously [4]. MAS is a network platform composed of multiple loosely coupled and coarse-grained agents. Giving consideration to the basic characteristics of individual agent, MAS focuses on the coordination and cooperation among the agents in order to accomplish complicated control tasks and solve complex problems. Due to the autonomous ability and social acceptability of MAS, it is appropriate to construct a general information integration framework based on MAS.

There are many business process systems in AMI, such as meter data management (MDM) system and DRM system. Each business process system should

**Fig. 17.2** AMI information integration platform based on MAS



have strong comprehensive processing ability itself, which can take advantage of the intellectuality and autonomous ability of MAS. Multiple business process systems should cooperate with each other, which can take advantage of the social acceptability and coordination ability of MAS.

As shown in Fig. 17.2, this paper proposes an open AMI information integration platform based on MAS, composed of three layers: data layer, business layer, and interface layer.

Data layer is the base of information integration. Multi-source information is fused in this layer. Data layer contains three types of agent: utility integration bus management agent (UIB-MA), data agent (DA), and data service agent (DSA). UIB-MA is the core of the data layer, which provides service for upper business process. DA is newly built DA. DSA is the bridge to integrate legacy resource (LR) to UIB. Business layer consists of multiple business process agent (BPAs), e.g. MDM, BPA, demand response management (DRM) BPA, user information management (UIM) BPA, meter assets management (MAM) BPA, and so on. Each BPA corresponds to a business process having certain stability. Interface layer consists of a group of interface agent (IA). Through IA, end users and AMI administrator can process the human-machine interaction with AMI business systems, other applications can also interact with AMI business systems.

## 17.4 Agents in the Platform

### 17.4.1 Data Layer

IEC 61898/61970 established by IEC TC57 defines common information model (CIM) and component interface specification (CIS), used to facilitate and support the information fusion in power system [5]. Nowadays, IEC 61898/61970 begins to get applied in DMS and spread to other power systems [6]. This paper constructs a uniform AMI data model on the basis of CIM and realizes the seamless connection with other systems. Parts of AMI components (e.g. DER, load, and user

information) are already defined in CIM, besides, the rest parts need to extend the original CIM. Furthermore, XML/RDF in semantic net is imported to realize the openness and interoperability of data model.

DA is the newly built data server that supports IEC 61970 and provides CIS interface. Data are stored by XML format in DA. UIB-MA and DSA are stated with emphasis as below.

### 17.4.1.1 UIB-MA

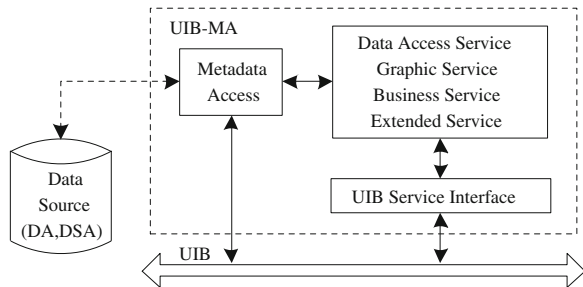
UIB-MA is used to manage the AMI utility integrate bus. It defines how the middleware software connects/registers with the UIB and provides service. “Service” is the key function of UIB-MA, e.g. data access service, graphic service, business service, extended service, and so on. UIB-MA provides a mechanism of how to construct/search/communicate/apply the service. Service targets contain hardware devices, software applications, databases, and system users. The structure of UIB-MA is shown in Fig. 17.3.

Data access service contains generic data access (GDA), high speed data access (HSDA), and time series data access (TSDA). GDA is used to access the common AMI meter data. HSDA is used to access real-time data. TSDA is used to access the historical data. Graphic service mainly refers to scalable vector graphics (SVG) service, used to obtain the AMI network topology and other graphs. Business service mainly refers to generic event and subscription (GES), used to obtain the AMI alarm and event information. Extended service is used to realize the “Plug and play” of software agent components. Note that UIB-MA covers all types of service defined in IEC 61970.

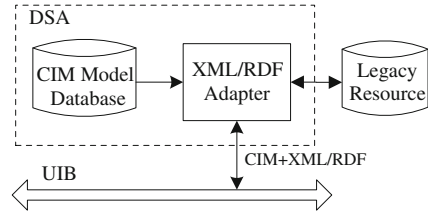
### 17.4.1.2 DSA

Some related systems are already installed in the existing DMS, like automatic meter reading system (AMR) and user information system (UIM), and so on. Normally, these LRs are commercial relational databases, e.g. ORACLE, SYBASE, etc. In constructing AMI, the LRs need to be partly transformed.

Fig. 17.3 Structure of UIB-MA



**Fig. 17.4** Structure of DSA



Through DSA, the heterogeneous private data in legacy systems are encapsulated to open data that are independent on developing platform/language.

The structure of DSA is shown in Fig. 17.4. The fusion process and principle of the multi-source information form LRs are given.

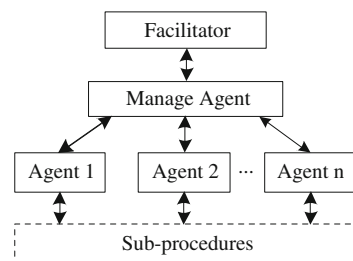
DSA reads in the data from legacy systems, encapsulates them to standard XML/RDF data files through XML/RDF adapter. BPAs can read/write these data through UIB. DSA supports nonstandard systems without middleware platform and provides synchronous data access and asynchronous subscribing/publishing functions.

### 17.4.2 Business Layer

Business layer reflects the actual AMI business process. It contains various AMI business process systems, e.g. MDMS used to acquire/store/manage meter data, UIMS used to manage end user information, MAMS used to manage assets information, geographic information, and operation status of AMI devices, DRMS used to publish real-time electricity price and control system load, and so on. Each system is corresponding to a BPA.

Business process is a typical distributed procedure. For instance, demand response process includes several correlated subprocedures, e.g. power load analysis, real-time price publication, auto response, and so on. Each subprocedure is relatively independent. Thus, BPA collocates a group of agents for every sub-procedure. These agents interact with each other. As shown in Fig. 17.5, this paper constructs a BPA union model based on facilitators. Several common agents and only one management agent (MA) constitute a union. Each agent union is

**Fig. 17.5** BPA agent union



corresponding to a subprocedure. Common agents do not communicate with each other, only communicate and coordinate with the MA. Several MAs communicate and coordinate with each other through facilitators.

Facilitator and MA are the core components of BPA. MA is the engine of an agent union, used to manage the planning and scheduling of common agents in the union. Facilitator provides a reliable channel for the BPAs communication and guarantees the information transmitted efficiently and purposefully. Facilitator does not only match the communication among MAs, but also translate the information and disassemble the problems.

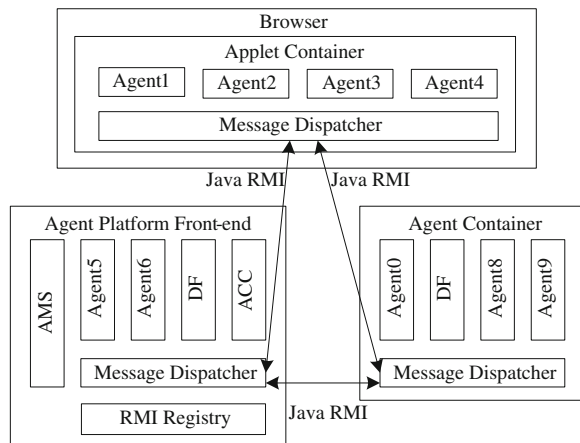
### 17.4.3 Interface Layer

Interface layer is composed of a group of IAs. IA is the interaction media between AMI and outside users (end users, AMI administrator, and other applications in smart grid). For end users, IA provides electricity consumption record, report forms display, and real-time electricity management service. For AMI administrator, IA provides security certification, information input/management, system operation, and work ticket management service. For other applications in smart grid (like DMS, DAS, etc.), IA provides communication adaption and data transmission service.

## 17.5 Software Implementation

There are several MAS software development schemes, such as CORBA and JADE. Take JADE as an example, the architecture of JADE platform is shown in Fig. 17.6.

**Fig. 17.6** Architecture of JADE platform



JADE is implemented in Java. It follows the specifications of the IEEE FIPA standard and allows interoperability among MASs [7]. A JADE agent runs as a thread that employs multiple tasks and simultaneous conversations. The agent threads are inserted into repositories of agents called containers. Each container has a message dispatcher. Different message dispatchers communicate with each other via Java RMI. The AMI information integration platform based on JADE is not only compatible with the original business systems but also extendible for new business systems.

## 17.6 Conclusion

This paper mainly researches the application of MAS in AMI multi-source information fusion, which constructs a three-layer multi-agent AMI information integration platform and realizes highly information sharing and comprehensive interaction. Software implementation based on JADE guarantees the openness and extendibility of the platform. The research work can provide reference for the information fusion in other systems in smart grid.

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# Chapter 18

## Control Strategies of the Health Hazards of Wood Dust to the Woodworking

Junwei Lou

**Abstract** The article surveys the occupational health examination material and collects health data of seven furniture factories woodworking, and compared with the medical examination of the people in the vicinity. According to health examination results, the rate of allergic dermatitis and bronchial asthma, interstitial lung disease, eye infections diseases, and nasal cancer in exposure group was significantly higher as compared with control group. There was a significant difference in exposure group and the control group ( $P < 0.05$ ). The rate of chronic respiratory disease in exposure group was also significantly higher as against the control group at different age. And in exposure group, the rate of chronic respiratory disease increases gradually with age. But the rate in the control group was different. Then the article gives some suggestion on effective control strategies for the woodworking health.

**Keywords** Wood dust · The wood working · Health · Control strategies

### 18.1 Introduction

During wooden furniture production process, milling, sawing, planing, sanding, and other processes will generate a lot of wood dust and other waste, which not only seriously endangers the health of workers, but causes serious pollution on enterprises and the surrounding environment. The wood dust in the production

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process also affects operational staff's attention, and further leads to staff's unsafe processing behaviors. If someone stays in high concentration wood dust environment for a long time, the wood dust will gather in his/her nasal cavity, which affects the health of his/her nasal cavity. Long-term exposure to wood dust may cause lung lesions. This article focuses on the analysis of the wood dust impact on the incidence of respiratory diseases, skin diseases, conjunctivitis, chronic rhinitis, nasal cancer, and so on in woodworking.

## **18.2 Data and Methods**

### ***18.2.1 Data and Sources***

We chose some carpentry staff of seven furniture factories in Ningbo City, who is only in contact with wood dust without exposure to other toxic dust, for the survey; and then randomly chose some surrounding residents without exposure to the wood dust as the control. Exposure group is 442 workers exposed to wood dust in seven furniture factories, their age is 20–58 years, and the average is 35.2 years old. Exposure seniority is from 1 to 15 years, an average of 8.3 years. Education level is above high school. Control group is 429 nearby residents without exposure to wood dust. Their age, educational level, gender is not significantly different from exposure group.

### ***18.2.2 Methods***

Conduct a health examination on the woodworkers of exposure group and the residents of control group, collect the data of the health examination for analysis, and compare the results.

Health examination includes common diseases of the exposure group and control group members, such as respiratory system diseases, skin diseases, conjunctivitis, chronic rhinitis, nasal cancer, etc. Exposure group members and local residents were divided into four age groups, and conduct the analysis and comparison of chronic respiratory diseases on each age group.

## **18.3 Results and Analysis**

For health examination results of exposure group and control group, see Table 18.1. From Table 18.1, we calculated and found: the incidence of bronchial asthma in exposure group was significantly higher than the control group

**Table 18.1** Health examination results of exposure group and control group

Groups	Total		Bronchial asthma		Interstitial lung disease		Conjunctivitis		Atopic dermatitis		Nasal cancer	
	Cases	Incidence (%)	Cases	Incidence (%)	Cases	Incidence (%)	Cases	Incidence (%)	Cases	Incidence (%)	Cases	Incidence (%)
Exposure group	442	26	57	12.90	17	3.84	25	5.6	15	3.39		
Control group	429	11	21	4.90	9	2.1	7	1.63	3	0.70		

**Table 18.2** The incidence of chronic respiratory disease at different ages

Age group (Years)	Exposure group			Control group		
	Number of subjects	Cases	Incidence (%)	Number of subjects	Cases	Incidence (%)
20–30	122	13	10.65	123	6	4.87
30–40	168	27	16.07	156	18	11.54
40–50	105	22	20.95	98	20	20.41
50–60	47	10	21.27	52	8	15.38
Total	442	72	16.28	429	52	12.12

( $X^2 = 5.15$ ,  $p < 0.05$ ), and the difference was statistically significant; the incidence of interstitial lung disease in exposure group was also significantly higher than the control group ( $X^2 = 16.1$ ,  $p < 0.05$ ), and the chi-square values were respectively  $X^2 = 3.4$ ,  $X^2 = 8.8$ . Therefore, they are  $p < 0.05$ , with a significant difference.

The incidence of chronic respiratory disease of all ages in the exposure group and control group is shown in Table 18.2. From analysis on the incidence of chronic respiratory disease for different age in Table 18.2, we found: the incidence of chronic respiratory diseases (such as chronic obstructive pulmonary disease, pneumoconiosis, allergic rhinitis, chronic simple rhinitis, chronic bronchitis) of age 40–50 years of both exposure group and control group is highest, respectively 20.95 and 20.41 %, and the difference is not very obvious; but in other age group, especially in the age of 20–30 and 50–60 years, the difference is more obvious, the incidence is respectively 10.65, 4.87, 21.27, and 15.38 %; for the incidence of chronic respiratory disease, the exposure group is significantly higher than the control group. And in the exposure group, the incidence of chronic respiratory disease gradually increases with the increase in exposure age (i.e., woodworker seniority). In the control group, it is not very obvious.

## 18.4 Discussion

### 18.4.1 Characteristics of Wood Dust

Compared with mineral dust, wood dust size is much smaller, and monomer weight is smaller, with complex shapes: irregular or multi-row [1]. Some studies (dust control studies of wood flooring plant) showed that: small dust particles tend to spread in the air, so they are easily transported by the wind in the vacuum system; but it is difficult to be separated in solid, gas; the disparity of wood flour produced by grinding is higher than that of sawing process. When the wood particle diameter is less than 10  $\mu\text{m}$ , it spreads in the air and it is in suspended state. The drift of the dust is not only the hidden danger of fire, explosion accidents, but seriously pollute

environment and endanger the health of workers. Therefore, dust pollution has been considered one of the three major hazards in wood processing.

### ***18.4.2 Wood Dust Hazards***

On the surface, wood dust does not directly hurt human, but in fact wood dust contains a variety of phenols and hydrocarbons as well as highly carcinogenic substances; in particular, the wood dust of particle size less than 10 pm can enter directly into the lung tissue to damage mucous membranes because of light weight and small size. The extent of its harm is not less than formaldehyde. Wood dust contains a certain amount of wood tar, which contains a variety of acids, organic enzymes, hydrocarbons and alkaloids, ceasing, saprobe ether, and other chemical substances. Some data indicate that they all have a certain relationship with cancer. After a long study, International Agency for Research on Cancer believes that, if the wood dust produced by a variety of hard wood (known as hardwood) and pine is handled improperly, it is carcinogenic, and has the long incubation period. Especially, the wood dust produced by oak, teak, beech, walnut, and other wood is a carcinogenic “murderer” [2]. Wood dust may enter the respiratory tract with breathing; not all the dust in respiratory tract enters alveolus, it maybe deposited in the respiratory tract from nasal cavity to alveolus. If the deposited wood dust is not removed by your body, its long-term chronic effects can cause chronic inflammatory diseases. Wood dust acts on the respiratory mucosa, early, makes it hyperfunction, congestion, telangiectasia, increased secretion of fluid, in order to block more wood dust; over time, hypertrophic lesion occurs, and mucosal epithelial cells are dry and lack of nutrition, even atrophic changes.

In addition, wood dust deposits on the skin surface, blocking the pores of the skin, which causes blockage sebum inflammation, acne, folliculitis pyoderma; wood dust of entering eyes can cause corneal damage, chaos, conjunctivitis, and so on. Given the potential effects of wood dust on health, many countries have developed the harmful warning concentrations of wood dust: The United States limits softwood is 5.0 mg/m<sup>3</sup>, hardwood is 1.0 mg/m<sup>3</sup>; Finland, Britain, and the Netherlands is 5.0 mg/m<sup>3</sup>; France is 3.0 mg/m<sup>3</sup>; Germany, Denmark, and Sweden is limited to 2.0 mg/m<sup>3</sup> [3]. China’s industrial enterprises hygienic standards prescribe: For timber processing enterprises, workshop wood dust concentration in air should not exceed 10 mg/m<sup>3</sup>. Although China’s emission standards of wood dust have exceeded far more than developed countries, during the actual production, because of management or economic interests, many enterprises invite less on dust removal equipments, so that the wood dust concentration is between 10 and 40 mg/m<sup>3</sup>, which far exceeds the national emission limit values. Furthermore, wood dust emissions change with different processing materials and different jobs [4]. In the furniture production workshop, about 56 % of the operating positions are over the standard [5]. Problems at operating locations, such as band saws, milling machines, mortising machines, sanding machines, and other

machines, are especially severe, so that great harm has been caused on respiratory tract, skin, eyes, and other organs of workers.

Wood dust not only affects people's health, reduces the quality of wood processing products, accelerates wear of mechanical rotating parts, but the fine powder of raw materials or finished dust enters the air, resulting in waste and air pollution. Although wood dust is a good burning material, it is dangerous flammable product. Due to small size and large contact surface with air, if wood dust contact spark, it will burn and quickly spread. With the substantial increase of wood dust, the risk of explosion and burning is increasing. Therefore, wood processing enterprises need to strengthen security measures of the anti-burning and explosion-proof of wood dust.

### *18.4.3 Specific Measures to Control Wood Dust*

Wood dust is a product of wood cutting, and its generation and distribution is directly related to timber cutting methods, cutting conditions, and tool structure. In order to reduce the wood dust of furniture manufacturers, improved cutting technology is important to wood dust control and reducing wood dust pollution on woodworker health. In addition, other measures such as: using central dust removal system, keeping wood processing plant air circulation which is important to reducing the concentration of wood dust in plant.

In order to improve the work environment of woodworking, furniture manufacturing enterprises should actively adopt effective measures to reduce wood dust concentrations in workplace. In the beginning of plant design, corporate managers must consider the wood dust removal system, maximize the use of a central vacuum system, and ensure that all equipment can be installed vacuum facilities. In order to improve vacuum efficiency, the central dust removal system must also ensure air pressure balance in main vacuum pipe, which requires managers cannot freely bore a hole in the vacuum pipe to install vacuum port. At the same time, it should strengthen the supervision and use of personal protective equipment, for example, in the course of their work, provide workers with face masks, nasal congestion, and other protective facilities; give good occupational health examination, and require workers to do pre-job health examination; during the post, provide workers with the health examination on a regular basis, in particular for workers of sanding, milling, and other key positions. For workers, to carry out the training of occupational health safety and laws and regulations knowledge; by taking various measures to reduce the damage of occupational diseases to workers health, and make prevention of work injuries and occupational diseases. In addition, relevant departments can invite technical staff to conduct targeted education for woodworks, for example: wear a mask during working and operating, to avoid the nasal inhalation of wood dust, should promptly wash their hands after work, change clothes, and clean their noses with a clean towel and so on. Minimize the health hazards of wood dust on woodworkers. Cutting at the base of wood types

and improving cutting tool technology in order to achieve no dust, low dust, and smooth discharge of dust, this is a major technological revolution in the field of wood processing. As a result of traditional metal cutting tool is difficult to cutting with debris-free, so people focus more on the laser cutting and high-pressure water jet technology and other special cutting techniques. Why can thin laser beam be used as cutting tools? It is because the laser direction is good, it's beam can focus on a small area, the focus spot size diameter is less than 1 mm, and the output power density is up to 105–1013 W/cm<sup>2</sup>. Laser cutting is a form of thermal processing of wood, and does not produce wood dust. After being irradiated by laser, the wood combusts and carbonize to form a kerfs, which cut the wood. In addition to no wood dust, the advantages of laser cutting of wood include a small incision, saving wood, high precision, and no noise [6]. Some scholars have proposed using high-pressure water jet to cut wood, namely so-called Water Jet Cutting. According to pressurized liquid theory, when the water with tremendous pressure flows through the nozzle holes, pressure is converted into kinetic energy to form high-speed jet. Wood cut by high-pressure water jet has a narrow cut, easy to control the cutting conditions, no flying dust pollution, etc., it is beneficial to the environment and human health; you can choose any starting point for processing, and by CNC equipment, the work piece with complex shape is automatically processed without tool wear; with long nozzle life, the method substitutes carbide cutting tools, which saves grinding time and cost. However, the shortcomings of current water-jet cutting technology include low energy efficiency, small cutting depth, slow feed, easy to cause material wet, etc., and are in the research stage [7].

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# Chapter 19

## Modeling on Sensitivity of Influential Factors to City Water Demand Based on System Dynamic Mechanics Method

Guang-Hui Wei, Feng Liu, Liang Ma and Liang-Liang Chen

**Abstract** To study the sensitivity of the influential factors to city water demand, thus promoting the construction of water-saving society. The paper gives a preliminary qualitative analysis by applying system dynamic mechanics method and gray relational analysis in city water demand, followed by the default factor analysis and principal component analysis further authentication. The results showed that: city population and GDP per capita are more sensitive than any other factors to the city water demand; results of system dynamic mechanics method and gray relational analysis method is basically same as principal component analysis model based on the default factor method; the six factors have multi-co linearity on city water demand, the city water demand prediction model based on principal component regression method can make variable reasonable, in line with the objective interpretation of the actual physical cause. This provides a new thinking and methods for government developing water-saving policy and water resources planning.

**Keywords** System dynamic mechanics · City water demand · Sensitive factor · Gray relational analysis · Principal component analysis

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## 19.1 Introduction

With the city development of the increasing water demand, water has become bottlenecks restricting city development, city water demand analysis and forecasting science are to meet the city demand, the premise of ensuring the sustainable use of water resources [1]. On city water demand prediction model, the most common is the use of local water requirement of factors, through multiple regression analysis, impact factor and the water demand of water between the empirical models. However, city water demand factors on the sensitivity studies are rarely reported. Sensitivity of city water demand in favor of city water demand to identify the main factors, then for the government to develop water resources planning and construction of water-saving society to provide a theoretical reference for these reasons, this paper is on the basis of previous research, the first use of gray relational analysis is to determine the initial impact of city water demand factors, on this basis, the default factor test method will be introduced to the principal component regression analysis, as further verify the correctness of the gray relational analysis, and further influencing factors of city water demand to do the sensitive relationship between qualitative and quantitative analysis.

## 19.2 Analysis of Sensitivity Based on System Dynamic Mechanics Method and Gray Relational Model

### 19.2.1 Gray Relational Model

There is a female factor series  $X_0 = (X_0(1), X_0(2), X_0(3) \dots X_0(n))$ , while a series of subfactors series, followed denoted  $X_1, X_2, X_3, \dots, X_m$ .

$$X_1 = (X_1(1), X_1(2), X_1(3) \dots X_1(n));$$

$$X_2 = (X_2(1), X_2(2), X_2(3) \dots X_2(n));$$

...

$$X_m = (X_m(1), X_m(2), X_m(3), \dots, X_m(n)).$$

The correlation coefficient in the  $k$  points may be used, the expression is:

$$\zeta_i(K) = \frac{\min_i \min_k |X_0(K) - X_i(K)| + P \max_i \max_k |X_0(K) - X_i(K)|}{|X_0(K) - X_i(K)| + P \max_i \max_k |X_0(K) - X_i(K)|} \quad (19.1)$$

where:  $P$  for the resolution ratio, the value between 0 and 1, is generally preferable to 0.5 [2].

**Table 19.1** Relational degree

Factor	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$
Relational degree	0.9219	0.9022	0.8262	0.9416	0.7359	0.5074
Order	2	3	4	1	5	6

### 19.2.2 Gray Relational Analysis Sensitive Factor

In this paper, Auks City, Xinjiang Province, 1990–2005 data were as an example of city water demand [3, 4], from which selected six factors:  $x_1$  per capita GDP (RMB, yuan),  $x_2$  for the fixed asset investment (RMB),  $x_3$  for the industry number (unit),  $x_4$  for city population (million),  $x_5$  for the Water Supply ( $10^4 \text{ m}^3$ ),  $x_6$  for per capita daily water consumption ( $\text{L}\cdot\text{d}^{-1}$ ), and  $y$  for the city water demand ( $10^4 \text{ m}^3$ ). Using (19.1) calculates the city water demand and the correlation of each factor (see Table 19.1).

Table 19.1 shows the correlation of various factors on city water demand associated sequence is:  $x_4 > x_1 > x_2 > x_3 > x_5 > x_6$ . Gray relational analysis is mainly due to the system data by the geometric relationship between sequence analysis system in comparison to the relationship between the degree of each factor [5], so in order to further verify the accuracy of gray correlation analysis, factor analysis for the introduction of this paper, the default of which the principal component analysis is to verify the correctness of gray correlation analysis.

## 19.3 Modeling on Sensitivity Based on the Default Factor and Principal Component Analysis

### 19.3.1 Principal Component Analysis

Hostelling proposed in 1933 by the principal component analysis with a reduced-dimensional thinking, a few more indicators into composite indicators are not related to a multivariate statistical analysis, can be observed from the explicit variables to extract information, the composition cannot be directly observe implied variables. The main principle adopted is to make the maximum variance, the sample does not change the data structure, and as much as possible to retain the information contained in the original variables, while the main components with as little as possible to substitute the original variables, so that the problem is reduced [6]. Indicators with the composition of  $p$  random variables, as a linear combination of indicators:

$$\begin{cases} F_1 = a_{11}x_1 + a_{21}x_2 + \dots + a_{p1}x_p \\ F_2 = a_{12}x_1 + a_{22}x_2 + \dots + a_{p2}x_p \\ F_3 = a_{13}x_1 + a_{23}x_2 + \dots + a_{p3}x_p \\ \dots\dots\dots \\ F_p = a_{1p}x_1 + a_{2p}x_2 + \dots + a_{pp}x_p \end{cases} \quad (19.2)$$

where:  $F_1$  in the  $x_1, x_2, \dots, x_p$  of all linear combinations of the biggest variance;  $F_2$  and  $F_1$  is not related,  $F_p$  and  $F_1, F_2, \dots, F_{p-1}$  is not relevant.  $F_1, F_2, \dots, F_m$  cumulative contribution rate, the greater the cumulative contribution rate, the less loss of data, usually in the cumulative value of the standard contribution rate should be made more than 85 % [6].

The impact of city water demand factors with principal components regression analysis, the results are listed in Table 19.2. Can know from Table 19.2, the first, second, and third are the three principal components of the total contribution rate of 97.90 %, essentially all of the variables to reflect the original information, so use the first three principal components as the data analysis active ingredients.

Tables 19.2 and 19.3 show that the first principal component of the total contribution rate of 79.12 % variance of information mainly reflecting the per capita GDP, fixed asset investment, industry, and the number of four factors of city population variation of this information, the second principal component of the total contribution rate of 10.80 % variance information daily per capita water consumption mainly reflects the variation of this factor information, the third principal component of the total variation of the contribution of information of 7.97 % mainly reflecting the variation of city water supply information. Load value of the variable mainly reflects the contribution of principal components, can know from Table 19.3, the first principal component mainly covers the per capita GDP, fixed asset investment, industrial, and city population, the number of these four factors of information and data, these four factors are in the load on the first principal components 0.7741, 0.834, 0.8907 and 0.8477, respectively, in excess of 0.7 or more, so we think that four factors affect the first component of the main factors. The second principal component mainly reflected the daily per capita water consumption information data factors, the factor in the load on the second principal component is 0.9354. The third principal component mainly reflected the city's total water supply information and data, and its load on the third principal component is -0.9108.

**Table 19.2** Eigenvalues and cumulative contribution ratios

PC	Eigenvalues	Percent (%)	Accumulate percent (%)
1	4.7474	79.1231	79.1231
2	0.6483	10.8042	89.9273
3	0.4783	7.9723	97.8996
4	0.1145	1.9085	99.8081
5	0.0078	0.1298	99.9378
6	0.0037	0.0622	100

**Table 19.3** Eigenvectors and factor loads of correlation matrix

Factor	1 PC		2 PC		3 PC	
	Eigenvectors	Load	Eigenvectors	Load	Eigenvectors	Load
$x_1$	0.444	0.7741	0.453	-0.1795	0.4087	-0.5891
$x_2$	0.2563	0.834	0.0362	-0.3115	-0.1852	-0.4426
$x_3$	0.0189	0.8907	0.1686	-0.3603	0.5153	-0.1377
$x_4$	-0.3858	0.8477	-0.258	-0.1905	0.71	-0.4847
$x_5$	-0.7519	0.3225	0.5436	-0.211	-0.17	-0.9108
$x_6$	0.1506	-0.2855	0.6348	0.9354	0.0162	0.2011

In summary, we can see that the contribution of the first principal component accounted for 79.12 % variation information, and the first principal component highlights the per capita GDP, fixed asset investment, industrial and city population, the number of these four factors of information and data, so we think that four factors that affect city water demand factors, which can be grouped into four factors and the indicators of city economic development, the following factors will be combined with the default method and the main component regression for quantitative analysis.

In this paper, sensitive factor analysis is the default factor method introduced into the calculation of principal component regression [7], through the default input factors for each principal component regression model and testing, according to its full-factor model test error and error ratio  $R_i$  to determine the size of the default factor sensitivity of the output factors.

$$R_i = RMSE_i / RMSE \tag{19.3}$$

where:  $R_i$  for sensitivity index; Ramset for the default when the first  $I$ -factor model checking errors; RMSE for the full factorial model checking errors [8]. If  $Rumsey > Rumsey$ , that factor  $i$  is more sensitive to factor  $j$ , otherwise, factor  $I$  is less sensitive to factor  $j$ .

### 19.3.2 Results of Sensitivity Factor Analysis

In this paper, by default factor test method, the results showed that (Table 19.4).

Table 19.4 shows the city population and per capita GDP of these two factors to the city water demand greater sensitivity index, the  $R$  values were 4.38 and 4.02; followed by the number of industrial and domestic water consumption per capita at the two of factors, the  $R$  values were 2.02 and 1.76; final total for the water supply and fixed asset investment is these two factors, the  $R$  values were 1.59 and 1.04. The analysis results and the previous principal components analysis of qualitative results are basically consistent with the results of gray correlation analysis there are some out, but in the main determining factor is sensitive to exactly the same.

**Table 19.4** Validation results of default factors

Factor	RMSE (%)	R	Order
All factor	1.57		
$x_1$	6.31	4.02	2
$x_2$	1.63	1.04	6
$x_3$	3.17	2.02	3
$x_4$	6.88	4.38	1
$x_5$	2.49	1.59	5
$x_6$	2.77	1.76	4

## 19.4 Conclusion and Discussion

City water demand factors for the sensitivity analysis, the paper first with a preliminary correlation analysis of gray judge, after the introduction of the default factor and principal component analysis to check results show that the results of two methods sensitive to factors in the main the judge is exactly the same, but the judge in the secondary sensitive factors, there is a certain difference, which shows that the combined model in distinguishing the major sensitive factors is applicable.

Sensitivity analysis, the city population and per capita GDP of these two factors on the city water demand changes are the most sensitive.

As a government department, in water resources planning and decision-making process, should take full account of the city population and per capita GDP of these two factors on the impact of city water demand, the reasonable control of the city scale, construction of small-and medium-sized cities to develop appropriate control the development of large cities.

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# Chapter 20

## Agent-Based Risk Simulation System Design Model for Generation-Side Electricity Market

Xian Li and Cunbin Li

**Abstract** In the background of searching a way for China's electricity market reformation, a lot of researchers make focus on the stage of opening the generation side stage. Based on the detailed analysis of its structure, this paper first describes the generation side electricity market operating model. And then a risk-based simulation system based on multi-agent technology is designed. By considering some of the issues that need to be paid attention in the traditional simulation process of electricity market, a risk-based simulation analysis software structure is schemed out. It can provide some technical support for market simulation system designers.

**Keywords** Generation side · Electricity market · Risk · Simulation system · Design model

### 20.1 Introduction

After decades of power market reformation, many countries in the world have built their electricity market in line with their own characteristics. The effective operation of the electricity market strengthens the optimal allocation of power resources. And the resource utilization is also improved. China is also gradually establishing electricity market according to China's national conditions. The

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reformation idea of China's power market is roughly consist of three steps. The first step is the separation of power generation and power transmission–distribution companies, introduced competition in the generation side. The second step is to gradually open the gentian market to large power users which means that the large power users can directly purchase electricity from generation-side market. The third step is to establish and improve the distribution-side power market. However, market liberalization will lead to the occurrence of trading risk. So how to avoid market risks reasonable and effectively, and how to establish the reasonable electricity market operation rules is one of the problems to be solved.

Artificial intelligence technology is now widely used in the electricity market simulation due to its autonomy, learning, and adaptability. T. Pinto, H. Morais using the multi-agent technology to model and simulate virtual power producers which are represented as coalitions of agents in electricity markets [1]. A. Azadeh proposed an innovative model of agent-based simulation based on ant colony optimization (ACO) algorithm in order to compare three available strategies of clearing wholesale electricity markets [2]. E. Guerci also used a multi-agent interacting framework to model power exchanges and a model of the day ahead market session of the Spanish power exchange is proposed using real demand data with simulated seller strategies [3]. Zhao Bo provides a simulating system based on multi-agent system (MAS) and CORBA technology [4]. Zhou Hai-ming developed an electricity market simulation system to implement modeling for electricity market simulation mainly bidding the process of market participants by agent-based bidding strategies [5]. Liu Xiaoguang introduced a simulation system of electricity market based on multi-agents. The system can be used to compare the effects of different mechanisms to the market [6].

In summary, agent-based technology simulation in the research of electricity market characteristics is very mature. But only a few of them are used for the electricity market reformation analysis in China. From the perspective of risk-based multi-agent technology, this paper builds a simulation model based on the second step in the electricity market reform process in China. Namely, release the large power users and power producers direct purchase electricity from generation-side market. Among them, the risk factors including the power load uncertainty, market power and other uncertain factors. The system designed to be easily extended and easily to operate. And it is used in Chinese power market reformation process research.

## **20.2 Transactions Principles of Generation Side Market**

Generally speaking, power generation-side electricity market consists of power generation companies, large power users, independent system operator, and power supply company. Power generation companies generate electricity through the use of fossil fuels or other energy resource. A power generation company may have several generators. Power generation companies sell electricity to large power

users and power companies through competitive bidding process in generation-side market. Large power users purchase electricity for their own use. While the power supply company buys electricity from generation-side market and then sells the electricity to the power common users through transmission and electric distribution equipment. In this process, power generation companies achieve electricity generation amount or capacity through competition in market. And large power users and power supply company buy electricity through bidding from market. The power supply company purchases electricity from the market, and then sells the electricity to end users. Because of the high volatility of the end users' electricity demand, the power supply company is faced with high risks. And the bidding strategy of power supply company may affect the entire market. Different from some other electricity markets such as PJM electricity market; they are not including power supply company. Most electricity markets consist of generation companies and users, and independent system operator ensures the electricity trading results can be normally delivered. So the model in this paper is only suit for the China's generation side market analysis of which the participants consist of generation companies, large power users, power supply company, and market supervisor organization.

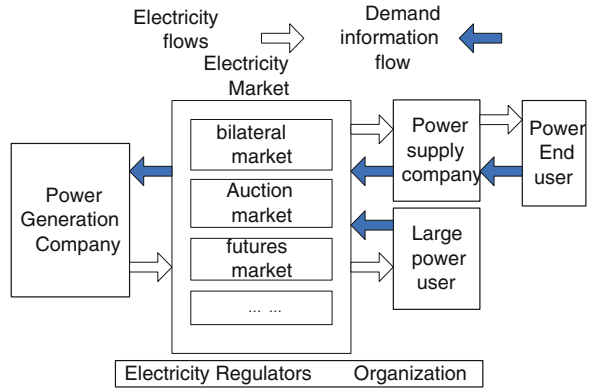
In this electricity market mode, the large power users and power supply company participate in the market bidding for the purchase of electricity. The power supply company predicts the electricity load of the next trading session firstly, and then makes their bidding strategies according to the power load information. While the large power users bid according to the actual need situation. Market trading center made out the reasonable clearing transaction results after considering transmission restrictions of the power system. And then, the ISO dispatches the electricity of successful bidding power generation. Electricity regulatory organization supervises the whole process of electricity trading.

There are a variety of power transactions patterns, including bilateral contracts, centralized auction, and so on in the electricity market. Variety of trading patterns can be further divided in accordance with the trading session such as long term, mid term, and short term. Power producers can choose to trade generation power via multiple trading patterns.

In the electricity trading, physical restrict is a crucial problem, so the constraints of the transmission line must be taken into account. The block diagram of electricity market trading principles is shown in Fig. 20.1.

In this paper, a model consists of power generation company, power supply company, large power users, and electricity regulatory organization are included. Each role is considered as a kind of agent, respectively. Each agent has the ability to learn and adapt. And a risk agent which affects the other agents is defined to simulate the stochastic character of the process. The whole system is used to simulate the electricity market procedure.

**Fig. 20.1** Electricity market trading principle block diagram



### 20.3 Risk Disturbance Agent Simulation System Needs Analysis in Electricity Market

In the process of simulating the electricity market, we must refine the constituent elements of the electricity market. The characteristics of each element must be analyzed clearly, and then each of the constituent elements should be detailed modeling. In the agent-based simulation system for the electricity market simulation procedure, power generation company, electricity supply company, large power users, electricity regulatory organization, and so on can all be seen as agents.

The agent has the character of autonomous, communication capable, ability to respond, spontaneous behavior, mobility, reasoning ability, planning ability, learning ability, and ability to adapt.

The power generation company agent takes part in the bidding process in generation markets. Its aim is to achieve maxed profit. If bidding failure, it must modify the bidding strategy via self study. Through establishing a successful rate function of the power generation company, the generation agent's learning ability is achieved. The simplified successful bidding probability function  $P_i(L, b_i)$  is the probability of its agent under load  $L$  with price  $b$  [7]. In actual simulation, the successful bidding probability function can be obtained via multiple simulations. In general, power producers maximize their own effectiveness as the goal for the next step decision making. So the decision-making model of the generator agent in period  $t$  is:

$$\max\{P_i(L_t, b_{i,t}) \cdot [b_{i,t} \cdot q_{i,t} - C_i(q_{i,t})] - C_{fixed,i}\} \quad (20.1)$$

In the formula,  $L_t$  is the load at time  $t$ .  $b_{i,t}$  is the bidding price of generator agent  $I$  at time  $t$ .  $q_{i,t}$  is the output of generator agent  $I$ .  $P_i(L_t, b_{i,t})$  is successful bidding probability.  $C_i(q_{i,t})$  is variable cost  $C_{fixed,i}$  is fixed cost-sharing [8].

Electricity supplier agent purchases electricity from the power generation-side market according to region load, and then sold electricity to end electricity customers through transmission network and distribution network. In a time series, the

power supply company must be profitable. The decision-making function of Power Supplier agent is:

$$\max \{ L_{user,t} \cdot (p - p_{clear,i}) - C_{s-fixed,i} \} \tag{20.2}$$

In the formula  $L_{user,t}$  is the total load of users.  $p$  is user side electricity price.  $p_{clear,i}$  is the clearing price at time  $i$ .  $C_{s-fixed,i}$  is fixed cost-sharing. From this formula, we can see that the electricity supply company will buy electricity at a price that it is as low as possible.

Large power user agent purchases the required electricity through bidding in generation side market. Its goal is buying electricity as cheap as possible. Similarly with the power supply company agent, the large power user agent buy electricity at a price which is as low as possible.

In addition, electricity supervision organization agent is used to adjust the exception bidding state in order to keep the market trading normally.

In an electricity market clearing process, we must consider the physical constraints of the transmission system. Physical constraints are the crucial constraints of the electricity trading, it must be calculated after each transaction. That is generators, transformers, transmission lines, nodes, and so on. Which constitute power system can correct deliver the electricity in accordance with the transaction result. Otherwise, the trading volume needs to be adjusted, repeated the calculations until the transaction can satisfy the physical constraints. The electricity trading simulation process is shown in Fig. 20.2.

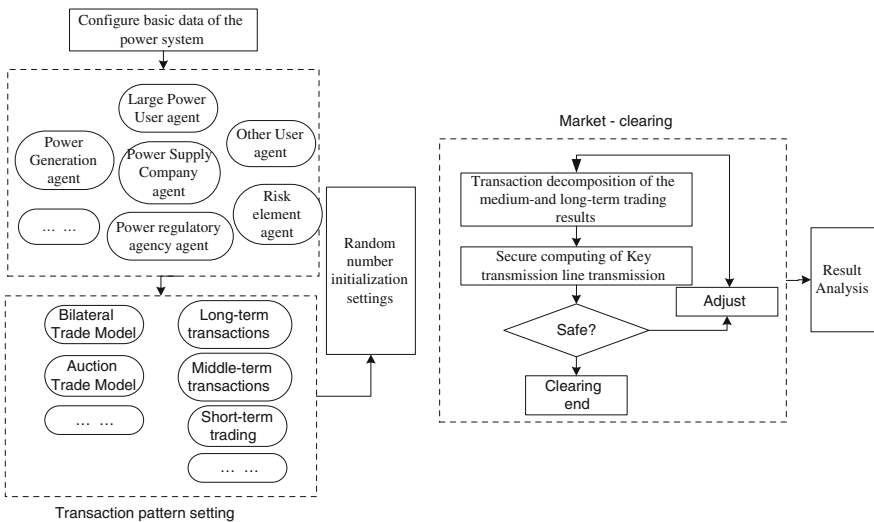


Fig. 20.2 The process of electricity market trading simulation

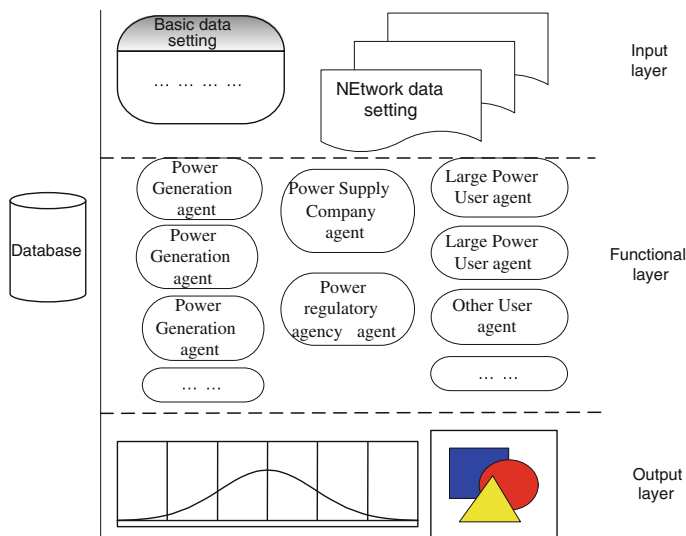


Fig. 20.3 The architecture of software

## 20.4 Risk Disturbance Simulation System of Electricity Market Design Model

The establishment of the multi-agent simulation analysis of electricity market is based on the Swarm platform. The Swarm platform is developed by the Santa Fe Laboratory (the Santa Fe Institute), which provides a reusable standard software tools for system simulation of the study interaction between the agent and the behavior of other objects [9].

The software is designed with three-tier structure. The first layer is input layer; the initial data can be set by the user in this layer. The second layer is the functional layer; the organizational structure is established by multi-agents. The third layer is the output; this layer displays system output charts and data. The software architecture is shown in Fig. 20.3.

## 20.5 Conclusion

This paper analyzed a possible stage of the reformation process of China's power market may experience. It means the stage that the large power users can direct purchase electricity from generation-side market together with power supply company. After analyzing the situation of this stage, a risk-based agent simulation system is established in order to achieve the simulation analysis of this stage. That provides the electricity market designers a useful research tool.

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# Chapter 21

## 3D Simulation of Rock Fractures Distribution in Gaosong Field, Gejiu Ore District

Chunzhong Ni, Chunxue Liu, Shitao Zhang and Chunming Fu

**Abstract** Fracture networks often are hierarchical and always present some kinds of scaling invariance. To consider these special characteristics, a geomathematical method is proposed in this paper to simulate the fracture distribution. The method mainly consists of: simulation of location, direction, aperture, and fracture connectivity, just as the application in Gaosong Triassic dolomite. The fracture locations are simulated using SGS method; the fracture strikes are simulated using principle component analysis method and Ordinary Kriging method. From the result, simulated fracture distribution corresponds well to hydraulic conductivity map, real fracture zone, and spring water distribution.

**Keywords** Geostatistical simulation · Rock fractures distribution · SGS method · Ordinary kriging method · Gaosong field

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## 21.1 Introduction

Fractures are ubiquitous in rocks in nature and play an important role in many fields, such as geology, architecture, geophysics, and so on. It is elementary to simulate the three-dimensional distribution of fractures because the fracture spatial distribution effects the rock stability in architecture, permeability, and storage of underground resources, such as oil, groundwater, geothermy, and so on. It is difficult in practice because three-dimensional fracture distributions are imbedded in rocks that are opaque to almost all probes and real fractures are often only observed as two-dimensional outcrops or cross sections or one-dimensional boring holes. In addition, these two-dimensional and one-dimensional sample data are always biased and in most cases seem impossible to be corrected [1]. Although a lot of methods have been tried to simulate the distribution of fractures in different fields recently, these methods are mostly limited on basing on stochastic (Gaussian or Poisson) generation [2, 3]. This paper introduces a geostatistical method to simulate the distribution of fractures by considering the directions. Fracture locations are generated randomly according to fracture densities which are simulated by sequential Gaussian simulation (SGS) [4, 5]. Fracture directions are transformed into indicators consisting of several two-valued (0 and 1) variables and these indicators are deduced to three variables by using principle component analysis method. Then ordinary kriging (OK) method is employed to estimate the distributions of the three principle components and the results are inverted to the original indicator form. Finally, fracture directions are generated randomly according to their own cumulative distribution function (CDF). As an application, a case study is performed in Gaosong field, Gejiu ore district.

## 21.2 Method

The distinguished characters of fractures complicate the simulation on the spatial distribution of fractures. Fractures process multiple properties, such as location, direction, aperture, shape, and so on. Different fractures may go through the same spatial position; fracture networks often are hierarchical and always present some kinds of scaling invariance [6, 7]. To consider these special characteristics, a geomathematical method is proposed in this paper to simulate the fracture distribution. The method mainly consists of: simulation of location, direction, aperture, and fracture connectivity [8].

### 21.2.1 Simulation of Fracture Location

Fracture locations are characterized by their center points coordinates (maybe one, two, or three dimensional form) [9, 10]. Their distributions simulation is



performed by a Monte Carlo method according to their corresponding fracture density (FD) [11].

### **21.2.1.1 Calculating Fracture Density**

Though fracture locations always show clustering in spatial space, FD exhibits normal distribution in most cases. So FD provides a useful tool to estimate the fracture location distribution.

Fracture density is defined as the number or total area of fractures per unit volume ( $\text{m}^{-3}$  or  $\text{m}^{-1}$ ), or the number or total length of fractures per unit area in trace map ( $\text{m}^{-3}$  or  $\text{m}^{-1}$ ), or number of fracture intersections with a scanline per unit length ( $\text{m}^{-3}$  or  $\text{m}^{-1}$ ). All these quantities can be converted into one another when reasonable assumptions on the fracture shape, size, and orientation distribution are used.

### **21.2.1.2 Estimating Fracture Density Distribution**

Semivariogram was employed to dispose the spatial correlation among FD. Then based on the simulated semivariogram model, OK or SGS method is valid to estimate the FD distribution. While in most cases the SGS method presents better suitable effect because it can remedy the over-smoothing defect. After the estimation, every estimating cell will possess an FD value.

### **21.2.1.3 Generating Fracture Locations in Estimating Cell**

As the definition, value of FD in each estimating cell means the fracture number in this estimating cell. Then in each estimating cell, FD fracture spatial locations are generated by Monte Carlo method according to a uniform distribution.

## ***21.2.2 Simulation of Fracture Directions***

Directions of fractures can be represented with their normal unit vector, or the usual form used in geology with strike (orientation) and dip (inclination) [12]. Fracture directions always occur in some notable directions owing to the natural forces. This leads to the original direction data to not be used directly in OK in most cases. Therefore, the principle component analysis method is employed on the direction data and the direction form of strike and dip is used in this paper.

### 21.2.2.1 Converting Fracture Direction into Indicator Form

Fracture direction scope is divided into  $n$  equal or unequal exclude groups as ( $g_1, g_2, \dots, g_n$ ). Only the group covered the direction angle is given value 1 to represent fracture appeared in this group and the other groups are given 0 for not appearing. For example, the fracture strike range  $[0, \pi/2)$  can be divided into four groups as (EW NE NS NW), where EW is equal to  $[0, \pi/8), (7\pi/8, \pi)$  and NE, NS, and NW are equal to  $(\pi/8, 3\pi/8], (3\pi/8, 5\pi/8],$  and  $(5\pi/8, 7\pi/8]$  respectively. Then a fracture orientated  $\pi/4$  is classed into NE, so the corresponding indicator is (0 1 0 0). Of course the group number can be free, while usually  $n = 4$  is enough.

### 21.2.2.2 Principle Component Analysis on the Indicator Value

Because fracture indicator includes many components, principle component analysis is used to reduce the group number. As always known, three components can represent all the components with high confidence; and three variables are proper for practice calculating.

### 21.2.2.3 Estimating the Distribution of Principle Components

Semivariogram of each component is calculated to find the hidden spatial variety law. Distribution of principle components are estimated using OK or SGS method. So at each estimating fracture location all (usually three) components are estimated.

### 21.2.2.4 Inverse Principle Components to Indicator Form

Those component values estimated at each location are inverted to indicator form, and only the biggest value is replaced with 1 to represent the most possible group where the fracture occurs and the rest is applied as 0 for not occurring. For example, at an estimated location inverted indicator is (0.5 0.3 0.1 0.9), then the biggest value 0.9 is replaced with 1 and the others are replaced with 0, and the result is (0 0 0 1). Then NW group  $(5\pi/8, 7\pi/8]$  is considered as the highest possible group in which the fracture direction appears.

### 21.2.2.5 Randomly Generating Directions in Their Corresponding Group

Strikes are generated randomly according to the experimental CDF in their corresponding group range.

### 21.2.3 Simulation of Fracture Apertures

Apertures are estimated with the OK or SGS method described several times above. If the semivariogram is difficult to be calculated in all directions, only those fractures in the same direction group can be estimated by OK or SGS.

## 21.3 Fractures Connectivity

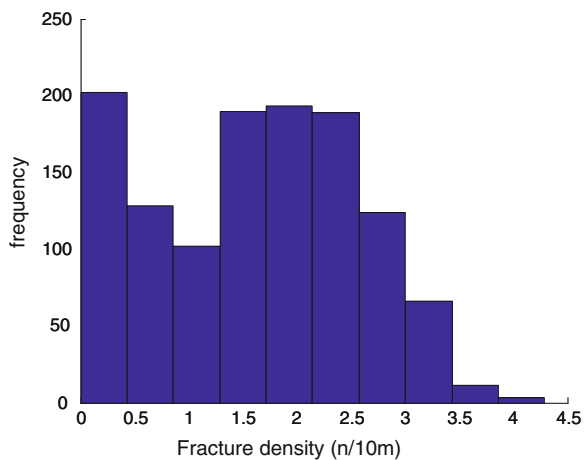
Two similar fractures are linked as one fracture. First, the distance between the two fractures is shorter than LD; second, the angle between the two fractures is smaller than LA. LD and LA are the maximum tolerance values on distance and angle respectively. Then this operation is performed on all the fractures repeatedly and the related fractures are linked as one fracture.

## 21.4 Application in Gaosong Field, Gejiu Ore District

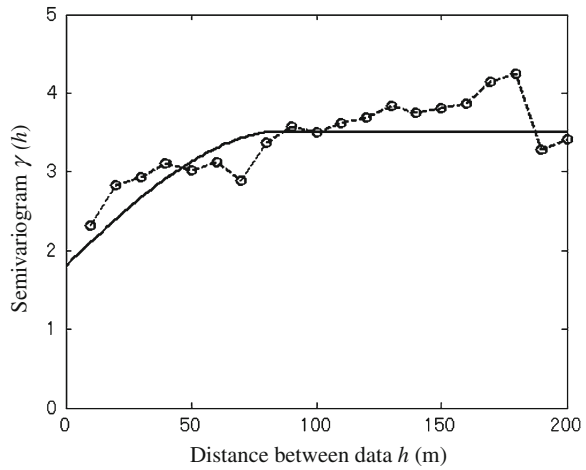
The proposed method was applied to the fracture data obtained from several tin ore underground tunnel in a Triassic dolomite massif, southeast Yunnan province. The study area is about 4,000 m in east–west direction and 5,000 m in north–south direction and covers seven tunnels orientated N40°E or so, as sample data. Sample data (fractures) include joint, fracture, fault zone, and apluite. The total length of the seven tunnels is about 5,463 m and the total number of fractures is 12212.

Fracture density is calculated as the fractures number per 10 m. From the histogram (Fig. 21.1), FD shows an approximative Gaussian distribution and the

Fig. 21.1 Histogram of FD



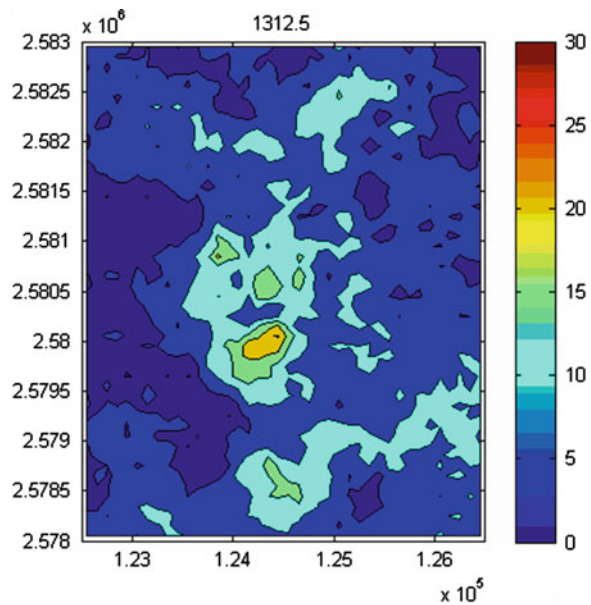
**Fig. 21.2** Semivariogram of FD

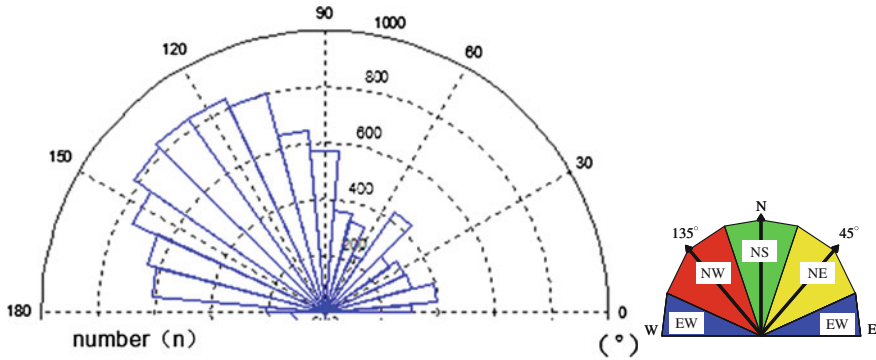


main FD is concentrated at 4/10 m. Semivariogram of FD are calculated and modeled with parameters of the sill as 3.5, range as 80 m (Fig. 21.2). Based on the semivariogram, FD map (Fig. 21.3) is estimated using SGS based on Ordinary Kriging on unit cells of 10 m × 10 m. Then in every cell, fracture locations of the same number are equal to their corresponding FD and are generated randomly according to uniform distribution.

Fracture orientation diagram shows two leading perpendicular orientations in NE and NW (Fig. 21.4). Fracture orientations are classified into four groups at the

**Fig. 21.3** Distribution map of FD simulated by SGS



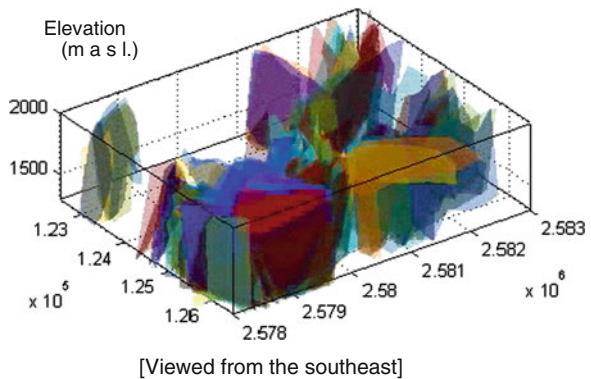


**Fig. 21.4** Fracture orientation histogram fracture orientation scope and its four divided groups

scope from 0 to  $\pi$ , then every orientation corresponds to one group and this group is assigned 1 to represent the orientation existing in this group and the other three groups are assigned 0 to represent not existing as the form (1 0 0 0), (0 1 0 0), and so on. The simulated fractures are shown in Fig. 21.5.

Hydraulic conductivity is used to validate the fracture spatial distribution. Ordinary Kriging method is also used to estimate hydraulic conductivity with 268 conductivity sample data. Fractures whose apertures are more than 2 cm are superposed on the hydraulic conductivity map. These fractures concentrate at the high value zone of conductivity and reveal the NE linear structure. The west part corresponding not so well is regarded as their filling is developed and results in water shielding effect. These fractures congregate well corresponding to the high hydraulic conductivity zone. It seems those not oriented NW fractures with poor continuity also have relation to hydraulic conductivity. This phenomenon is also found from the spring water distribution.

**Fig. 21.5** Distribution map of fractures



## 21.5 Results

The proposed method is proper to simulate the fracture distribution considering fracture directions. Just as the application in Gaosong field Triassic rocks, the fracture locations are simulated using SGS method, the fracture strikes are simulated using principle component analysis method and Ordinary Kriging method. The results show that simulated fracture distribution corresponds well to hydraulic conductivity map, real fracture zone, and spring water distribution.

The SGS method is suited to simulate fracture locations. SGS is a stochastic method based on Ordinary Kriging method. It combines the strong points of the trend shown in OK and is randomly processed by stochastic process. It can produce trend and random at the same time. These are also the characteristics processed by fractures.

The insufficiency is the application of this method is on a two-dimensional example restricted by the tunnel sample data. Further research will be performed on three-dimensional cases.

**Acknowledgments** The author wishes to express sincere thanks to Project 40902058 supported by National Natural Science Foundation of China for the research activities.

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# Chapter 22

## Application-Oriented Designing for Remote Control Scheme of Robot Integrated Machine

Wenming Wang

**Abstract** This paper introduces the network remotely operated robot system architecture and its principles. Designed a remote login control scheme, realized a local communications framework based on the realization of USB2.0 between the upper and lower computer communications. Through Single chip microcomputer to control robot, and can support the wireless network, such as Bluetooth protocol, with the aid of a remote login realize robot integrated system for local control, according to the video information of robot master movement, but also according to simulation robot to grasp the real robot specific parameters, and uses the CAMSHIFT algorithm to realize the robot moving target tracking and positioning, so as to realize the remote control center remote control task, the purpose is to design a set of the practical application of remote control system of robot, robot applications in different fields and provide reference.

**Keywords** Robot integrated machine · Remote operation · USB communication · Single chip microcomputer

### 22.1 Introduction

In a few developed countries, along with the technical progress, remote control robot combat vehicle can evolve as semiautonomous combat vehicle [1]. Semi-autonomous vehicle in surveillance of self-determination, in the face of difficulties operating personnel can carry out remote intervention [2, 3]. Semiautonomous

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vehicle can rely on their own autonomous navigation, obstacle avoidance, and completion of the particular target shooting, but require manual to be on target identification, the robot combat vehicle two orders, which determine the target, determine the course of action, artificial participation will depend on the robot combat vehicle autonomous capability. Such, can cancel the remote optical fiber, using radio control mode.

Most of the existing research achievements are the use of wired network transmission control command and feedback information, largely limits the range of motion of the robot. If the robot is not laying cable network areas or in large area operation, operator and robot must be built between a wireless connection.

At present, network-based remote operation robot system according to the structure of the different, can be divided into two categories [4, 5]: Based on Internet C/S remote operation robot system with the Web browser based B/S remote operation robot system.

In this paper, based on the above considerations, from a practical point of view, in view of the practical application, research and design a set of remote robot control program, and has been verified by experiments.

## 22.2 The System Structure and Function Module

### 22.2.1 Remote Operation System Model

Remote operation system model can be divided into: remote monitoring system, remote data transmission system, and onsite equipment monitoring and control system in three parts. Through the division of labor and cooperation, to achieve remote operation of equipment, remote network operation model is as shown in Fig. 22.1.

*Remote monitoring terminal system.* Remote terminal is the interface between user and field devices. From a functional perspective, including displaying the remote device state of terminal, input control command and parameter, performing processing of command parameter and state data, and other operations. There will be a remote computer as a remote login device.

*Remote data transmission system.* Remote data transmission system is a channel for remote control of the information transmission. It can perform transmission of various types of control data. The purpose is to transfer the equipment state

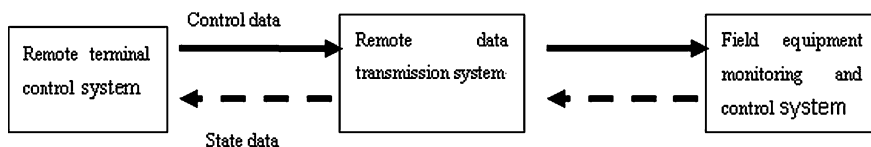


Fig. 22.1 Remote network operation model



information to the monitoring end as soon as possible, so that the operator understands state of equipments, and to determine next steps (for example, through the transmission system sends control command); In addition, the control information is also transmitted to the site of the control host, so that the equipment will be controlled. Here is from a remote login to one of the PC (field), directly manipulate communication between PC and SCM, to control the robot.

*Field equipment monitoring and control system.* Field equipment monitoring and control is a system monitoring and controlling on the site equipment directly. The main task is to monitor terminal control data for controlling apparatuses, simultaneous monitoring equipment states, and make the necessary analysis, then the state feedback to the monitoring end through a transmission channel. Field monitoring system is actually a computer control system, is a computer center for collection of field control, management, and data acquisition. Mainly through the video observation state and the simulation robot data, It can accurately grasp the state of the robot.

### 22.2.2 The System Topology

*System structure definition.* System structure diagram as shown in Fig. 22.2.

The local structure: design and implementation of local structure is only important, it will realize the comprehensive control of robot and the PC machine. Here the PC machine, single chip microcomputer is cable connected between the robot, so in the actual application, the PC, single chip computer and robot integration can be integrated, namely the form shown in Fig. 22.1 of the integrated structure, make a single chip PC and become equipment supplement of the robot itself. The machine will be integrated as a whole (robot), and it will appear on the scene, to work. Its working position, working status, and site conditions get into the PC machine through the camera in video form, thus PC machine can make timely understanding of the working conditions.

Remote terminal: the remote terminal is the computer used by the operator, through the remote machine, an operator can control remote robot's behavior,

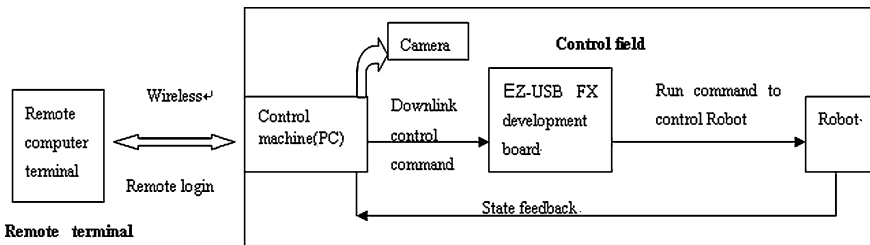


Fig. 22.2 Structure of the system

understand the field working situation. Remote terminal works through communication between Internet and field PC. But because of considering the communication delay, video transmission and other factors, this project does not use the method. The system adopts the strategy of remote login, remote wireless login to the PC machine, make PC machine directly to be simulation terminal. Directly using remote PC machine, to achieve purpose to control the robot integrated machine.

About the robot machine application: the structure of the robot has a wide application prospect. In the military, can be arms in front of the robot, with mine detectors and a variety of test equipment, test results will be returned to the PC control machine and sound the alarm, remote operator can be learned; an operator can remotely control the movements of the robot, and according to the video information, can understand the neighborhood. In civilian areas, if the robot itself is a semiautonomous robot, such as GPS itself, it can also be a limited freedom of movement, will capture the information back to the control unit, so that the remote operator grasps near the scene, the robot can be used for routine patrol and surveillance functions, suspicious target made warning role, after execution of the task back to the original places. If the configuration tracing algorithm, but also for moving target tracking, monitoring, and issued a warning to the main control machine. In scheme, the integrated machine refers to the robot, SCM, and the PC integrated as one machine. If one machine with wheels or tracks, mine detection, guns, and other equipment, can form application type semiautonomous robot, it can be a range of autonomic activity, can also receive control commands, to achieve remote operation intention. Of course, one of the movement can be completely took over by remote operator, the so-called semiautonomous refers to one machine installed corresponding control software and hardware, can move independently and avoid obstacles, this part no longer papers discuss. In integrated machine, PC is responsible for control task of robot, in order to make the machine really convenient movement, really convenient for application in different situation, it uses wireless Internet access. If cable Internet, it will limit the scope of activities of the integrated machine, difficult to truly put into application in different situations.

#### *Function of the system*

Remote login: a remote operator logs on the PC from a remote computer, and controls robot's behavior through the operation of PC.

Local communication control: it includes realization of communication between PC and SCM, controlling the movement of a robot. Robot control is through the following three ways.

Method a: to capture robot field states through the camera, and correction;

Method b: to capture specific movement parameters through the communication;

Method c: when not to see situations through the camera, for example, in the camera damaged or video transmission and other problems, can also understand current situation by watching the simulation robot behavior.

Moving target tracking: realization of dynamic target tracking of background fixed and unfixed background conditions. Target what action to take, by the corresponding application fields as well as additional equipment decision. Such as shooting, landmine detection, alarm, and other application type action.

Robot simulation: use of independent intellectual property rights of the simulation platform (BITBOT) to complete the simulation of robot production system, according to the feedback information and simulation robot specific action, accurately grasp the actual field. This is the powerful supplement of the video observation.

## 22.3 Design and Implementation

### 22.3.1 Local Architecture Design

Local (spot) architecture is as shown in Fig. 22.3. This part of machine components, mainly used to control the robot and robot behavior accept feedback.

*Main control machine.* Microcomputer (PC) in robot remote network operation system has been playing a very important role. As the main control machine, PC sends control command into the robot as target, through the network transmission to control the remote robot; and the robot after executing the command sends a feedback message to the host, let controller understands the current status of robot through the main control machine. It can be achieved synchronous remote operation robot through real-time monitoring. During development, the PC is as the software development platform. In PC, this project completed the system control interface, hardware device drivers, communication program, and robot modeling. The whole test is mostly completed in microcomputer.

*Single chip microcomputer control.* Robot joint part is composed of a motor in robot remote operation. In the experimental process, robot control is essentially to control the motor of robot through the input voltage. Because sent control command by PC is data format, but the robot needed a process in which a control command is converted into voltage wave. In order to facilitate the test and be restricted by time, this project decided in the SCM that control command is

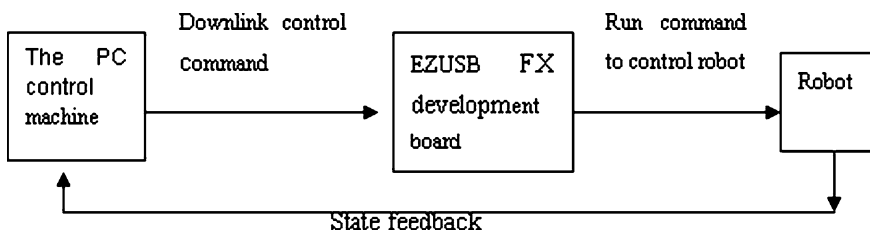


Fig. 22.3 The local communication structure diagram

converted into an electrical signal control. Since Cypress semiconductor's EZUSB FX2 is the world's first integrated USB2.0 microprocessors, which integrate the USB2.0 transceiver, serial interface engine (SIE), enhanced 8051 micro controller, and programmable peripheral interface. FX2 this original structure can make the data transmission rate of 56 Mbps, USB2.0 allows the maximum bandwidth. In FX2, intelligent SIE hardware processing many USB1.1and USB2.0 protocol, thereby reducing the development time and ensure that the USB compatibility. General programmable interface (GPIF) and the master/slave end FIFO (8 or 16 bit data bus) for ATA, UTOPIA, EPP, PCMCIA and DSP provide simple and seamless connection interface. In view of the above characteristics EZUSB, this project chose EZUSB FX2 to complete the test.

The principle of SCM is as shown in Fig. 22.4.

The working process is procedure to achieve the contents of the lower position machine. First, read the data from the buffer, the data decomposition is divided into target position and velocity by the communication and calculation module. The target position is eventually reach the position, communication calculates the required number of steps to reach the target location through reading the data. Subroutine will calculate each generated velocity waveform and output. The algorithm flow diagram is as shown in Fig. 22.5.

Actuator based on SCM control method has the advantages of simple structure, high precision, low cost, the characteristics of small size, and according to the different gear number to be flexible application. In robot control system, steering gear control effect is the important influence factor of performance. Steering gear in microelectronics systems and model aircraft as a basic output actuator, its simple control and output, the single chip microcomputer system is very easy to interface with it.

*USB communication between microcomputer and single chip microcomputer.* If the host does not know how to communicate between USB peripherals, then the USB peripherals is useless. Human interface device (HID) class is fully supported by Windows, and is the first batch of USB equipment type. Running on PC machine of Windows 98 or higher version, the application can use the operating system built-in drive to communicate with communication, but not to open a port, set several parameters, then you can read and write data so simple. In the application program with HID and exchange data, it must first find equipment, access reports relating to information. In order to obtain such information, the application must pass to access the communication function of application program located

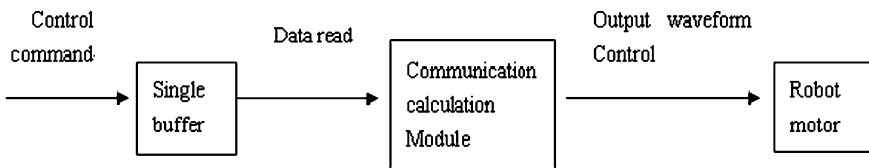
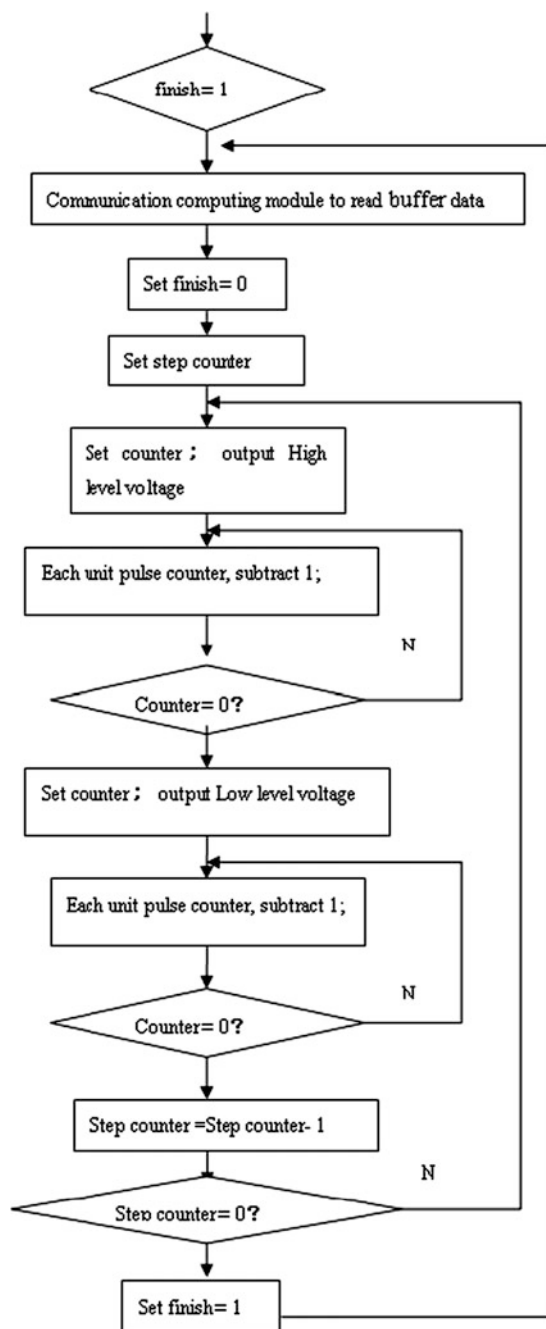


Fig. 22.4 The principle of SCM

**Fig. 22.5** PC communication algorithm with the lower



(API), application program located in the upper application and lower the device driver can exchange data. An application can use any programming language access to API function.

In Windows, reading and writing port and reading and writing files are calling the same API function, opening or creating port uses `CreatFile`, reading data from port uses `ReadFile`, writing data with `WriteFile`. For example, call the `ReadFile` function in the following manner.

```
HANDLE hCom;  
Void *pBuffer;  
DWORD iLength;  
DWORD pReadFact;  
BOOL ReadFile(hCom,pBuffer,iLength,&pReadFact,NULL);
```

### ***22.3.2 Remote Login Design***

The use of virtual network computing (VNC) realized remote login and control. VNC was first set by the British ATT of University of Cambridge laboratory to develop a lightweight remote control computer software. VNC software is mainly composed of two parts: VNC server and VNC viewer.

The VNC server mounted on the machine's PC, then VNC viewer mounted on a remote computer, So through the VNC viewer, can control PC machine, and then through robot Integrated machine, achieved implementation of robot control.

VNC server and VNC viewer support multiple operating systems, such as windows, Linux, MacOS, and Unix series (Unix, Solaris), VNC server and VNC viewer can be respectively installed on a different operating system. If without installing VNC viewer, the remote computer also can pass general Web browser (such as IE) to control the controlled end (requires Java virtual machine support). System for remote login process is as shown in Fig. 22.6.

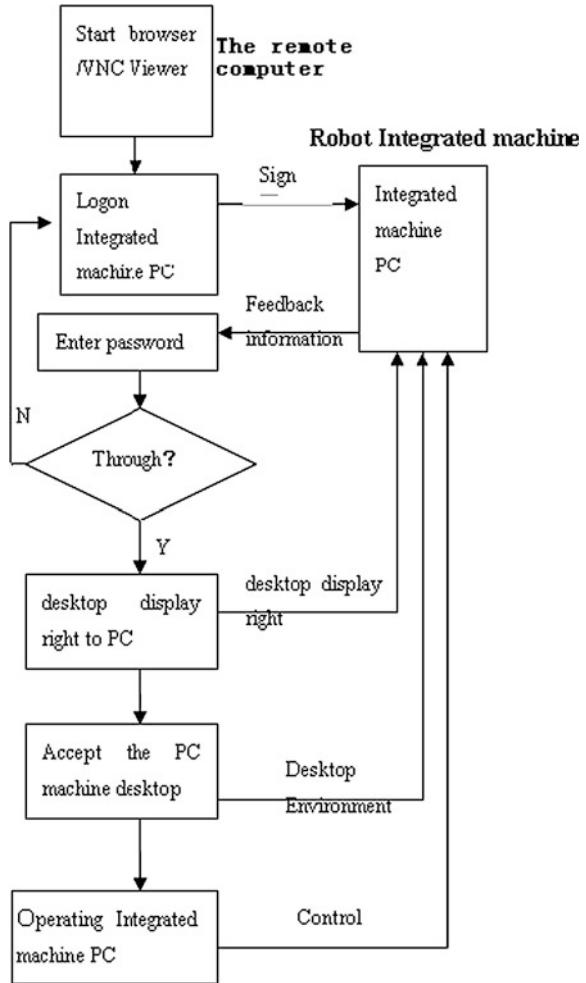
Finally, PC will bring screen desktop environment is sent to the client by using the communication protocol of VNC, and allow the client to control the PC environment.

## **22.4 System Testing**

### ***22.4.1 Local Communication Experiment***

The entire test includes: upper machine (PC), lower machine (SCM), and robot. First, run the computer program, the control command is sent to the SCM, and then let the chip run the control command into motor control waveform, and through

**Fig. 22.6** Flow chart of remote login



the USB interface connected with the robot, to realize controls of the robot in different parts of the rotation of the motor, and then to achieve the purpose of robot motion.

According to the testing results, in the robot remote operation, achieved SCM servo motor control in robot local communication system, and robot USB control.

### 22.4.2 Telnet Experiment

Telnet experiment is crucial; it will be directly related to the remote control problem. For the sake of simplicity, not a real one, just use a “six feet beast” as a robot, SCM and PC machine each one, a camera, connected to each other to form

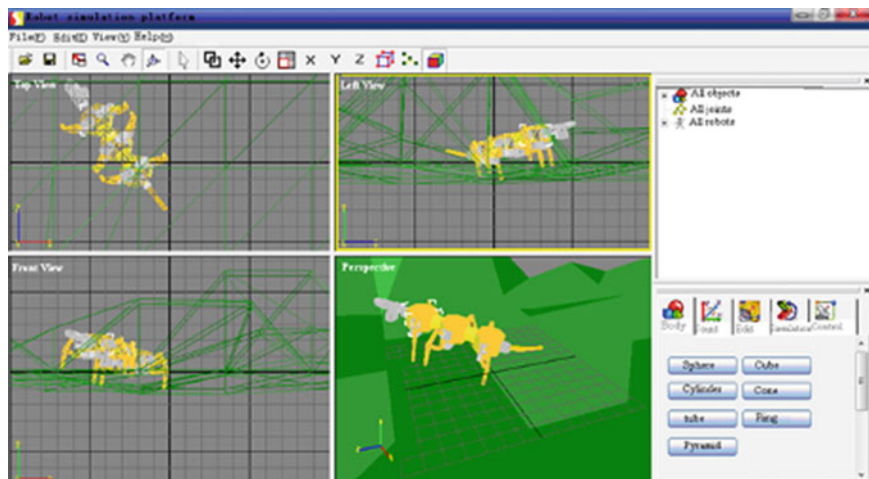


Fig. 22.7 Robot simulation modeling

an integrated machine system. The 6 feet beast simulation interface as shown in Fig. 22.7. Through the experiment achieves the desired results.

After a successful login, observation robot can be achieved by one machine camera; PC can send commands to make the robot moving; the robot feedback information can be seen on PC; Dynamic target in the camera video information is tracked. Start simulation software on the PC, through the simulation robot and the real robot motion contrast, also achieve a certain effect. The existence of the problem is the remote machine's display problems, especially the video information and simulation robot image information are not clear, display is too slow. Upgrade the remote machine and PC machine can approach to initial remission, especially the network transmission rate needs to be further improved, while also looking forward to more efficient video image transmission algorithm appears.

## 22.5 Conclusion

The purpose of the research is to design a set of the practical application of remote control system of robot, to provide services and references for robot applications in different fields. System belongs to an application technology integration Scheme, also in constant improvement. Project involves many technical problems, such as remote login technology, SCM control technology, video object tracking technology, wireless network transmission technology, and some technology has been studied and improved, the core of project is a variety of technology integration, platform construction. In particular, robot machine program realized the remote control of robot's purpose, the proposal is simple and practical, it can provide a reference for the robot in different applications. The experiment is still ongoing.



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# Chapter 23

## Network Intrusion Detection Based on Dynamic Self-Organizing Map

Baoping Gu and Hongyan Guo

**Abstract** Self-organizing map (SOM) is getting more attention in the intrusion detection. Considering current intrusion detection system with high false alarm rate and low detection rate, this paper introduces a simple modification to the SOM that eliminates learning rate, weight update, and trust degree, and adds automatic clustering. The improved SOM (DSOM) is implemented and applied to the intrusion detection. The validities and feasibilities of the DSOM are confirmed through experiments on KDD Cup 99 dataset. The experimental result shows that the detection rate has been increased by employing the DSOM.

**Keywords** Intrusion detection · Neural networks · Self-organizing map · Learning Rate

### 23.1 Introduction

An intrusion can be defined as a series of activities aiming at compromising the security of a computer network system. Intrusions may take many forms: external attacks, internal misuses, network-based attacks, information gathering, and denial of service, and so on. Intrusion detection is an important step of protecting the computer network system from intrusions. Intrusion detection systems (IDSs) are used to detect, identify, and stop intruders. The administrators can rely on them to find out successful attacks and prevent future use of known exploits. IDSs are also

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considered as a complementary solution to firewall technology by recognizing attacks against the network that are missed by the firewall.

Intrusion detection techniques can be mapped into four classes: anomaly detection, misuse detection, specification-based detection, and model-based detection. Anomaly detection consists of establishing normal behavior profile for user and system activity and observing significant deviations of actual user activity with respect to the established habitual pattern. Misuse detection refers to intrusions that follow well-defined attack patterns that exploit weaknesses in system and application software. In specification-based detection, the correct behaviors of critical objects are manually abstracted and crafted as security specifications, which are compared with the actual behavior of the objects. Intrusions, which usually cause the object to behave in an incorrect manner, can be detected without exact knowledge about them. Model-based intrusion detection compares a process's execution against a program model to detect intrusion attempts.

The objective of the research presented in this paper is to construct an anomaly detection system that will highlight "abnormal behavior" without incurring extensive computational overheads. To achieve this, self-organizing maps are applied to the problem of intrusion detection on computer networks. To develop such a system, we first try to define learning rate, weight update, and trust degree. At last, we use KDD 99 dataset to carry out the experiment.

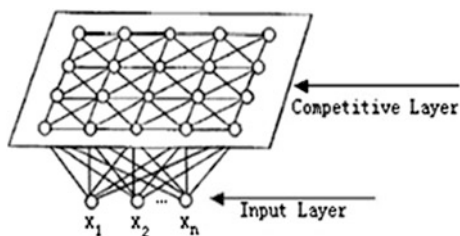
The rest of this paper is organized as follows. Section 23.2 presents a brief survey of the related research in intrusion detection. Section 23.3 introduces clustering algorithm of DSOM. Our experiments and their results are detailed in Section 23.4. Section 23.5 concludes this paper.

## 23.2 Related Research

### 23.2.1 Self-Organizing Map

Since 1981, the original self-organizing map (SOM) is proposed by Professor T. Kohonen, SOM neural network is believed to resemble processing that can occur in the brain and form a feature map, which is very useful for visualizing high-dimensional data in two-dimensional or three-dimensional places [1]. A typical structure of the SOM is described as in Fig. 23.1.

**Fig. 23.1** A typical structure of SOM neural network



The typical SOM neural network is to form topology distribution of the input signal based on the one-dimensional or two-dimensional cellular array, so the SOM neural network has the ability to extract the feature of the input signal's mode. The SOM neural network commonly only includes a one-dimensional or two-dimensional array, but could also be extended to handle the multidimensional cellular array.

The SOM neural network is composed of the following four parts:

Cellular array for processing: this is mainly used for receiving the input signals and forming the discrimination function to recognize the input signals.

Mechanism for comparing and choosing: this is used for comparing these discrimination functions and making a decision to choose a processing unit with a bigger functional output.

Local interconnection and interaction: this is used for stimulating both the chosen processing unit and its nearby processing unit.

Self-adapting process: this is used for modifying the parameters of the stimulated processing unit, so that it can increase the output value of the given discrimination function.

The SOM has been successfully used in numerous fields of application such as intrusion detection, image processing, etc. [2]. Designing of classifiers and other pattern recognition systems based on the SOM are some of the most successful areas of application [3]. It simulated biological neurons in the nervous system rely on the excitement, coordination, and suppression, competition for information processing, so the information mapping characteristics are similar with human brain, particularly suited to the pattern recognition and classification. It is a kind of competition learning network, in which the unsupervised self-organization learning is conducted.

There have been several research works on how the SOM can help improve intrusion detection systems. Heywood et al. [4] presented an approach to dynamic intrusion detection using the SOM. They estimate that the hierarchically built unsupervised neural network approach is able to produce encouraging results; Binh Viet presents a machine learning approach that can be used for the anomaly detection problem [5]. The SOM is, according to the authors, a powerful mechanism for modeling the network traffic; Lichodziejewski et al. operate on real-time data without extensive off-line training and with minimal expert knowledge [6]. Specific recommendations are made regarding the representation of time, network parameters, and SOM architecture; Richard et al. have developed a prototype for this framework, and also discussed the issues of combining intelligent agent technology with the self-organizing networks for intrusion detection [7]; Vivek et al. experiment shows if a user's footprint does not match his/her reference footprint based on normal system activities, the system administrator or security officer can be alerted to a possible security breach [8]. At the end of the paper, we will figure out the advantages and disadvantages of self-organizing maps and explain how it is useful for building an intrusion detection system.

The traditional classification using the SOM neural network faces many challenges:

The number of competitive layer neuron in network training must set at first, that is to say, must set the number of clustering.

With no prior knowledge of the case, clustering number of data is uncertain, so clustering result by SOM is not too ideal and may even contain error.

The SOM's structure is to solidify and it cannot flexibly adjust in the training process of network structure.

### 23.2.2 System of Intrusion Detection Based on SOM

We aim to automate the process of detecting intrusive actions as much as possible. In order to develop such a system, we first try to classify the structure into four sections as in Fig. 23.2 feature selection, neural network, cluster analysis, and module of response.

Feature selection: feature selection can be considered as an important asset in building classification models, as some data may hinder the classification process in a complex domain. Moreover, elimination of useless features enhances the accuracy of detection, while speeding up the computation. Thus, feature selection improves the overall performance of the detection. From our experiments done with feature selection, we have observed that feature selection contributed to improving overall accuracy, reduced the number of false positives, and improved the detection of instances with low frequency in the training data.

Neural network: the SOMs represent a very well known and widely used neural network model which employs unsupervised learning. The SOMs learn to classify input features according to how they are grouped in the input space. The SOMs differ from the competitive layers method, because the neighbor neurons in the SOM learn to recognize neighbor sections of the input space. Therefore, the SOMs are trained to learn about the distribution (like in competitive layers) as well as the topology of the input features.

Cluster analysis: cluster analysis or clustering is the task of assigning a set of objects into groups (called clusters), so that the objects in the same cluster are more similar (in some sense or another) to each other than to those in other clusters. A clustering is essentially a set of such clusters, usually containing all objects in the dataset. Additionally, it may specify the relationship of the clusters

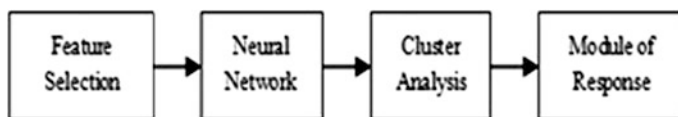


Fig. 23.2 System flowchart

to each other. In this paper, according to output of neural networks, we can judge which is normal or abnormal.

Module of response: module of response can identify and respond to malice activities by monitoring the host system or the Internet. It can also prevent intrusion activities with the linkage of other security technology.

### 23.3 Clustering Algorithm of Dynamic SOM

In order to increase the learning speed and enhance the classification accuracy of SOM network in the practical application. Through the analysis of SOM network learning process, we can know that topology of competitive layer, the neighborhood size, the initial weight, learning rate, and trust degree are the main reasons. This paper is from the two aspects of improvement to the classification performance of the SOM. For simplicity, the proposed method is called dynamic self-organizing map (DSOM).

Assuming that the input mode is for  $n$ -dimensional data, input nodes:  $\{X_1, X_2, \dots, X_n\}$ , among them,  $X_k = (x_{k1}, x_{k2}, \dots, x_{kn})$ ,  $k = 1, 2, \dots, n$ ; output layer is for two-dimensional SOM ( $M = mxm$ ), weight of network between input layer and output layer is for  $w_j = (w_{1j}, w_{2j}, \dots, w_{nj})'$ , the algorithm is described as below:

Step 1: initialize network. Define the input layer structure of the  $N$  nodes and the number of competitive layer neurons  $M$  ( $mxm$ ), initialize the weight of network.  
 Step 2: initialize the SOM's parameter values. For example, the largest neighborhood radius, the least neighborhood radius, learning rate, and etc.  
 Step 3: distance calculation. At this step,  $d_j$  is the distance between input nodes:  $\{x_1, x_2, \dots, x_n\}$  and competitive layer neurons. Formula is as follows:

$$d_j = \|x_i - w_j\| = \sqrt{\sum_{k=1}^n (x_{ki} - w_{kj})^2} \quad (23.1)$$

If  $\|x_i - w_c\| = \min_{1 \leq j \leq p} \|x_i - w_j\| \leq \xi$  then the node of weight for  $W_c$  is optimal matching neurons; else create a new clustering node  $x_i$ ,  $w_{p+1} = x_i$ .

Step 4: learning rate and weight update. The scaling variable depending on how good the fit of the weight vector of the winning neuron is to the last input,  $e(j)$  is defined in Eq. (23.2).

$$e(j) = \frac{\sqrt{\sum_{k=1}^n (x_{ki} - w_{kj})^2}}{p(j)} \quad (23.2)$$

$$p(j) = \max \left( \sqrt{\sum_{k=1}^n (x_{ki} - w_{kj})^2}, p(j-1) \right). \quad (23.3)$$

$e(j)$  is best understood as the normalized Euclidean distance from the input vector to the closest weight vector. If this variable is large, the network fits the input data poorly, and needs a large readjustment. Conversely, if  $e(j)$  is small, the fit is likely to already be satisfactory for that input.

$$h_{ci} = e^{-\frac{d(i,c)^2}{\theta(j)^2}}. \quad (23.4)$$

$h_{ci}$  is referred to as the neighborhood function, and is a scaling function centered on the winning node ( $c$ ) decreasing in all directions from it.  $d(j, c)$  is the Euclidean distance from cell  $i$  to the winning node ( $c$ ).

The weight update is calculated using equation

$$w(j+1) = w(j) + e(j)h_{ci}(j)[x(j) - w(j)]. \quad (23.5)$$

Step 5: calculate trust degree. Working out the output  $O_j$  according to formula (23.6)

$$O_j = f(\arg \min \|X - W_j\|) \quad (23.6)$$

where  $f(\cdot)$  generally is a function with the domain 0–1 or some other nonlinearity function.

Step 6: offering new learning samples to repeat the learning process then to Step 3.

Step 7: if all input mode is completed, then the clustering process ends.

## 23.4 Performance Analysis

### 23.4.1 Experimental Environment

The experiments were done on a 2.2 GHz CUP: E2200 PC with 2 GB main memory. The dataset of intrusion detection was selected from the KDD cup “kddcup.da-ta10.percent” [9]. There are 494,021 records in this dataset, including the normal 97,278, abnormal 396,473 records; there are four types of abnormal dataset: denial of service (Dos), User to root (U2R), Remote to user (R2L), and Probe. In order to evaluate the classification accuracy of the DSOM algorithms, we used the false alarm rate (FAR) and detection rate (DR) which are widely accepted in intrusion detection.

$DR = TP/(TP + FN)$ ,  $FAR = FP/(TN + FP)$  where  $TP$  is the number of true positives;  $TN$  is the number of true negatives; and  $FN$  is the number of false negatives. The most effective approach should reduce as much as possible  $FAR$  and at the same time increase  $FR$ .

Network intrusion detection based on DSOM is as shown in Fig. 23.3.

Normalize

The experimental dataset is divided into training dataset and testing dataset as the different original data have different representation scale. In order to solve this problem, data standardization is transformed into a standardized space. Standardization of the methods is as follows: Calculate mean absolute deviation  $s_f$

$$m_f = \frac{1}{n} \sum_{i=1}^n x_{if}$$

$$s_f = \frac{1}{n} \sum_{i=1}^n (x_{if} - m_f) \tag{23.7}$$

Among them,  $m_f$  is mean of  $f$ , then calculate standardized measure, or Z-score

$$z_{if} = \frac{x_{if} - m_f}{s_f} \tag{23.8}$$

Initialize: Because of 41 dimensions and five types of data in the dataset of “kddcup.data10.percent”, the input layer has 38 nodes (except nondata). Competitive layer node represents potential categories of input data. The number of competitive layer node is much more than the actual categories; in this paper, we select 36 nodes in the competitive, and these nodes are arranged in a matrix of  $6 \times 6$ . Table 23.1 is extracted from dataset; there are training dataset and testing dataset including five categories of dataset.

Calculation of winning node: competitive layer node which is closest to input node is as the winning node.

Weight adjustment: in this paper, the largest neighborhood radius is 2; the least neighborhood radius is 0.6; the largest learning rate is 0.1; the least learning rate is 0.01. The number of adjustment is 20,000 epochs.



Fig. 23.3 Algorithm flow



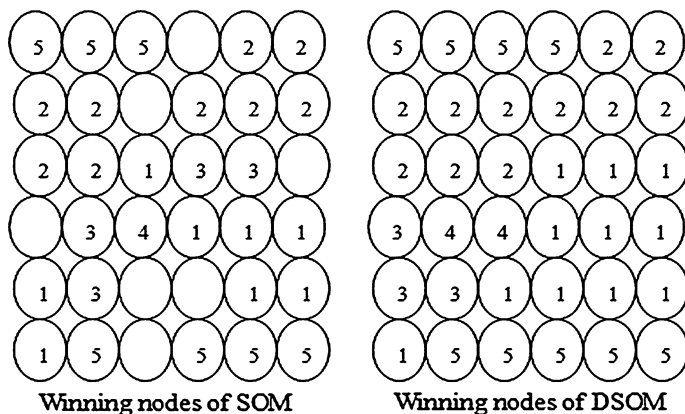
**Table 23.1** Training and testing data

Category	Attack name	Training data (10%)	Testing data
Normal	Normal	9,728	4,834
DOS	Back	2,203	1,102
	Smurf	2,808	1,408
	Teardrop	979	490
	Neptune	1,072	536
R2L	Guess_passwd	53	27
	Warezclient	1,020	510
U2R	Rootkit	10	10
	Buffer verflow	30	30
Probe	Ipsweep	1,247	629
	Nmap	231	116
	Portssweep	1,040	520
	Satan	1,589	785

### 23.4.2 Performance Evaluation

There are 22,010 records in Table 23.1, in training data including the normal 9,728, abnormal 12,282 records; there are four types of abnormal dataset: DOS (6062), U2R (40), R2L (1073), and Probe (4017). To evaluate the classification accuracy of the DSOM algorithm, we compare DSOM with the original SOM algorithm which is widely accepted in the machine learning field for detection rates. Comparison results of attack and category specific detection rates are shown in Fig. 23.4, Tables 23.2, and 23.3, respectively.

Figure 23.4 shows the overall comparison of clustering results between two algorithms for intrusion detection in training dataset. There are seven blank nodes which do not belong to any categories in the winning nodes of SOM; however, in



**Fig. 23.4** Distribution of winning nodes

**Table 23.2** Number of winning node

Category	SOM node number	DSOM node number
Normal(1)	15, 22–24, 29–31	16–18, 22–24, 27–30
DOS(2)	5–9, 10–14	5–15
R2L(3)	16–17, 20, 26	19, 25–26
U2R(4)	21	21–22
Probe(5)	1–3, 33–36	1–5, 32–36

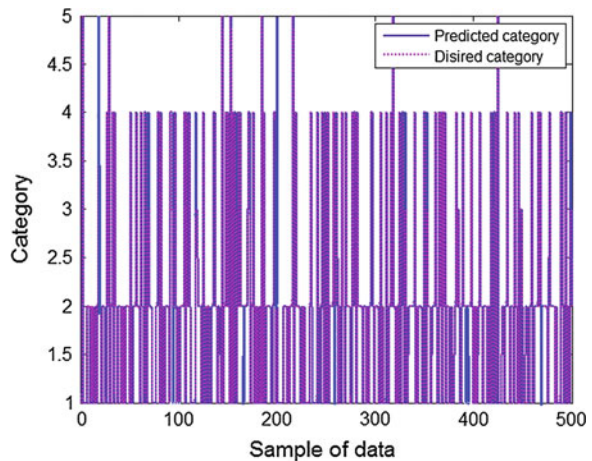
**Table 23.3** Comparison of DR

Category	DR (%)	
	SOM	DSOM
Normal	91.7	92.5
DOS	90.4	90.1
R2L	20.5	42.1
U2R	30.4	58.2
Probe	81.9	85.6

DSOM there is no blank node. From the distribution of winning nodes, different types mostly distribute different blocks; algorithm of DSOM achieves better results than the SOM in intrusion detection. Table 23.2 is the specific number of the winning node statistics.

From Table 23.3, we conclude that either the DSOM or the SOM can detect attack types in the training dataset. Meanwhile, the DSOM has shown better results than the SOM for Normal, R2L, U2R, and Probe attacks. However, characteristics of R2L and U2L are as similar as normal packet, and are disguised as a legitimate user; therefore it is very different to identity normal dataset from R2L and U2R dataset.

**Fig. 23.5** Result of classification



To test the accuracy of DSOM, we also collected 500 classified data from the KDD cup “kddcup.data10.percent”, then into the trained network by DSOM. Result of classification is shown in Fig. 23.5.

From Fig. 23.5, we can conclude that most of the test dataset which predict category is the same as the desired category. From the test results of a total of 500 sets of data, 460 sets are correct; the correct rate is 92 %. From another side, to illustrate the DSOM can get better detection rate to the intrusion detection.

## 23.5 Conclusions

In this paper, we described how we can use the SOM for building IDS. We also presented, implemented, and evaluated the DSOM neural network. The validities and feasibilities of the DSOM are confirmed through experiments on KDD Cup 99 dataset. The experiment result shows that the detection rate has been increased by employing the DSOM.

Our actual experiments show that even a simple map will detect anomalous features of both buffer overflow intrusions to which we exposed it. Since the learning process of the DSOM has to be defined by many parameters, the selection of the parameters is a complex task. A part of our future research will focus on the test of different parameter values.

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**Part III**  
**Intelligent Evolutionary Algorithm**

# Chapter 24

## An Improved Particle Swarm Optimization Algorithm for QoS Anycast Routing

Yanyun Zhou, Zhenhong Jia, Xizhong Qin, Xiaoyan Xia  
and Lei Deng

**Abstract** To solve anycast routing problem with multiple QoS constraints, an improved particle swarm optimization (PSO) algorithm for multiple QoS anycast routing is presented. The algorithm adopts inertial weight and shrinkage factor to be effectively control the flight speed of the particles to ensure the convergence of particle swarm; uses a special addition operator to make the worse path learning from the better path in order to approach to global optimal path; and designs a optimal location of mutation operator to guarantee the diversity of the particle and make sure that algorithm can jump local optimal quickly. The experimental results illustrate that the algorithm improves the convergence speed and jump out of local optimal ability.

**Keywords** QoS · Particle swarm optimization algorithm · Pecial addition operator · Llobal optimum location of mutation operator

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## 24.1 Introduction

Along with the continuous expansion of Internet communications business, networks are increasingly congested, the tradition of the best data transmission service has failed to meet the normal operation of the network, how it will meet the user's quality of service (QoS) requirements, at the same time improving the throughput of the network system and avoiding congestion, become a hotspot of modern communication network routing algorithm. The key to QoS anycast routing problem is to find a business index constraint of QoS routing, and thus required to meet application requirements, such as bandwidth, delay, delay jitter and packet loss rate, and so on.

The multiple constrained anycast routing problems is known to be NP-complete [1]. To reduce computational complexity, many heuristic methods for multicast or anycast routing problem are presented [2, 3]. But these algorithms are too complex and cannot obtain best global solution [4, 5].

In recent years, PSO in continuous problem has been more satisfied with the results, but rarely used in discrete problems, NP-complete problem. In this paper, design and implementation of an effective QoS anycast routing algorithm based on improved PSO to meet business QoS constraints [6, 7].

## 24.2 Theoretical Basis

### 24.2.1 *The Improved Particle Swarm Optimization Algorithm*

PSO algorithm is a global optimization technology based on the swarm intelligence. Inertial weight and shrinkage factors are introduced in the velocity evolution equation in this algorithm [8].

Inertial weight is introduced in velocity evolution equation in order to improve convergence performance of basic PSO algorithm, namely:

$$v_{id}(t+1) = \omega v_{id}(t) + c_1 r_1 (p_{ibest}(t) - x_{id}(t)) + c_2 r_2 (p_{gbest}(t) - x_{id}(t)). \quad (24.1)$$

The inertial weight  $\omega$  describes the self-adapting inertial particle generation to the influence of the contemporary velocity and control the size values can be adjusted PSO algorithm of the global and local optimization ability. If  $\omega$  is carried out with the iterative algorithm decreases linearly, will significantly improve the algorithm convergence performance. The self-adapting inertial meets the following formula [9]:

$$w = w_{\max} - \frac{w_{\max} - w_{\min}}{q_{\max}} \times q \quad (24.2)$$

where  $w_{\max}$  is the maximum weight,  $w_{\min}$  is minimum weight,  $q_{\max}$  is the maximum iterating time, and  $q$  is current iteration times.

Shrinkage factor  $\chi$  can effectively control and restrict the flight velocity of particles. At the same time, it improves the local search capability of the algorithm. The evolution equation of the improved particle swarm algorithm is described as:

$$v_{id}(t+1) = \chi(wv_{id}(t) + c_1r_1(p_{ibest}(t) - x_{id}(t)) + c_2r_2(p_{gbest}(t) - x_{id}(t))) \quad (24.3)$$

$$x_{id}(t+1) = x_{id}(t) + v_{id}(t+1) \quad (24.4)$$

$$\chi = \frac{2}{\left|2 - \mu - \sqrt{\mu^2 - 4\mu}\right|}, \dots \mu = c_1 + c_2, \mu > 4. \quad (24.5)$$

### 24.2.2 Special Addition Operator

Set the current worse path as a Route, it will be closer to the better path is OptRoute, the operator of the design ideas is: first of all, according to the size of the impact factor  $r_1, r_2$ , randomly select a route on the OptRoute fragments, its length is controlled by  $r_1, r_2$ , set the fragment to SubOptRoute. Second, establishment of the left (or right) node of the neighbor node is set, and then find the same node in Route to convergence, if do not have the same node, inserted into the optimal path. Finally delete duplicate nodes in the path.

Through the addition of a special operation, the poor can learn from the better path. That achieves close to the action.

### 24.2.3 The Global Optimum Location of Mutation Operator

The global optimum location of mutation operator is inspired from the mutation operator of genetic algorithms. It makes the algorithm found the global optimal  $g_{best}$  and accorded to a certain probability variation. Mutation probability of randomness, a large mutation probability will change the structure of the particle swarm; a small mutation probability will not achieve the variation. With the continuous evolution of the particle swarm, the global optimum constantly improved variation of the number should continue to reduce, so the mutation rate should be declining with the number of iterations, the mutation probability  $P_m$  is

calculated as follows, where  $q$  is the number of iterations of the particle swarm; controlling factor is  $\alpha$ ,  $0 < \alpha < 1$ .

$$P_m = \frac{1}{1 + q^\alpha}. \quad (24.6)$$

Formula (24.6) gives the mutation condition of  $g_{\text{best}}$ , when the algorithm converges but did not get the global optimal solution; the  $g_{\text{best}}$  carried the mutation operation. Specific practices to  $g_{\text{best}}$  increased random perturbations. Let  $\eta$  is a random variable subject to the standard normal distribution, namely  $\eta$  between 0 and 1, as follows:

$$g_{\text{best}} = g_{\text{best}}(1 + 0.5 \times \eta). \quad (24.7)$$

### 24.3 QoS Anycast Routing Network Model

A network can be described by a weighted directed graph as  $G = (V, E)$ , in this model,  $V$  denotes the set of nodes while  $E$  is the set of links. For each link  $e(u, v) \in E$  and some QoS metrics related,  $s$  with  $G(S) = \{s_1, s_2, \dots, s_p\}$  represents a set of request routing services to the source node, and  $G(S) \in V$ ,  $p < n$ ;  $G(T) = \{t_1, t_2, \dots, t_q\}$  represents a set of services provided by the destination node to source node, and  $G(A) \in V$ ,  $q < n$ .

Based on the above network model, QoS routing with multiple constraints problem can be described as follows: given network  $G = (V, E)$ , the source node  $s$ , destination node  $t$  and five constrains  $Pb$ ,  $Pd$ ,  $Pdj$ ,  $Ppl$ , and  $Cost$ , all the constraints parameters are nonnegative real numbers. For a selected routing path, it must meet requirements as follows:

- (1) Delay constraint:  $Delay(p) \leq Pb$
- (2) Delay-jitter constraint:  $Delay\_Jitter(p) \leq Pdj$
- (3) Bandwidth constraints:  $Bandwidth(p) \geq Pd$
- (4) Packet-loss constraints:  $Packet\ loss(p) \leq Ppl$
- (5) Cost constraint:  $cost(p)$  is minimized among all paths that meet the above conditions.

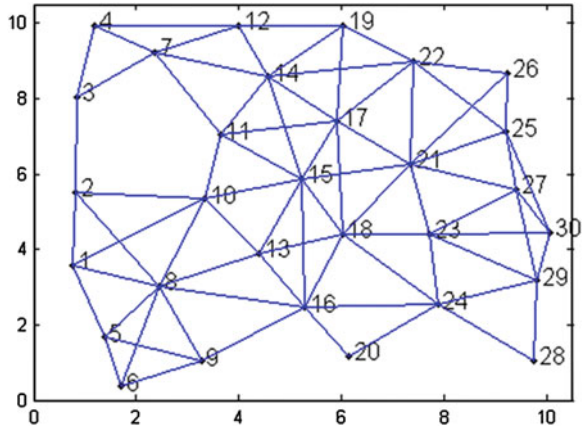
### 24.4 Description and Realization of the Algorithm

#### 24.4.1 Encoding and Initialization

In order to overcome the negative effects of real coded, this algorithm uses the node sequence encoding scheme. The initial particle can be generated by random depth-first search of graph algorithms directly, that is, random to find  $k$  from the



**Fig. 24.1** A network topology diagram



source node to the path of the anycast group node as the initial population. As shown in Fig. 24.1.

### 24.4.2 The Fitness Function

The fitness function is the use of each individual in the population to adapt to the value of screening; it is designed to directly affect the performance of the algorithm. The fitness function is designed to:

$$\begin{aligned}
 \text{Fitness} = & \alpha \times \text{Cost} + \beta \times |\text{Delay} - \text{QoSD}| + \gamma \times |\text{Delay\_Jitter} - \text{QoSDJ}| \\
 & + \varepsilon \times |\text{packloss} - \text{QoSPI}|.
 \end{aligned}
 \tag{24.8}$$

When in the following conditions:  $\text{Delay} \geq \text{QoSD}$ ,  $\text{DelayJitter} \geq \text{QoSDJ}$ ,  $\text{PacketLoss} \geq \text{QoSPL}$ , fitness functions will be minimum and provided end-to-end quality of service guarantees to the user when it meets QoS requirements. But if these conditions are not met, the fitness function corresponding to 0. Coefficient  $\alpha, \beta, \gamma, \varepsilon$  selected reasonable, making the child on target weights are in the same order of magnitude.

### 24.4.3 Steps of the Proposed Algorithm

The proposed algorithm (IPSO-AR) is presented as following:

Step 1: code and initialize the PSO parameters, which are adopted depth-first search method of randomly generated particle. Pretreatment on bandwidth, delete path which is not met criteria.

Step 2: update the speed and position according to the Eqs. (24.3) to (24.4) and calculate the fitness value of each particle according to the Eq. (24.8).

Step 3: according to the fitness value judgment, particles through the special addition operation to its optimal location close to optimal location history and global history.

Step 4: calculate the mutation probability  $P_m$  by the formula (24.6), meet the conditions of  $g_{\text{best}}$  is updated according to the formula (24.7), the output corresponding to the optimal particle path. Otherwise, repeat the process from Step 2.

## 24.5 The Simulation Results and Analysis

Table 24.1 shows the run time comparison results of finding an optimal path between PDO-PSO [10] and our algorithm (IPSO-AR) in the way of anycast communication. IPSO-AR introduced  $\omega$  and  $\chi$ , they can control and restrain the particle velocity while enhancing the local search algorithm, so that it reduces run time. As shown in Table 24.1, the iteration when 40, running time not much improved, but when iterative 80 or 100 times, and have a noticeable increase in run time.

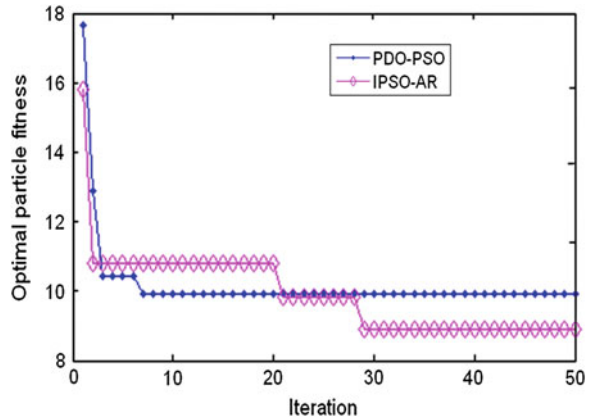
Particle swarm optimization of initial population of randomness, so every time the result will have slightly different. The average relative error of every method is the average of the program running 10 times separately. Figure 24.2 is a comparison of optimal particle for fitness value; Fig. 24.3 is a comparison of average fitness value. Set iteration times for 50 times, the number of particles for 20, is shown as:

From Figs. 24.2 and 24.3, we can see that IPSO-AR can overcome the disadvantage of PDO-PSO to jump out of the local optimum. Mutation causes a certain probability variation, so as to maintain the diversity of the particle swarm, to improve the performance of search and prevent IPSO-AR into a local optimum. So we can know that IPSO-AR has better performance than PDO-PSO.

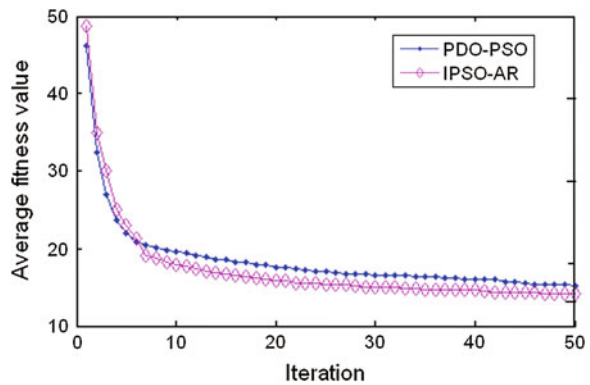
**Table 24.1** The run time comparison among PDO-PSO and IPSO-AR

Iterations	PDO-PSO time (s)	IPSO-AR time (s)
40	7.786	5.635
80	16.093	8.327
100	20.356	12.586

**Fig. 24.2** Comparison of best fitness value



**Fig. 24.3** Comparison of average fitness value



## 24.6 Summary

The paper proposes an improved particle swarm optimization to solve the QoS multicast routing problem. IPSO-AR is applied some methods such as the inertial weight and shrinkage factor during the run time, and used a special addition operator and global optimum location of mutation operator to maintain particle's diversity. The experimental results show that IPSO—AR has a better ability to escape from a local optimum and balance global and local search effectively, and its convergence speed is faster than PDO—PSO. The results illustrate that IPSOAR is feasible and effective.

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# Chapter 25

## Asymptotic Distribution of Makespan in Permutation Flowshops

Gengcheng Liu, Shiji Song and Cheng Wu

**Abstract** In this paper, for permutation flowshops with two machines or more than two machines, as the number of jobs tends to infinity, the properties of asymptotic distribution of makespan are proposed. We introduce several conclusions in queuing theory to the scheduling problem, and convert the distribution of makespan to the distribution of waiting time in the queue. In two-machine conditions, the asymptotic distribution of makespan is proved to be the right half of a normal distribution. In  $m$ -machine conditions ( $m > 2$ ), the asymptotic distribution of waiting time is proved under certain assumptions, and the bounds of probability distribution functions of waiting times are given.

**Keywords** Scheduling · Flowshop · Makespan · Asymptotic distribution

### 25.1 Introduction

Flowshop scheduling problem (FSP) is a widely studied sort of production scheduling problems, and it has application in various industrial manufacturing systems [1]. Assume that the set of machines is  $M = \{M_1, M_2, \dots, M_m\}$ , and the set of jobs is  $J = \{J_1, J_2, \dots, J_n\}$ . Each job has to go through all machines in the same order  $M_1, M_2, \dots, M_m$ , the processing time of  $J_j$  at  $M_i$  being  $p_{ij}$  ( $p_{ij} \geq 0$ ), and no operation should be started before its former operation is completed; that is, the model of an  $n * m$  FSP. If we require the schedules of jobs at all machines to be the

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same, this specified FSP is called “permutation FSP” (PFSP). In most studies and our work as well, FSP is restricted to PFSP [2].

The largest completion time, *i.e.* the “makespan”, is the most common criterion for FSP, which means the completion time of the last job at the last machine [3–5]. Denote makespan as  $C_{\max}$  and the completion time of the  $j$ th job at the  $i$ th machine as  $C_{ij}$  (assume that the job sequence is  $J_1, J_2, \dots, J_n$ ), so we have  $C_{\max} = C_{mn}$ . The following recurrence formula is easy to be concluded:  $C_{ij} = \max\{C_{i-1,j}, C_{i,j-1}\} + p_{ij}$ .

A considerable difficulty in FSP studies is the distribution of makespan in solution space. As we all know, an  $n$ -job permutation flowshop has  $n!$  different scheduling solutions; however, different solutions may share one makespan value. If we list all possible values of makespan and statistics of their frequencies of occurrence, we will get makespan distribution in the whole solution space of an FSP. This distribution will help us to evaluate the quality of a schedule, so the research on makespan distribution is practically meaningful.

The earliest research result on FSP makespan distribution was put out by Heller [6]. For permutation flowshops, he claimed that makespan tends to normal distribution as  $n$  tends to infinity, and he used the Markov Chain model to give a theoretical proof. Heller’s proof seemed to be strictly correct, till Jin et al. [8] found out its mistake. Heller applied a proposition about a property of Markov Chain by K. L. Chung in his proof, but unfortunately, a necessary condition of the proposition is not satisfied in this problem; thus, Heller’s conclusion would not hold any more. In addition, Jin et al. constructed a counter-example of “structured FSP” and claimed that makespan distribution may have more than one peak in the structured FSP, which forms a contradictory to normal distribution.

Up to now, theoretical studies on FSP’s makespan distribution are mainly concentrated in simple and special models, *e.g.* two-machine problems, or problems with processing times obeying certain distributions. Baptiste and Jacquemard studied a specific model of two-machine FSP, whose processing times are all 0–1 variables, and they proposed several conclusions about makespan distribution for this simplified model, but their work can hardly be promoted or applied in more generalized cases. From the view of probability, Ramudhin et al. studied the mathematical expectations of makespans of Johnson’s optimal schedule and random schedule in two-machine FSP, in condition that all processing times are independent and obey the same uniform distribution.

However, even fewer results have been achieved for complex multimachine problems. Former conjectures of makespan’s asymptotic distribution are often related to normal distribution, concerning about the necessary conditions for normal distribution to be held. By means of simulation experiment or extreme analysis, some literatures support the normal distribution [10, 11], but others doubt about it [10, 11]. Unlike those previous works, we aim to investigate the problem from a new mathematical point of view, not restricted to normal distribution conjectures.

In our work, for permutation flowshops, we will establish queuing system models to analyze the asymptotic probability distribution of makespan. The rest of the chapter is organized as follows. In Sect. 25.2, the asymptotic distribution of makespan for two-machine problems is proved. In Sect. 25.3, the properties of makespan distribution for  $m$ -machine problems ( $m > 2$ ) are investigated. Finally, Sect. 25.4 is the conclusions.

### 25.2 Flowshops with Two Machines

The online version of the volume will be available in LNCS online. Members of institutes subscribing to the Lecture Notes in Computer Science series have access to all the pdfs of all the online publications. Nonsubscribers can only read as far as the abstracts. If they try to go beyond this point, they are automatically asked, whether they would like to order the pdf, and are given instructions as to how to do so.

For a two-machine FSP, we select a random schedule (without loss of generality, we denote the job series as  $1, 2, \dots, n$ ). From the Gantt chart below (see Fig. 25.1.), we can easily get the following equation of makespan:

$$C_{\max} = \sum_{j=1}^n p_{1j} + W_{2n} + p_{2n}. \tag{25.1}$$

Within the Eq. (25.1),  $\sum_{j=1}^n p_{1j}$  is the total processing time at the first machine, which is independent to the scheduling of jobs and is a constant value.  $W_{2n}$  Refers to the last job’s waiting time to be processed at the second machine after it is completed at the first machine, and obviously  $W_{2n} \geq 0$ .  $p_{2n}$  Is the last job’s processing time at the second machine, which depends on the scheduling of jobs?

Thus, the problem of makespan’s distribution can be converted to the distributions of variables in the equation’s right side. Assume that all the processing times are generated independently from the same uniform distribution:  $p_{ij} \sim U[l, u]$  ( $i = 1, 2, j = 1, 2, \dots, n$ ), so the expectation of  $p_{ij}$  is  $\mu = \frac{l+u}{2}$ , and its variance is  $\sigma^2 = \frac{(u-l)^2}{12}$ .

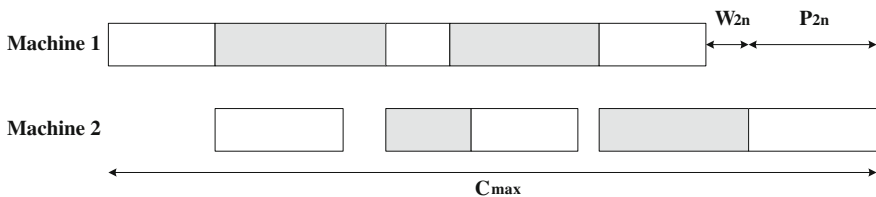


Fig. 25.1 Makespan of a two-machine flowshop

Now the asymptotic distribution of  $W_{2n}$  is considered. Regard the second machine as a server,  $p_{1,j+1}$  ( $j = 1, 2, \dots, n - 1$ ) being the interval of each job's arrival time to the server,  $p_{2j}$  being each job's service time; thus, a two-machine FSP is equivalent to a single-server queuing system, and  $W_{2n}$  is the waiting time of the last job (*i.e.* the last client in the queue). In condition that all  $p_{ij}$  are independent and obey the same distribution, the queuing system meets the GI/G/1 model [7]. Because the expectation of arrival time interval  $E[p_{1,j+1}]$  is equal to the expectation of service time  $E[p_{2j}]$ , the rate of the GI/G/1 system is  $\rho = \frac{E[p_{2j}]}{E[p_{1,j+1}]} = 1$ , which represents that the queue is balanced. In this particular case, we have the following asymptotic property in queuing theory [7]:

$$\lim_{n \rightarrow \infty} P \left\{ \frac{W_{2n}}{s\sqrt{n}} \leq x \right\} = \begin{cases} \sqrt{\frac{2}{\pi}} \int_0^x e^{-\frac{y^2}{2}} dy, & x \geq 0; \\ 0, & x < 0. \end{cases} \tag{25.2}$$

where  $s^2$  is the variance of  $p_{2j} - p_{1,j+1}$ , so  $s^2 = \frac{(u-1)^2}{6} = 2\sigma^2$ . Denote  $\frac{Z}{s\sqrt{n}}$  to be a standard normal variable, so  $Z \sim N(0, ns^2)$ . It can be seen from (25.2) that  $W_{2n}$  obeys the same distribution as  $|Z|$ .

As  $n \rightarrow \infty$ , let  $f_2(t)$  be the probability density function of  $W_{2n}$ ; then, we have

$$f_2(t) = \begin{cases} \frac{1}{\sqrt{\pi n} \sigma} e^{-\frac{t^2}{4n\sigma^2}}, & t \geq 0; \\ 0, & t < 0. \end{cases}$$

Let  $f(t)$  be the probability density function of  $C_{\max}$ . Since  $C_{\max} = \sum_{j=1}^n p_{1j} + p_{2n} + W_{2n}$  and  $p_{2n} \ll W_{2n}$ , *a.s.*, it holds that  $f(t) = f_2(t - \sum_{j=1}^n p_{1j})$ . So makespan's asymptotic distribution is the right half of a normal distribution  $N(\sum_{j=1}^n p_{1j}, ns^2)$ .

Now, we have the following proposition:

**Proposition 1** *For flowshops with two machines, as  $n \rightarrow \infty$ , makespan has an asymptotic distribution, whose probability density function is  $f(t)$ .*

### 25.3 Flowshops with More than Two Machines

When  $m > 2$ , similarly to (25.1), the equation of makespan is as follows:



$$C_{\max} = \sum_{j=1}^n p_{1j} + \sum_{i=2}^m W_{in} + \sum_{i=2}^m p_{in} \tag{25.3}$$

where  $W_{in}$  refers to the last job's waiting time at the  $i$ th machine. Thus, the key point of the asymptotic distribution of makespan is to study the distribution of  $W_{in}$  ( $i > 2$ .)

There exists a single-server queuing system at each machine  $i$  ( $i > 2$ ), where the  $j$ th job's service time is  $p_{ij}$ , and the corresponding arrival time interval is  $C_{i-1,j+1} - C_{i-1,j}$  instead of  $p_{i-1,j+1}$ , so the arrival time intervals are no longer independent or of the same distribution, and the GI/G/1 model cannot be directly adopted here. Denote a series  $\{V_{ij}\}$ ,  $j = 1, 2, \dots, n$  where  $V_{ij} = p_{ij} - (C_{i-1,j+1} - C_{i-1,j})$ . Let  $W_{ij}$  be the waiting time of the  $j$ th job, and in queuing theory there exists a recurrence formula [7]:  $W_{ij} = \max\{W_{i,j-1} + V_{i,j-1}, 0\}$ . To investigate the asymptotic distribution of  $W_{in}$ , we propose the following lemma first:

**Lemma 1** *The expectation of service time is smaller than that of arrival time interval, i.e.  $E[V_{ij}] < 0$  ( $i > 2$ ).*

*Proof* Note that

$$\begin{aligned} C_{i-1,j+1} - C_{i-1,j} &= \max\{C_{i-2,j+1}, C_{i-1,j}\} + p_{i-1,j+1} - C_{i-1,j} \\ &= \max\{C_{i-2,j+1} - C_{i-1,j}, 0\} + p_{i-1,j+1} \geq p_{i-1,j+1}, \end{aligned}$$

We have

$$E[C_{i-1,j+1} - C_{i-1,j}] > E[p_{i-1,j+1}] = E[p_{ij}].$$

The inequality above means the expectation of arrival time interval is larger than that of service time. So  $E[V_{ij}] = E[p_{ij} - (C_{i-1,j+1} - C_{i-1,j})] < 0$ , Q.E.D.

Lemma 1 confirms that the queuing system at the  $i$ th ( $i > 2$ ) machine is in light traffic, with the rate  $\rho = \frac{E(p_{ij})}{E(C_{i-1,j+1} - C_{i-1,j})} = \frac{E(p_{ij})}{E(p_{ij}) - E(V_{ij})} < 1$ .

### 25.3.1 Conclusions for Three-Machine Case

To discuss the waiting time distribution of flowshops with more than two machines further, we consider three-machine problems for instance first. In this case, the following lemma holds.

**Lemma 2** *As  $n \rightarrow \infty$ , we have  $E[V_{3n}] \rightarrow -\frac{\sigma}{\sqrt{\pi n}}$ .*

*Proof* Note that

$$V_{3j} = p_{3j} - (C_{2,j+1} - C_{2j}),$$

combined with the following two equations:

$$C_{2,j+1} = \sum_{k=1}^{j+1} p_{1k} + W_{2,j+1} + p_{2,j+1},$$

$$C_{2j} = \sum_{k=1}^j p_{1k} + W_{2j} + p_{2j}.$$

We can conclude that  $V_{3j} = \sum_{l=2}^3 p_{lj} - \sum_{l=1}^2 p_{l,j+1} - (W_{2,j+1} - W_{2j})$ . Calculate the expectation in both sides, and we have

$$E[V_{3j}] = E[W_{2j}] - E[W_{2,j+1}].$$

According to the conclusions in Sect. 25.2, as  $n \rightarrow \infty$ ,  $E[W_{2n}] \rightarrow 2\sigma\sqrt{n/\pi}$ , so  $E[V_{3n}] = E[W_{2n}] - E[W_{2,n+1}] \rightarrow \frac{2\sigma}{\sqrt{\pi}}(\sqrt{n} - \sqrt{n+1}) \rightarrow -\frac{\sigma}{\sqrt{\pi n}}$ , Q.E.D.

Lemma 2 indicates that when  $n \rightarrow \infty$ ,  $E[V_{3n}] \uparrow 0$ , so the rate of the queuing system  $\rho \uparrow 1$ . Based on Lemma 1 and Lemma 2, the light traffic system at the third machine can be regarded as an approximately balanced queue. Note that  $C_{1,j+1} =$

$\sum_{l=1}^j p_{1l} + p_{1,j+1}$  and  $C_{2j} = \sum_{l=1}^j p_{1l} + W_{2j} + p_{2j}$ , so we have:  $C_{2,j+1} - C_{2j} = p_{2,j+1} + \max(0, C_{1,j+1} - C_{2j}) = p_{2,j+1} + \max(0, p_{1,j+1} - p_{2j} - W_{2j})$ . From Sect. 25.2 we know  $W_{2j} \rightarrow \infty$  ( $j \rightarrow \infty$ ), so  $\max(0, p_{1,j+1} - p_{2j} - W_{2j}) \rightarrow 0$ , i.e.  $C_{2,j+1} - C_{2j} \rightarrow p_{2,j+1}$ . Based on this conclusion, we can say that the arrival time intervals are independent and of the same distribution approximately, and conclusions for GI/G/1 systems may be applied here; thus, the following proposition holds:

**Proposition 2** *Assume that the arrival time intervals are independent and of the same distribution, as  $n \rightarrow \infty$ , the asymptotic distribution of  $W_{3n}$  exists, and its distribution function is  $\lim_{\rho \uparrow 1} P\{W_{3n} \leq x\} = 1 - e^{-\frac{x}{\sqrt{\pi m \sigma}}}$ ,  $x \geq 0$ .*

*Proof* In GI/G/1 systems, we have the following conclusion [9]:

$$\lim_{\rho \uparrow 1} P\{W_{3n} \leq x\} = 1 - e^{-\gamma x}, \quad x \geq 0,$$

where

$$\begin{aligned} \gamma &\equiv \frac{2E[-V_{3n}]}{E[V_{3n}^2]} = \frac{2E[-V_{3n}]}{(E[V_{3n}])^2 + D[V_{3n}]} \approx \frac{-2E[V_{3n}]}{D[V_{3n}]} \\ &= \frac{-2E[V_{3n}]}{D[p_{3n} - (C_{2,n+1} - C_{2n})]} \approx \frac{-E[V_{3n}]}{D[p_{3n}]} \approx \frac{\sigma/\sqrt{\pi n}}{\sigma^2} \\ &= \frac{1}{\sqrt{\pi n \sigma}}, \end{aligned}$$

So  $\lim_{\rho \uparrow 1} P\{W_{3n} \leq x\} = 1 - e^{-\frac{x}{\sqrt{\pi n \sigma}}}$ ,  $x \geq 0$ , Q.E.D.

### 25.3.2 Conclusions for General Cases

Now let us go back to the general case when the number of machines is more than two. Based on Lemma 1, we have the following proposition on the upper and lower bounds of  $W_{ij}$  ( $i > 2$ ) distribution.

**Proposition 3** *When  $i > 2$ , the probability distribution of  $W_{ij}$  satisfies:*

$$0 < P\{W_{ij} > x\} \leq e^{-\theta_i(j)x} (x \geq 0),$$

where  $\theta_i(j)$  satisfies the following conditions::

1.  $0 < \theta_i(j) < \frac{-2E[V_{ij}]}{E[V_{ij}^2]}$ .
2.  $\theta_i(j)$  is decreasing as  $j$  increases (for any fixed  $i$ ).

*Proof* For any fixed  $i (i > 2)$ , let  $H_{ij}(y)$  be the probability distribution function of  $V_{ij}$ , and  $\theta > 0$  be a sufficiently small positive value, according to Lemma 1, we have

$$\int_{-\infty}^{\infty} e^{\theta y} dH_{ij}(y) = \int_{-\infty}^{\infty} (1 + \theta y + \frac{1}{2} \theta^2 y^2) dH_{ij}(y) = 1 + \theta E[V_{ij}] + \frac{1}{2} \theta^2 E[V_{ij}^2].$$

To make  $\int_{-\infty}^{\infty} e^{\theta y} dH_{ij}(y) < 1$ , we only need to make  $\theta < \frac{-2E[V_{ij}]}{E[V_{ij}^2]}$ . Let  $\theta_i(j)$  be a series decreasing by  $j$  for any fixed  $i$ , satisfying  $0 < \theta_i(j) < \frac{-2E[V_{ij}]}{E[V_{ij}^2]}$ . Now, we will prove that for any  $j$ ,  $P\{W_{ij} > x\} \leq e^{-\theta_i(j)x}$  ( $x \geq 0$ ), by mathematical induction.

Obviously,  $W_{i1} = 0$ ,

$P\{W_{i1} > x\} = 0 < e^{-\theta_i(1)x}$ , i.e. the conclusion holds for  $j = 1$ . Now assume that  $P\{W_{ij} > x\} \leq e^{-\theta_i(j)x}$ , and we need to conclude  $P\{W_{i,j+1} > x\} \leq e^{-\theta_i(j+1)x}$ . Actually, based on the recurrence formula  $W_{i,j+1} = \max\{W_{ij} + V_{ij}, 0\}$ , we have

$$\begin{aligned}
P\{W_{i,j+1} > x\} &= P\{W_{ij} + V_{ij} > x\} = \int_{-\infty}^{\infty} P\{W_{ij} > x - y\} dH_{ij}(y) \\
&= \int_{-\infty}^x P\{W_{ij} > x - y\} dH_{ij}(y) + \int_x^{\infty} dH_{ij}(y) \\
&\leq \int_{-\infty}^x e^{-\theta_i(j)(x-y)} dH_{ij}(y) + \int_x^{\infty} dH_{ij}(y) \\
&\leq \int_{-\infty}^x e^{-\theta_i(j)(x-y)} dH_{ij}(y) + \int_x^{\infty} e^{-\theta_i(j)(x-y)} dH_{ij}(y) \\
&= e^{-\theta_i(j)x} \int_{-\infty}^{\infty} e^{\theta_i(j)y} dH_{ij}(y) \leq e^{-\theta_i(j)x} \leq e^{-\theta_i(j+1)x}.
\end{aligned}$$

So it is proved that for any  $j$ ,  $P\{W_{ij} > x\} \leq e^{-\theta_i(j)x}$  ( $x \geq 0$ ), Q.E.D.

From Proposition 3, we can see that the probability distribution function  $P\{W_{ij} < x\}$  has both upper and lower bounds. Its upper bound is unit step function, and its lower bound is negative exponential function  $1 - e^{-\theta_i(j)x}$ ,  $x \geq 0$ .

## 25.4 Conclusions

In this chapter, we have made in-depth studies and achieved several new results on makespan distribution of permutation flowshops. Mathematical models of makespan are established based on queuing theory, and different properties of asymptotic distribution of makespan are analyzed for two-machine problems and  $m$ -machine problems ( $m > 2$ ). The main conclusions are three propositions in Sects. 25.2 and 25.3. In two-machine cases, makespan's asymptotic distribution is the right half of a normal distribution. In cases that machines are more than two, the distribution of waiting time on the  $i$ th ( $i > 2$ ) machine has upper and lower bounds.

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# Chapter 26

## Optimized BP Neural Network Model Based on Niche Genetic Algorithm

HaoDong Zhu and HongChan Li

**Abstract** According to the shortcomings of BP neural network model, such as slower convergence speed, entrapment in local optimum, unstable network structure etc., and an improved BP neural network model based on niche genetic algorithm (NGA-BP) was presented. The proposed model first makes full use of the global searching ability of genetic algorithm and the nonlinear reflection ability and the association learning ability of BP neural network to optimize the initial connection weights and thresholds of the neural network by means of selection operation, crossover operation, mutation operation and niche pass, and then adopts BP algorithm to train network, which can effectively solve the problems of BP network about unreasonable initial value and network nonconvergence, and improve the convergence speed and the stability of network. The experimental results show that the model is more feasible and effective than the traditional methods.

**Keywords** BP neural network · Niche genetic algorithms · Nonlinear reflection · Genetic operations

### 26.1 Introduction

Artificial neural network is a self-adoption nonlinear large-scale dynamics system [1], the research of which is the up-to-date research field of modern neuroscience, informatics, and computing science. The back propagation (BP) algorithm is the

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widest adopted in artificial neural network [2]. However, BP has the shortcomings of slower convergence speed, entrapment in local optimum, unstable network structure, and so on. [3]. Although some improved algorithms have overcome some shortcomings of the BP algorithm, they cannot completely solve the shortcomings of BP algorithm in the practical application. Network structure, initial connection weight, and threshold which are hard to accurately obtain indeed have great impact on train network, but the genetic algorithm can optimize the BP neural network. The genetic algorithm is a self-adoption global optimization probability searching method which is based on such evolution mechanism as natural selection and natural genetic through imitating the genetic and evolution process of the biology in the nature [4]. Although the genetic algorithm performs well on macrosearching capability and global optimization, it still has the problems of low local searching ability and premature convergence [5]. Hence, this paper will introduce the niche evolve its population in a specified living environment, which can effectively maintain the population diversity and improve its global optimizing capability and convergence speed.

## 26.2 The Optimized BP Neural Network Model

### 26.2.1 *The Ideas of Optimized Model*

Niche genetic algorithm (NGA) is shaped by combining the genetic algorithm with the “niche” concept, therefore, it can effectively maintain the population diversity, improve the global searching capability, and avoid to entrapment in local optimum. Literatures introduced many niche realization concepts with such a main idea as: First, computing the Euclidean distance between any two individuals, if the distance is less than the given value  $D$ , and then adding a stronger punishment function to the one with lower fitness [6, 7]. It separates the whole searching space into several areas to realize that only one excellent individual exists in each (in distance  $D$ ), which not only maintains the population diversity but also keeps a certain distance between the individuals and disperse them in the whole constraint space [8, 9].

NGA based on the optimized BP neural network (NGA-BP) algorithm model not only shares the learning capability and robustness of the neural network but also possesses strong global random searching capability of the genetic algorithm, which gives the self-evolution and self-adaptability to neural network. Its ideas lies in: First, adopting NGA to optimize the neural network weight and narrow the searching range before evolving the optimized initial weight and threshold. And then, solving the accurate solution by using BP neural network to both realize global optimizing with high effectiveness and avoid entrapment in local optimum [10, 11]. This optimized model, therefore, strengthens the abilities of automatic

acquisition, searching space accumulation and self-adaptable searching process control, which greatly improves the algorithm results.

## 26.2.2 The Parameters Settings of Optimized Model

### 26.2.2.1 Coding Scheme

To learn neural network weight and threshold is a complex consecutive parameter optimization problem; therefore, the adoption of the traditional binary coding system will bring overlenght encoded string and negatively affect the network accuracy. This paper adopts the real number coding and makes each weight and threshold as the gene of NGA in the coding process, which greatly reduced the coding length.

Where,  $W_{ih}$  is the connection weight between the input layer and the hidden layer,  $\theta_i$  is the threshold of hidden layer,  $W_{ho}$  is the connection weight between the hidden layer and the output layer,  $\gamma_o$  is the threshold of the output layer,  $S$ ,  $S_1$  and  $S_2$  are separately the neuron numbers of the input layer, the hidden layer, and the output layer [12].

### 26.2.2.2 Fitness Function Scheme

The smaller the mean square error of neural network, the better performance the network has, thus, we adopt reciprocal of the mean square error as the fitness function with such a conclusion as: the smaller error, the higher fitness degree. Setup the fitness function as follows:

$$f_i = \frac{1}{E(i) + 1} \quad (26.1)$$

where

$$E(i) = \sum_{k=1}^m \sum_{o=1}^q (d_o(k) - y_o(k))^2 \quad (26.2)$$

Adding 1 to the denominator in the formula (26.1) is to avoid  $f_i$  diverge.

### 26.2.2.3 Genetic Operators

According to roulette and optimized individual reserved strategy to obtain selection operator. Due to the real number coding method, we adopt the arithmetic crossover operator in such way as: adopt smaller crossover rate for the individual



of higher fitness degree while adopt larger crossover rate for the one of lower fitness degree. We adopt the uniform mutation process to guarantee that the mutated gene values are within the parameter range.

Selection operator:

$$p_i = \frac{f_i}{\sum_{i=1}^n f_i} \quad (26.3)$$

Crossover operator:

$$p_c = \begin{cases} p_{c1} - \frac{(p_{c1} - p_{c2})(f' - f_i)}{f_{\max} - f_{\text{avg}}}, & f' \geq f_{\text{avg}} \\ p_{c1}, & f' < f_{\text{avg}} \end{cases} \quad (26.4)$$

Mutated operator:

$$p_m = \begin{cases} p_{m1} - \frac{(p_{m1} - p_{m2})(f_{\max} - f')}{f_{\max} - f_{\text{avg}}}, & f' \geq f_{\text{avg}} \\ p_{m1}, & f' < f_{\text{avg}} \end{cases} \quad (26.5)$$

where  $f'$  is higher fitness between two individuals,  $f_{\max}$  is the largest individual fitness in the population,  $f_{\text{avg}}$  is the average fitness in the population, this paper appropriately adjust  $p_{c1}$ ,  $p_{c2}$ ,  $p_{m1}$  and  $p_{m2}$  according to the last searching result.

#### 26.2.2.4 Niching Strategy

Adopting the Euclidean distance to measure the difference between the population individual according to exclusion mechanism of the niche algorithm.

$$\begin{aligned} \|X_i - X_j\| &= \sqrt{\sum_{k=1}^M (x_{ik} - x_{jk})^2}, i = 1, 2, \dots, M + N - 1, j \\ &= i + 1, \dots, M + N \end{aligned} \quad (26.6)$$

When  $\|X_i - X_j\| < D$  establishes, compare the fitness degree between  $X_i$  and  $X_j$ , and add the punishment function to the one of lower fitness degree.

$$F_{\min}(X_i, X_j) = \text{Penalty} \quad (26.7)$$

#### 26.2.3 The Implementation Steps of Optimized Model

Step 1. According to the coding scheme and fitness function Scheme, we randomly generate  $N$  individuals as initial population and calculate fitness degree of each individual, and rank them in a descending order and fetch first  $M$  ones ( $M < N$ ).

Step 2. Computing selection operator, crossover operator, and mutate operator according to the formula (26.3), the formula (26.4), and the formula (26.5).

Step 3. Niche Mechanism. Combining the  $N$  individuals generated in step 2 and the  $M$  individuals generated in step 1 to obtain a new  $M + N$  population. Figuring out the euclidean distance between individual  $X_i$  and  $X_j$ , comparing their fitness degree when the distance is less than  $D$ , and adding a punishment function to the one of lower fitness degree. According to the new adaptabilities of  $M + N$  individuals, ranking them in a descending order and fetch the first  $M$  ones.

Step 4. If the maximum evolution algebra is not gat, then adopting the first  $N$  individuals ranked in step 3 as a new generation population and computing the fitness degree of each individual. Repeat the steps 2 and 3 until they meet the termination condition.

Step 5. Adopting the optimist individual decodes that are generated from NGA as the weight and threshold of BP network.

Step 6. Input the samples, and train the network until it meets the needed accuracy.

## 26.3 Simulation Experiments

### 26.3.1 Experiment Settings

We collect 1,000 classical history data samples of the Transformer Factory in Henan Nanyang and randomly select 200 individuals to train them. We construct a neural network with five inputs, five outputs, and 10 hidden layers, the output variable  $X_i$  ( $i = 1, 2, \dots, 5$ ) which separately represent the percentage of  $H_2$ ,  $CH_4$ ,  $C_2H_6$ ,  $C_2H_4$ , and  $C_2H_2$  in the total gas, and output fault type  $Y_i$  ( $i = 1, 2, \dots, 5$ ) which separately represent normal, low, and medium temperature overheating, high temperature overheating, low energy discharge, and high energy discharge.

The initial weight and threshold of BP neural network are within the range of  $[-1, 1]$ , the maximum training times are 5,000, the transforming function of the hidden layer neuron adopts S-type function tansig, the output layer neuron layer transformation function adopts S-type function logsig, train function traingdx, the performance function MSE, and the target error is 0.01. The population size of genetic algorithm is 15,  $p_{c1} = 0.9$  and  $p_{c2} = 0.6$ ,  $p_{m1} = 0.1$  and  $p_{m2} = 0.001$ , the assigned distance value is  $D = 0.5$ , and the evolution generation number of the genetic algorithm is 500.

### 26.3.2 Simulation Result and Analysis

Adopting the above samples to analyze the BP neural network algorithm, the one based on the optimized genetic algorithm (GA-BP), the one based on the optimized neural genetic algorithm (NGA-BP) to train the error curve showed in Fig. 26.1.

From Fig. 26.1, we can see that NGA-BP has faster convergence speed. In order to accurately illustrate their performance, we figure the average convergence number for each 100 times of network training, and the results of the above three algorithms are showed in Fig. 26.1: NGA-BP network improved its convergence speed by 31 % than that of BP network, 22 % than that of GA-BP; meanwhile, NGA-BP network model enjoys greater convergence stability than that of BP network model with the convergence success rate of 97 % while those of BP network model and GA-BP model are 90 and 93 %. Therefore, NGA-BP algorithm has greatly improved the network convergence speed and stability.

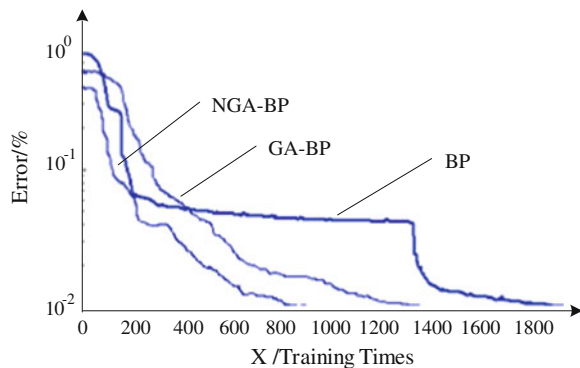
### 26.3.3 Algorithm Reliability and Practicability Evaluation

We randomly select 100 individuals from the 1,000 history faults of the Transformer Factory in Henan Nanyang as the test samples, and then separately test the above three algorithms, the comparable results are listed in Table 26.1.

Separately, analyzing the diagnosis statistic results of the above three algorithms: the fault of the NGA-BP network diagnosis model is accordant with practical condition with only one fault diagnosis example and three uncertain examples with the accuracy rate of 90 %. For the same 100 test sample, BP network model has four fault diagnosis examples and 11 uncertain examples with the accuracy result of merely 85 %; as for the GA-BP network model, it has two fault diagnosis examples and six uncertain examples with the accuracy rate of 92 %, which fully demonstrates that the NGA-BP network model possesses superior adaptability and fault diagnosis accuracy for the electric transformer fault diagnosis system.

From the test results, we can also see that NGA-BP model performs better than BP model and GA-BP network model on convergence speed and stability through adopting NGA optimized network in the simulation experiment of transformer fault diagnosis and comparing the convergence ability of NGA-BP model and the

**Fig. 26.1** Training error converges curve



**Table 26.1** Comparable diagnosis results of algorithms

Algorithms	Average convergence times	Convergence success rate (%)	Accuracy (%)
BP	1,664	90	85
GA-BP	1,458	93	92
NGA-BP	1,132	97	96

other two models, which further testify the superiority of the NGA optimized BP network diagnosis system with good result.

**Reliability:** because the samples are randomly from the real history fault data of the Transformer Factory without any priority selection or typical optimization. Meanwhile, all the three algorithms adopt the same sample; thus, the test enjoys strong reliability with great generality and universality rather than merely superior for the specified data.

**Practicality:** the proposed model adopts the niche to optimize the initial neural network value, which effectively solves the problems of unreasonable initial value and low convergence speed. The algorithm is simple and could be widely adopted in any neural network field, thus has strong practicality.

## 26.4 Conclusions

This paper dynamically integrates the NGA and the BP algorithm, which not only takes full advantage of the nonlinear reflection, prediction, and diagnosis ability of the neural network, but also the global optimization ability of the NGA; thus, the BP network enjoys the intelligences of learning and evolution. The simulation result demonstrates that: compared to the traditional algorithm, the optimized BP neural network in this paper can, to some extent, overcome the shortcomings of unreasonable neural initial value, entrapment in local optimum, nonconvergence or slower convergence speed; meanwhile, it also improves the convergence speed and the stability of network, which shows that the model enjoys strong practicality and effectiveness.

**Acknowledgments** This work is supported by the Foundation and Frontier Technologies Research Plan Projects of Henan Province of China (No. 102300410266 and No. 122300410287) and a grant from the Ph.D. Research Funded Projects of Zhengzhou University of Light Industry (No. 2010BSJJ038). In addition, this work also received guidance from Huang De-Shuang who is a distinguished professor in Henan Province.

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# Chapter 27

## Alphabet Recognition Based on Scaled Conjugate Gradient BP Algorithm

Feiyan Zhou and Xiaofeng Zhu

**Abstract** Artificial neural network is a reflection of brain function to some degree. Neural network has adaptive and self-learning ability and gets features by learning from samples. It can also apply the knowledge which is obtained from learning to the recognition of images, text, and so on. To study alphabet recognition, the Scaled Conjugate gradient BP algorithm is used in this chapter. The simulation results show that, this method can effectively identify the English letters with noise. Compared with the standard BP algorithm, the improved BP algorithm can greatly reduce the training times of the network, and its speed of convergence is much faster.

**Keywords** BP neural network · Conjugate gradient algorithm · Alphabet recognition

### 27.1 Introduction

As an important branch of pattern recognition, character recognition inputs text into the computer for processing and application. Its application is more and more extensive in modern daily life. Alphabet recognition is an important branch of character recognition, which has great practical value in license plate number recognition, ID card number recognition, check number identification, office

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automation, and so on [1]. The use of neural networks for character recognition is one of the most popular identification methods. In recent years, the application of neural network has made remarkable progress, in which pattern recognition is one of the earliest and most extensive areas of neural network application. From the earliest perception to character recognition, and so on all are examples of the application of neural network in pattern recognition. Neural network is a computing model which imitates the work mechanism of the human brain, connects into a network with a large number of simple computational neurons, carries on the parallel computation, and can save a great deal of experience knowledge [2]. Interaction between neurons achieves the information processing of the neural network. Neural work is good at handling the problems of the complex multivariate nonlinear relationship between the input and output elements [3]. The neural network also has very strong capability of knowledge acquisition and classification capability, high fault tolerance and robustness, and can form arbitrarily complex decision regions in feature space. Its self-organizing and self-learning ability greatly relax the constraint conditions which the traditional pattern recognition methods suffered from. These characteristics all contribute to the text pattern recognition [4]. In the neural network, the most core is the BP neural network. BP network is essentially a kind of approximation of any nonlinear mapping. Due to the adoption of the global approximation method, the BP network not only has better generalization ability but also has good fault tolerance, etc., so that the BP network for character recognition processing etc., needs to consider a variety of factors and conditions of the fuzzy information processing. But there is a local minimum, slow convergence speed, and other characteristics in the standard BP algorithm [5]. This article adopts the BP network based on the Scaled Conjugate gradient algorithm to the recognition of the 26 English letters. Experimental simulation results indicate that the convergence is faster and the algorithm can effectively recognize noisy letters.

## 27.2 Improved BP Neural Network

Artificial neural network has become a widely used technology in the field of artificial intelligence. Due to the characteristics of its numerical approximation ability and ability of handling the quantitative and numerical information, artificial neural network has been widely concerned [6]. The BP network is currently the most widely used one of the neural network models. BP neural network is also called the error backpropagation neural network. It is a multilayer forward neural network which uses nonlinear differential function to train weights. A typical BP network includes input layer, hidden layer, and output layer. Each layer of the BP network is made up of one or more neurons. There is no correlation among the neurons in the same layer but forward connections among the neurons in the different layers. In the BP neural network, the propagation of signal is forward, while the error is backward. The so-called backpropagation is that, if the outputs of

the output layer are not expected, then the error signal will return along the original connected path. Network modifies the connection weights of each layer according to the signal of backpropagation, so that the error signal achieves the required accuracy.

The BP neural network usually uses BP algorithm. It has strong nonlinear approximation ability, adaptive and self-learning ability. Standard BP algorithm also has the advantages of feasibility, small amount of calculation and good parallelism, and so on. It is used most and one of the most sophisticated training algorithms currently in neural network training [7]. But when the standard gradient descent algorithm and gradient descent with momentum are applied to the practical problems, there are often the defects with too slow learning rate. Moreover, it is very easy to fall into the partial minimum point. Thus, people put forward many kinds of improved and high-efficient BP algorithms. These fast algorithms mainly may divide into two kinds. One is the heuristic learning algorithm, including gradient descent method of variable learning rate, gradient descent method for momentum and adaptive learning rate, elastic BP training method, and so on. Another is training algorithm based on the most optimization theory, including conjugate gradient algorithm, quasi-Newton method, Levenberg–Marquardt (LM) algorithm, and so on.

In the improved BP training algorithms, this article uses the Scaled Conjugate gradient algorithm of the second kind of fast algorithms. Compared to the standard BP algorithm, this algorithm requires fewer iterations and the convergence is faster. This kind of algorithm adjusts the weights and bias along the conjugate gradient direction and can usually get faster convergence than the standard gradient algorithm. The first step iterative of the conjugate gradient algorithm starts from the steepest descent gradient direction. The gradient vector is

$$p_0 = -g_0 \quad (1.1)$$

Adjust the weights and bias along this direction. The formula is

$$x_{k+1} = x_k + \alpha_k p_k \quad (27.2)$$

Next search direction is determined by the conjugate direction of the two previous search directions. The expression is

$$p_k = -g_k + \beta_k p_{k-1} \quad (27.3)$$

where  $x_k$  represents the current weight and bias.  $x_{k+1}$  is on behalf of the next iteration of weight and bias.  $g_k$  is the gradient of the current error function?  $\alpha_k$  is on behalf of the learning rate. While different calculation methods with coefficient  $\beta_k$  produce different conjugate gradient algorithms for the scaled conjugate gradient algorithm. In order to reduce the amount of computation in the training process, there is no need to calculate the search direction in every step of the iterative process in the Scaled Conjugate gradient algorithm [8].



### 27.3 Analysis of Experimental Results

The applications of character recognition more and more widely used in daily life are vehicle license plate recognition system, handwriting recognition systems, office automation, and so on [9, 10]. Character recognition is a traditional topic in the field of pattern recognition and is still theoretical and practical. This chapter uses the improved BP algorithm to recognize the 26 English letters.

Before conducting the recognition, first carries on the pretreatment to the letters. First digitize the 26 letters which will be recognized with the length and width of  $7 \times 5$  grid. Then the letters that have been processed will be represented by a vector. The corresponding data location is 1, other position is 0. As Table 27.1, it is the digital process of the letter A. It is represented by a  $1 \times 35$  vector.

The corresponding vector of the digital processing result of A is Letter  $A = [00100\ 01010010101000111111000110001]^T$ . Thus get a vector whose each letter is made up of 35 elements. The input vector which is composed of 26 standard letters is defined as an input vector matrix alphabet, namely the sample inputs of the neural network are a  $35 \times 26$  matrix, in which alphabet = [Letter A, Letter B, Letter C, . . . , Letter Z]. The network sample output needs an output vector which distinguishes the 26 input letters. For any input letter, the value of the network output on the letter corresponding to the ordinal position is 1, and the rest is 0, that is the network output matrix is a  $26 \times 26$  unit matrix whose main diagonal is 1. This matrix is defined as targets = eye(26).

In this chapter, two types of such data are used as the network inputs. One kind is ideal standard input signal. The other is the standard signal which adds noise signal in the Matlab toolbox, namely randn function.

Select the number of the network input layer neurons be 35, and the number of the output layer neurons is 26. Due to the output of the function is located in the interval  $[0, 1]$ , the activation function from the input layer to hidden layer is tansig, and the activation function from hidden layer to output layer is logsig. The number of hidden layer neurons is 10, based on experience. This chapter trains the network with the ideal signal and the noise signal, so that the network has certain fault-tolerant ability for input vectors. In the different signal training, all are implemented by BP network, and train with the function trainscg. First train the network with ideal signals. The maximum number of iterations is 5000, and the squared

**Table 27.1** Digital character

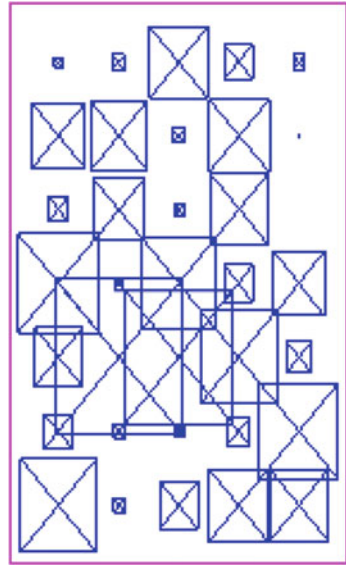
0	0	1	0	0
0	1	0	1	0
0	1	0	1	0
1	0	0	0	1
1	1	1	1	1
1	0	0	0	1
1	0	0	0	1
A				

error is 0.1. The training results are RAINSCG, Epoch 88/5000, SSE 0.0951744/0.1, Gradient 0.110742/1e-006 TRAINSCG, Performance goal met. It can be seen that after 88 times of training, the network error meets the requirements.

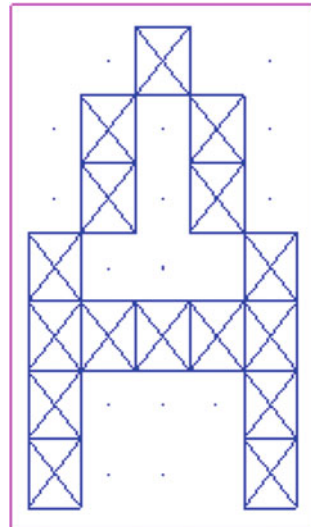
Use the standard BP algorithm to carry on the training with the same samples. Its training results are TRAINGD, Epoch 5000/5000, SSE 26/0.001, Gradient 1.72381e-008/1e-010 TRAINGD, Maximum epoch reached, performance goal was not met. It can be seen from the training results, the network error has not yet met the requirement after the training with the standard BP algorithm reaches the maximum number of iterations. In contrast, the Scaled Conjugate gradient BP algorithm needs fewer iterations and the convergence rate is faster.

In order to make the network have a certain degree of fault tolerance, we also need noise signals to train the network. This article uses 10 groups of noise signals. Then respectively use standard BP algorithm and Scaled Conjugate gradient BP algorithm to train the network. Noise signal average which is added into the alphabet is respectively 0.1 and 0.2. This ensures that the neural network learns to recognize the alphabet with a noise signal vector, and can also recognize the vector of ideal letters correctly. After training the network, the network may also be the way with a noise signal for the ideal signals. Therefore, in order to enable the network to identify the ideal signal, we need to train the network again with the ideal signals. Use the standard BP algorithm to carry on the training. Its results are TRAINGD, Epoch 500/500, SSE 26/0.1, Gradient 1.72469e-008/1e-010 TRAINGD, Maximum epoch reached, performance goal was not met. Train the network with the Scaled Conjugate gradient BP algorithm. Its results are RAINSCG, Epoch 0/500, SSE 0.0772028/0.1, Gradient 0.143634/1e-006 TRAINSCG, Performance goal met. We can see that the Scaled Conjugate gradient BP algorithm needs fewer iterations than the standard BP algorithm', and the convergence is faster. In order to test the performance of the network, this chapter uses the letter samples whose noise average is 0.6 as input samples. Let letter A which is a noisy letter be the input sample. Similarly, use standard BP algorithm and Scaled Conjugate gradient BP algorithm to train the network, respectively. Their output sentence is  $a = \text{randn}(35, 1) * 0.6 + \text{alphabet}(, 1)$ ;  $\text{plotchar}(a)$ ; the recognition sentences are  $\text{plotchar}(a)$ ;  $\text{output} = \text{sim}(\text{netn}, a)$ ;  $\text{output} = \text{compet}(\text{output})$ ;  $\text{answer} = \text{find}(\text{output} = 1)$ . The simulation results by Scaled conjugate gradient BP algorithm obtains is  $\text{output} = [0.8520 \ 0.0000 \ 0.0001 \ 0.0001 \ 0.0000 \ 0.0000 \ 0.0000 \ 0.0000 \ 0.0018 \ 0.0000 \ 0.0004 \ 0.1210 \ 0.0000 \ 0.0000 \ 0.1625 \ 0.0000 \ 0.0001 \ 0.0480 \ 0.0001 \ 0.0000 \ 0.0002 \ 0.0000 \ 0.0054 \ 0.0000 \ 0.2994 \ 0.0000]$ , while the simulation results by standard BP algorithm is  $\text{output} = [1.0e-007 * 0.9402 \ 0.1964 \ 0.8429 \ 0.7433 \ 0.2045 \ 0.1169 \ 0.7081 \ 0.1273 \ 0.1964 \ 0.1387 \ 0.0448 \ 0.3942 \ 0.2096 \ 0.5958 \ 0.5237 \ 0.0949 \ 0.8519 \ 0.1503 \ 0.7255 \ 0.0333 \ 0.3305 \ 0.1516 \ 0.2478 \ 0.0937 \ 0.0519 \ 0.4695]$ . From the simulation results it can be seen that the output error of Scaled Conjugate gradient BP algorithm is less than standard BP algorithms. The figures below show the noisy letter A and standard letter A which are recognized by Scaled Conjugate gradient BP algorithm. It can be seen that using Scaled Conjugate gradient BP algorithm can effectively recognize noisy letters (Fig. 27.1, 27.2).

**Fig. 27.1** Noisy letter A



**Fig. 27.2** After scaled conjugate gradient bp algorithm training letter A



### 27.4 Summary

Using the Scaled Conjugate gradient, BP algorithm can improve the generalization ability of neural network without affecting the approximation accuracy or training errors and achieve good recognition results. This chapter uses the Scaled Conjugate gradient BP neural network for noise letters to carry on the recognition and the simulation. Experimental results indicate that the network has associative

memory and anti-jamming capability. Improved BP algorithm reduces the number of training. It has high recognition accuracy and strong robustness. It can also effectively recognize the letters.

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# Chapter 28

## Research on Rumors Spread Based on Cellular Automata

Yiran Gu and Jinzhu Ding

**Abstract** This paper studies the phenomenon of rumors spread based on the modeling theory of cellular automata (CA). We define two parameters which is called trust degree among cells and spread intention of cell and establish the rumors spread evolution model. Compared with the previous propagation model, it can demonstrate the propagation of rumors in the interpersonal networks clearly. We can observe and analyze the influence of propagation effects by adjusting the parameters. Simulation results show that the different distribution of parameters has a certain influence on rumors spread and the diffusion degree of rumors will decrease with the increase of the variance of trust degree and spread intention.

**Keywords** NW small-world networks · Cellular automata (CA) · Rumors spread

### 28.1 Introduction

The early research on rumors transmission mainly shows as follow: Daley and Kendall proposed the mathematical model of rumor spread in the 1960s, which is called D-K model [1], and the model is mainly focused on the theoretical research; Zanettee D H is the first one who apply the complex network theory to the study of rumors, and build rumors spread model based on small-world networks, and draw some conclusions including the critical value of the rumors spread [2, 3];

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Moreno Y, etc. establish rumors spread model in the scale-free networks, at the same time, they compare the conclusion of computer simulation and the conclusion obtained through stochastic analysis methods [4]; Domestic xiaofan Wang, whose studies focused on the clustering coefficient, found that by increasing the network clustering coefficient can inhibit rumors spread effectively [5].

However, those studies on the model of rumors spread mainly adopt mathematical expressions (e.g., in the form of differential equations) to establish models, and propagation rules will require to be simplified generally. Hence, this article adopts cellular automata (CA) to research the phenomenon of rumors spread. It can be more flexible at the propagation rules and can be more intuitive to observe the progress of rumors spread than traditional methods.

## 28.2 Rumors Spread Model Based on CA

### 28.2.1 Cellular Automata Introduction

CA is discrete both in space and time, and each cell in the space evolution synchronous with the time advance according to the given rules, and it is described as the idealized model of a variety of complex nonlinear systems. CA is made up of cell, cell space, neighbor (neighborhood), and regulation. The constructed discrete mathematics models established through using CA has the following advantages: clear physical pictures, fully parallel, no truncation error. It becomes the powerful tool for exploration of the nonlinear complex system in recent years.

### 28.2.2 Specific Process of Establishing Model

According to the rumors propagation mechanism, the paper will introduce two parameters: trust degrees between cells and cell spread intention. This article adopts two-dimensional grid of CA, it supposes that the CA has  $N = n \times n$  cells.

**Definition 1** (*trust degree between cells*) Trust degree is the degree of trust and dependence between cells. The mathematical expression is:

$$b(i,j) = x, x \in [0, 1] \quad (28.1)$$

$i \in [1, N], j \in [1, N]$ . It has the same value ranger of  $i$  and  $j$  in the next text.  $b(i,j)$  means the trust and intimacy of cell  $i$  as to cell  $j$ . It is the measure indexes on the trust degree between  $i$  sand  $j$ . The much bigger of the value of  $b(i,j)$  means the higher trust degree of  $i$  as to  $j$ , and the more influences on the condition of cell  $j$  to cell  $i$ , and vice versa. In addition, the value of  $b(i,j)$  and  $b(j,i)$  does not necessarily equal. As for  $b(i,j)$ , if cell  $j$  is not in the neighborhood area of cell  $i$ , then  $b(i,j)$ .

**Definition 2** (*cell spread intention*) Cell spread intention is that when cell believes the rumor, it means the tendency degree that the cell takes the initiative to spread of rumor information. The mathematical expression is:

$$c(i) = y, y \in [0, 1] \tag{28.2}$$

$c(i)$  means the spread intention of cell  $i$ . Without considering the trust degree, the more bigger the value of  $c(i)$ , the more greater possibility for  $i$  to spread the rumors.

### 28.2.2.1 Selection of Network Model

This paper mainly studies rumors spread in the interpersonal network, while the interpersonal network has a typical feature of small-world network. This paper selected the NW small-world network model as the network model.

### 28.2.2.2 Dynamic Propagation Rules

Before setting the dynamic propagation rules, we will give the following illustration about the state of cell briefly. There are mainly three cell states in this model: health status (H), similar spread status (SS), similar immune status (SI).

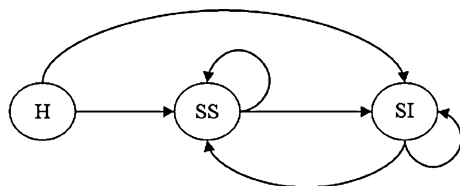
Cells of H: The cells have not received any rumor information, when they exposed to rumor, they may become cells of SS and also may become cells of SI.

Cells of SS: The cells believe the rumors and spread rumors to their neighborhood cells; It also includes this kind of cells, they are in the SI at the beginning, and will believe and spread rumors when they heard rumor repeatedly.

Cells of SI: The cells do not believe and do not spread rumor when they receive the rumor information; it also includes this kind of cells, they are in the SS at the beginning, and will not spread rumor when they spread rumor to their entire neighborhood for once.

As shown in Fig. 28.1. The state transition probability is determined by the trust degree and spread intention. Assumption for the cell  $j$ , there are  $m_j$  cells of SS,  $n_j$  cells of SI,  $l_j$  cells of H in its neighborhood area, then the rumor dynamic propagation rules will set as follows:

**Fig. 28.1** Cell state transition diagram



For the cell  $j$  of H, it will turn into SS in probability  $p_j$ , or else turn into SI.  $p_j$  is defined as  $p_j = \frac{1}{m_j} \sum_{i=1}^{m_j} b(j, i) * c(j)$ , and  $i$  denotes the  $i$ th cell of SS in the neighborhood of  $j$ .

For the cell  $j$  of SS, it will turn into SI in probability  $p_j$ , or else still to be the state itself.  $p_j$  is defined as  $p_j = \frac{1}{n_j} \sum_{i=1}^{n_j} b(j, i) * (1 - c(j))$ , and  $i$  denotes the  $i$ th cell of SI in the neighborhood of  $j$ .

For the cell  $j$  of SI, it will turn into SS in probability  $p_j$ , or else still to be the state itself.  $p_j$  is defined as  $p_j = \frac{1}{m_j} \sum_{i=1}^{m_j} b(j, i) * c(j)$ , and  $i$  denotes the  $i$ th cell of SS in the neighborhood of  $j$ .

For the cell  $j$  of SS, it will turn into SI, when it spreads rumor to its neighborhood.

For the cell  $j$ , it will turn into SS, when it receives rumor repeatedly.

### 28.2.2.3 System Model

Using below method extend the regular neighborhood cellular automata to have topological structure of the NW small-world network. For the formation mechanism of the NW small-world networks, we use the method of randomization plus edge to add remote cell neighbors to each cell, which make each cell to have a new neighborhood, and the new neighborhood increases remote cells generated by adding long-range edge on the basis of the original neighborhood.

Setting the initial to have very small amount of similar spread state cell (0.03 %), the rest cells are healthy. According to the dynamic propagation rules, the cells' state will change to form the dynamic process of rumor spread.

The  $cells(x, y)$  denotes the point at  $(x, y)$  position of cellular automata in the Quartet Figure. The values of  $cells(x, y)$  denotes the cell's state. The description of the cell's state is as follows:  $cells(x, y) = 0$  denotes the cell in the state of H, and is performance of red.  $cells(x, y) = 1$  Denotes the cell in the state of SS, and is performance of green.  $cells(x, y) = 2$  Denotes the cell in the state of SI, and is performance of blue.

The model generation algorithm is as follows:

Generating two-dimensional regular four rectangular diagram with  $N = n * n$  units, which will have 3600 cells when we take the  $n = 60$ ;

Based on the NW generation algorithm, we extend the topology of the signal cell network to the NW small-world networks;

Giving the initial value to each cell, with a certain percentage to make sure that very small amount cells (0.03 %) are in the state of SS and the rest cells are healthy. At the initial there are no cells in the state of SI;

Start from a cell, and make this cell as a center to traverse all its neighborhood. According to the above dynamic propagation rules to determine whether to change



and how to change state of this cell. The state transferred probability is determined by the trust degree and the spread intention of cell;

Each cell update its state according the step (4) synchronously;

Update their state repeatedly until achieving the external termination condition.

### 28.3 Simulation and Results

The core of the model is the dynamic propagation rules, and the most important things of the rules are the trust degree and the spread intention. So the simulation will take above two parts as the research object. In this paper, we only consider this case: The trust degree (or the spread intention) subject to uniform distribution. The spread intention (or the trust degree) subject to uniform distribution, normal distribution, and binomial distribution, respectively. This paper will not consider the cross-distribution.

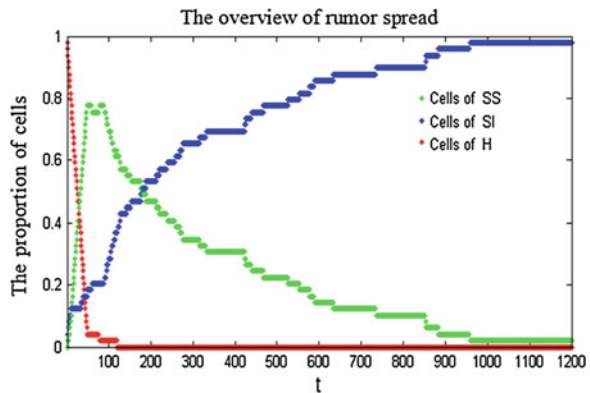
Based on the observation and the research on the rumors mechanism, we define two indicators to measure the effect of rumors spread:

**Definition 1:** The proportion of rumors spread which is called  $s$ ,  $s(t)$  denotes the proportion of the cells in the state of SS when the step of rumors spread is  $t$ . It corresponds with the share of the green cells when the evolution model runs to the step of  $t$ . To a certain extent, it shows the extent and impact of rumors spread.

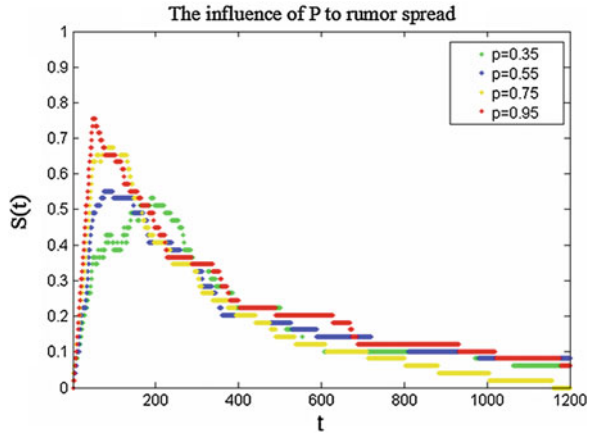
**Definition 2:** The diffusion time-consuming is  $n$ ,  $n$  denotes the required evolutionary steps of the rumor from starting spread to stopping spread.

The simulation results shows that with the increase of the evolutionary steps, the number of the healthy cells have been reduced to 0, and the number of cells of SS first increase to a maximum and then reduce to 0, and the number of cells of SI increase to the total number of possessive points. As the result in Fig. 28.2:

Fig. 28.2 The overview of rumor spread



**Fig. 28.3** The influence of  $p$  to rumor spread



### 28.3.1 The Influence of the Randomization Plus Edge Probability to Rumors Spread

The randomization edge probability will affect the characteristic and the topology structure of the generated NW small-world network. So it will definitely affect the impact of rumors spread.

Figure 28.3 shows that the randomization plus edge probability  $p$  will affect  $s$  and  $n$ . With the increase of  $p$ , the diffusion time-consuming  $n$  will decrease, which makes the system to turn into stability much more fast. (Because the increase in randomization plus edge probability is very conducive to enhancing the connectivity of the network, the spread efficiency becomes higher). What’s more, with the increase of  $p$ , the proportion of rumors spread  $s(t)$  increases, which means that to enhance the network connectivity improving the wide range extent of rumors spread.

### 28.3.2 Influence of Cell Spread Intention $C$

Distribution type of cell spread intention

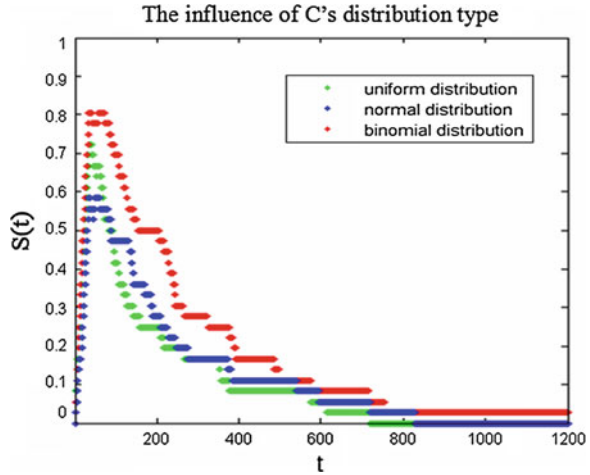
Selecting  $p = 0.75$ , the trust degree obey to uniform distribution. The spread intention obeys to uniform distribution, normal distribution, and binomial distribution, respectively. After 50 times simulation, we take the average and the curve as shown in Fig. 28.4:

Figure 28.4 shows that spread intention obeys different distribution will impact the proportion of cells of SS. It not only changes the proportion of rumor spread  $s$ , but also affects the diffusion time-consuming  $n$ .

Variance of cell spread intention

The relationship between  $C$  and rumors spread impact as shown in Fig. 28.5:

**Fig. 28.4** Influence of  $C$ 's distribution type



**Fig. 28.5** Influence of  $C$ 's variance

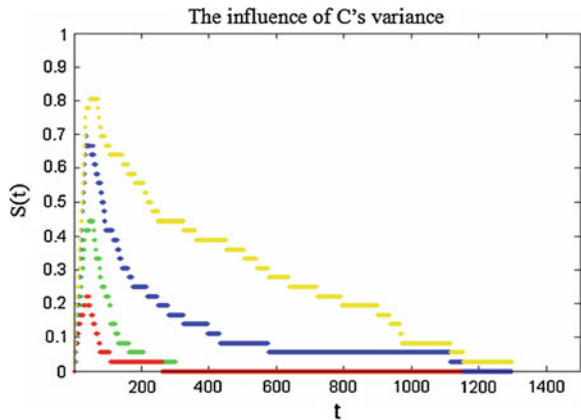


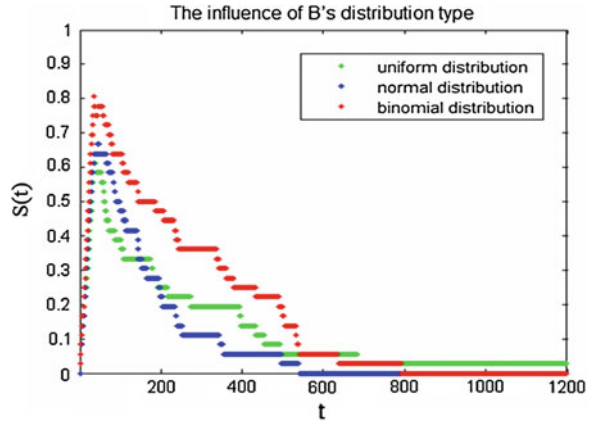
Figure 28.5 shows that the proportion of rumor spread  $s$  and the diffusion time-consuming  $n$  decrease with the increase of the variance of cell spread intention. It illustrates that much bigger the variance is, the much weaker the diffuse degree of rumors is.

### 28.3.3 Influence of Cell Trust Degree $B$

Distribution type of trust degree

Selecting  $p = 0.75$ , the spread intention obey to uniform distribution. The trust degree obeys to uniform distribution, normal distribution, and binomial distribution, respectively. After 50 times simulation, we take the average as the curve shown in Fig. 28.6:

**Fig. 28.6** Influence of B's distribution type



**Fig. 28.7** Influence of B's variance

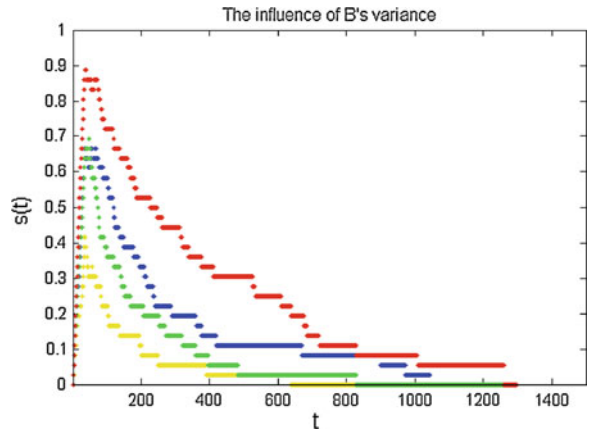


Figure 28.6 shows that trust degree's different distribution will impact the proportion of cells of SS. It not only changes  $s(t)$ , but also affects the diffusion time-consuming  $n$ .

Variance of trust degree

The relationship between B and rumor spread impact is shown in Fig. 28.7. Figure 28.7 shows that the proportion of rumor spread  $s$  decrease with the increase of the variance of trust degree. However, there is no significant relationship between the diffusion time-consuming  $n$  and the variance of the trust degree.

### 28.4 Summary

According to the research on the rumors spread mechanism, the paper gives the rumor dynamic propagation rules, and establishes a rumor spread evolution model based on the cellular automata. By choosing the different values of the parameters,

we can observe the rumors spread situation in different cases. The simulation results shows that: the network topology, the different choices of the value of parameters and the variances size of parameters all have a certain effect to the rumors spread impact.

The method which has used in this paper has many advantages compared with the previous method. First, the cellular automata model's structure is more flexible, and it can be fully run in parallel. Second, it not only can clearly demonstrate the propagation of the rumors spread in the whole interpersonal network, but also can change the control strategy in the evolution progress, and study the impact of the various factors on the rumors spread.

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# Chapter 29

## Dynamic Method of Secure Access Cloud in Mobile Environment

Rong Ouyang, Yunfa Li, Zujie Ren and Jian Wan

**Abstract** How to access cloud securely in the mobile environment is focused intensively by the cloud computing researcher and mobile user. People have to take security into account seriously for many mobile applications which connect to cloud. This paper presents a dynamic method of secure access cloud in mobile environments. Different from other secure access methods, our method can permit the operation privilege of the mobile user for storing or computing on cloud to change automatically when the location and time changes. It will make some mobile applications which connect to cloud, such as payment online, more secure. Signaling is adopted in our method to meet this goal.

**Keywords** Secure access · Cloud computing · Mobile environment · Signaling

### 29.1 Introduction

During the recent years, smartphones have evolved into a powerful platform and are popularized among the ordinary people. Many mobile applications which are downloaded from mobile app-stores have been created and put into use widely.

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With the rapid development of cloud computing, many mobile applications put their compute and storage into cloud. The mobile cloud computing was put forward against this background. Mobile cloud computing was defined in a 5 March 2010 entry in the Open Gardens blog as “the availability of cloud computing services in a mobile ecosystem. This incorporates many elements, including consumer, enterprise, femtocells, transcoding, end-to-end security, home gateways, and mobile broadband-enabled services” [1].

The security of mobile cloud computing is paid close attention to by related researchers. These researchers explored many aspects such as access scheme [2], authentication [3, 4], secret key management [5], and so on. In traditional secure access, when a mobile user login in cloud obtains a specified privilege, the privilege will not change whether or not he moves, and where he moves to. In fact, in our daily life, some locations have more security than other locations, such as home. The security requirement of mobile users is different at various locations. For example, the mobile user expects more privilege at home than out of door when he is transferring to other accounts or paying for online shopping. In fact, the username and password login on cloud may be peeped into by some malicious persons when the user is using his mobile device out of home, or the mobile device may also be stolen or lost accidentally. Malicious persons may obtain important privileges such as transferring accounts or payment online with the username, password, and so on, with the stolen mobile device. For some mobile cloud applications whose data are stored in cloud, when the mobile user stays in locations that are more secure, he can acquire more privileges such as data modification or deletion. If the mobile user stays in locations that have less security, these mobile cloud applications can obtain less privileges such as data reading only. Of course, different people have different secure locations.

On the other hand, some people may think some time slots are more secure than others in their daily life, especially for people whose daily life is very regular. If more security is necessary, time can also be added to become a new constraint condition in addition to location. In this way, the privilege of mobile cloud applications can be determined by the location and time. In the case mentioned above, even if the malicious person breaks into the home of the mobile user and steals the username, password, and mobile device, he cannot obtain high privilege in wrong time. Different from other secure access schemes, this paper presents a dynamic method of secure access cloud, in which the operation privilege changes automatically when the location and time changes. To meet this goal, we adopt signaling, which can create session between the mobile device and cloud. Session implies certain messages including creating time, duration time, privilege grade, and other security parameters. The session is updated dynamically. The information about geography location and time is added into the session. In this way, the privilege grade can be related to the geographic location and time.

The next step in the signaling (NSIS) protocol suite is developed to deal with signaling information about a data flow along its path [6]. To resolve the signaling of RSVP is the original motivation of developing NSIS. In fact, NSIS can also be applied to NAT/Firewall [7] and mobile Environments [8]. The NSIS protocol

suite consists of two layers: the NSIS transport layer protocol (NTLP) and the NSIS signaling layer protocol (NSLP). Each specific service can have its own NSLP protocol. The session ID (SID) used in NSIS signaling enables the separation of the signaling state and the IP addresses of the communicating hosts. This makes it possible to directly update a signaling state in the network due to mobility without being forced to first remove the old state and then re-establish a new one. This is the fundamental reason that NSIS signaling works well in mobile environments [8]. NSIS is flexible enough to fit other mobile applications that deal with signaling. The NSIS protocol suite is adopted to handle signaling in our secure access system.

The rest of this paper is organized as follows: First, in Sect. 2, we analyze and compare the related works. After that, Sect. 3 introduces the model of the dynamic secure access method, and NSIS model in the dynamic secure access method. Then Sect. 4 presents the performance study of our dynamic secure access system (DSAS). Finally, Sect. 5 summarizes the contributions and future directions.

## 29.2 Related Works

Dijiang Huang et al. aimed to build a secure mobile cloud framework that can enhance communication by addressing trust management, secure routing, and risk management issues [9]. In [3], the authors put forward a flexible framework for supporting authentication decisions, in which user behavior can be translated into authentication scores. Andreas Klein et al. presented a framework for the use of context information for heterogeneous access management (HAM) provided by the Mobile Cloud as a service for mobile terminals [2]. The mobile system must make intelligent decisions about what data should be stored locally and what processes should be run locally; as a result of these decisions, the user becomes vulnerable. In this case, Brent Lagesse analyzed security risks of mobile systems in detail [10]. Researchers of NSIS mobile applications pay more attention to the mobile Internet QoS. Sooyong Lee et al. put forward an approach that can enhance NSIS protocol based on advance resource reservation using Layer 2 and Layer 3 complementation for supporting host mobility. This approach can significantly reduce the latency of signaling session reestablishment caused by handoff [11].

The location of mobile devices was also considered in [12], the location message was used to help intrusion prevention. However, this paper aims to improve access security of mobile cloud applications by using location message.



### 29.3 Model of the Dynamic Secure Access Method

#### 29.3.1 Architecture of the Dynamic Secure Access System

Based on the dynamic Secure Access Method mentioned above, we built a new system called the DSAS. Figure 29.1 shows the architecture of DSAS. The NSIS Controller can deal with NSIS signaling between mobile device and Controller. To prevent heavy load, there are several NSIS Controllers working at the same time. A mobile device sends an NSIS signaling connection request to the NSIS Dispatcher. The NSIS Dispatcher dispatches the request to one of the NSIS Controllers, and sends back the mobile device some messages about the NSIS Controller which associates with this mobile device. Then the mobile device can build signaling connection with the NSIS Controller. At the register phase, the mobile user tells the DSAS which privilege he will obtain at different locations and time. The NSIS Controller will create the security scheme of this mobile user and save it to the Access Database. In addition, in mobile environments, state updates need to be handled independently for upstream and downstream paths. There are two paths between mobile device and NSIS Controller. Important messages such as security schemes, location of mobile device, time, and so on are stored in the access database. According to the mobile device's location and time, and the security scheme of this mobile user, the NSIS Controller will choose a corresponding security level, which determines the privilege of the mobile device at that time.

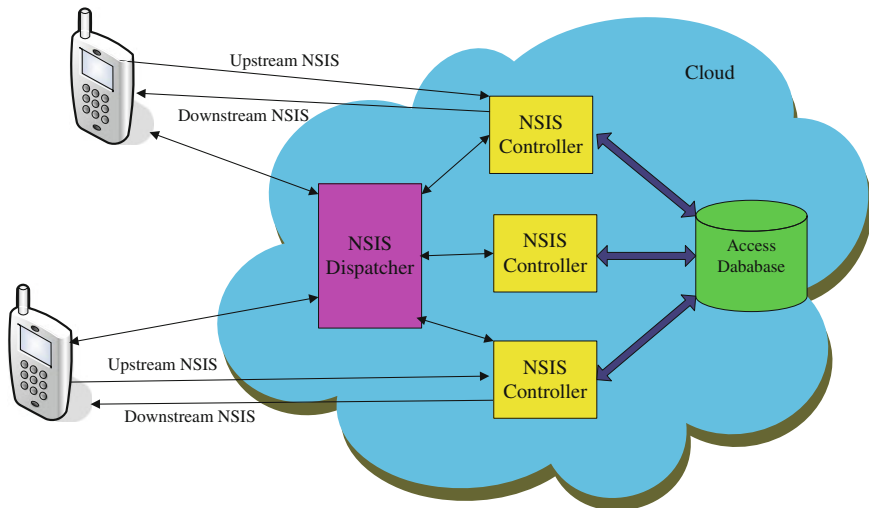


Fig. 29.1 Architecture of DSAS

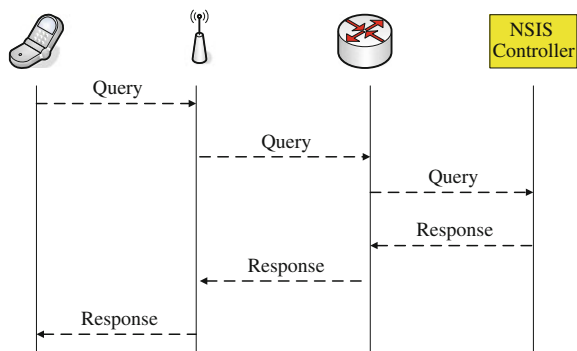
The DSAS needs to cooperate with identity authentication protocols such as Authentication, Authorization, and Accounting (AAA) protocol, which is reliable to ensure secure identity authentication.

### 29.3.2 NSIS Model in the Dynamic Secure Access Method

NSIS signaling uses the Session ID to make the separation between the signaling state and the IP addresses of the mobile device. When the mobile device moves, mobile NSIS state needs be re-established on the new path, and abandoned on the old path. On the common path, the mobile NSIS state will be updated. These state update procedures are only made in the affected flows. As the signaling path in the wireless access network usually changes only partially, NSIS needs to limit the scope of signaling information to only the affected portion of the signaling path. The session information on the old path needs to be removed when a path changes.

In Mobile IPv4 network, the data flows are forwarded based on triangular routing. When the mobile device is sending data, the data and signaling flows sent from the mobile device are directly transferred to the base station, and then forwarded to one or more routers, till they are received by the NSIS Controller. On the other hand, when the mobile device is receiving data, the data and signaling flows sent from the base station are routed through the IP tunneling between the home agent and the foreign agent. In this way, routing is dependent on the home agent, and therefore the NSIS protocols can interact with the IP tunneling procedure of Mobile IP for signaling. The signaling flows of the DSAS are shown in Fig. 29.2.

**Fig. 29.2** Signaling flow of the DSAS



## 29.4 Performance Study

Our main purpose of test is to evaluate the performance impact on the DSAS implementation under different number of sessions. This approach is considered since maximum supported flows is likely a bottleneck in heavy-load network environments.

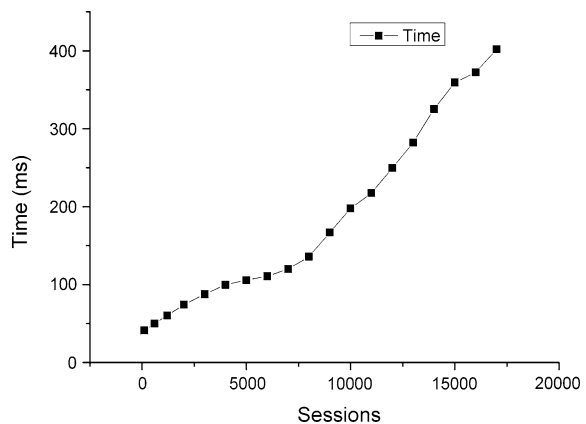
In our test environments, an NSIS Dispatcher and two NSIS Controllers are deployed in the cloud. 5 HTC smartphones (CPU: 1 GB, Memory: 768 MB RAM) and 5 Samsung smartphones (CPU: 1 GB, Memory: 1 GB RAM) are used as mobile terminals that are all configured with Android OS. GIST is configured to use C mode with a session refresh rate of 180 s. The DSAS is deployed as followed in Fig. 29.1 to simulate more sessions creations, we amend programs in mobile terminals to create plenty of sessions. Each mobile terminal can create a session every 1.25 s.

The processing time of NSIS Controller under different number of sessions is shown in Fig. 29.3. We note that time increases with the number of sessions. When the number of sessions is under 8,000, the average processing time is under 130 ms, and the growing rate is not fast. When the number of sessions is more than 8,000, the average processing time grows much faster.

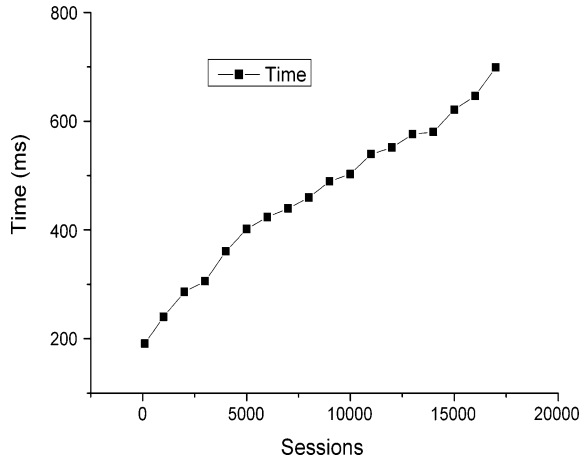
The next performance test examines the session setup time of the implementation to answer the following question: how long does it take to establish a session between mobile terminals and NSIS Controllers. The session setup time includes the NSIS Dispatcher processing time. Figure 29.4 shows the average session setup time under different number of sessions. The observation demonstrates a nearly linear increase of the session setup time with an increased number of sessions.

In session update process, upstream and downstream paths have to be considered individually while analyzing session update time. Figure 29.5 shows the average session update time of upstream and downstream. The session update time of upstream is usually higher than that of downstream.

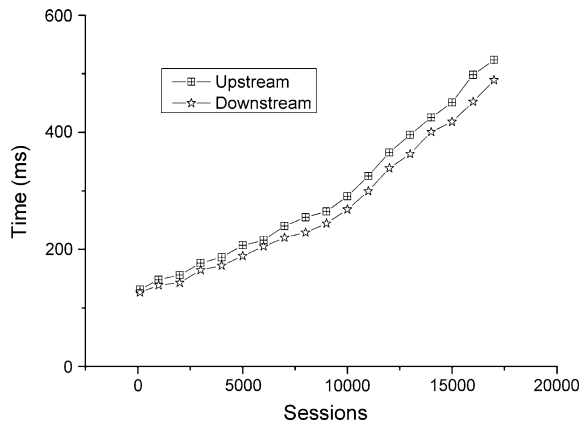
**Fig. 29.3** Average processing time of NSIS controller



**Fig. 29.4** Average session setup time



**Fig. 29.5** Average session update time



### 29.5 Conclusion

This paper presented the dynamic method of secure access cloud in mobile environments, which can permit the operation privilege of the mobile user who stores data or computes on cloud, to change automatically when the location and time change. The paper discusses the architecture of DSAS, and NSIS model in the DSAS. Some experiments were conducted to evaluate the performance of DSAS. The observations in our experiments demonstrate that the DSAS work well. However, the average processing time of NSIS Controller, average session setup time, and average session update time will increase with an increased number of sessions. Considering that only two NSIS Controllers were deployed in our experiments, adding more NSIS Controllers will obtain better performance if plenty of sessions come in.

In the future work, since locating accuracy of mobile device is not very difficult, more consideration is needed on how to deal with location messages if some locations are unsure of security. In addition, it also needs to be considered how to avoid a single-point breakdown in NSIS Dispatcher.

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# Chapter 30

## Intrusion Detection Engine Design Based on Immune

Zong Jiang Wang

**Abstract** Detection engine in intrusion prevention system is a key link for its performance. In order to improve the efficiency of intrusion detection engine, this paper starting from the intrusion defense system design of the engine, by use of immune principle put forward through the immune antigen classification algorithm to design a novel intrusion defense detection engine, using cluster analysis method to realize the data source classification, and strict mathematical theory proved the improvement effect of detection engine of intrusion prevention system. Finally, the experimental simulation is presented. It is shown that the method is effective.

**Keywords** Immune principle · Intrusion detection · Engine · Model · Design

### 30.1 Introduction

In the era of knowledge explosion, the network has already become the powerful force of the society and economy development. Its position is more and more important with the development of Internet; It also produced a variety of problems, including the security problem is highlighted particularly. For network security defence system, there are a lot of researches at home and abroad. The famous first is Network ICE company in overseas, it first put forward the IPS concept in 2000, and in 18 September 2000 launched the industry's first IPS products. Europe, America, and the developed countries have entered a rapid IPS research development orbit [1]. For domestic, from 2006, IPS abroad after entering the Chinese

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market, domestic IPS market has developed rapidly. This paper in view of the traditional intrusion detection engine leakage alarm rate and false alarm rate exorbitant problems, designed an intrusion detection engine based immune, and proposed immune antigen classification algorithm, by means of the simulation experiment and mathematical reasoning to prove its validity.

### 30.2 The Basic Idea of the Design

Modern medicine has proven that the body has a complete set of the immune system; it is helping us to resist and removal of various viruses and repair diseased cells, so that we can have a healthy body. This functionality with our network security intrusion prevention system is very similar, but a resist is biological virus, a block is a computer virus. So based on the natural immune system this characteristic, we can design a novel intrusion defense system. In order to make up for the current intrusion defense system for the detection engine of the false alarm rate, false alarm rate is too large [2].

Information security is the most successful application of artificial immune system, and also the most direct use in the field. In fact, their principle has striking similarities, the main task of information security is to prevent hacker attack and virus invasion, and the immune system is to prevent external viral and bacterial infections. There is an immune system to prevent internal cell carcinogenesis, and because of that, it provides us the thought of immune-based intrusion prevention system detection engine. Their basic principle diagram is as shown in Figs. 30.1 and 30.2.

From this chart, we can see very clearly, that the immune principle and intrusion detection principle are like two peas, which for our system designed is to provide a train of thought.

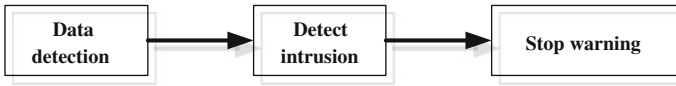
### 30.3 Natural Immune System Model

We can define the model into a four tuple representation:

$$\Sigma = (M, N, G, F) \tag{30.1}$$



Fig. 30.1 Natural immune system diagram



**Fig. 30.2** Intrusion prevention plans

In this equation,  $M$  represented as input,  $N$  represented as output,  $G$  representative system of internal composition,  $F$  expressed as the relationship between input and output function, the relationship between them can be expressed as:

$$N = G(M) \tag{30.2}$$

Thus, it can be defined as the natural immune system  $\Sigma_{IS}$ , so this time we can express the following formula:

$$\Sigma_{IS} = (M_{IS}, N_{IS}, G_{IS}, F_{IS}) \tag{30.3}$$

With the above said the same, in this way,  $M_{IS}$  represents the natural immune system input, it also may be of every hue of the somatic antigen, the antigen is likely its protein, there may be other pathogens, This time, if we make that  $C$  become antigen all, this whole includes two mutually exclusive set, is also own protein collection and pathogen collection. This time if  $A$  that their protein set,  $BA$  said pathogen collection, will have the following formula show:

$$A \cup BA = C, A \cap BA = \emptyset \tag{30.4}$$

If at this time input,

$$M_{IS} \in C \tag{30.5}$$

At the same time, we according to what is said above content, you can know  $N_{IS}$  can get 0 or 1 one that is the natural immune system to identify input myself or not self. If the above settings  $G_{IS}$  can be expressed as a natural immune system input and output of the nonlinear relationship between the function, it will have the following formula:

$$N_{IS} = G_{IS}(M_{IS}) = \begin{cases} 1, & \text{if } M_{IS} \in BA \\ 0, & \text{if } M_{IS} \in A \end{cases} \tag{30.6}$$

The above is a natural immune system.  $F_{IS}$  is the natural immune system internal composition, in different ways,  $F_{IS}$  with different part, from its basic functionality,  $F_{IS}$  including two innate and adaptive immune categories. We can mimic the natural immune system based intrusion prevention system model [3].



### 30.4 Model Design of Intrusion Detection Engine

The human immune system relies on its own multilevel, diversity, uniqueness, and negative selection mechanism, so it can reliably detect innumerable variety of pathogens, we do not follow the above natural immune system, the establishment of an immune-based intrusion prevention system  $\Sigma_{IPS}$ . We can set

$$\Sigma_{IPS} = (M_{IPS}, N_{IPS}, G_{IPS}, F_{IPS}) \quad (30.7)$$

$M_{IPS}$  as  $\Sigma_{IPS}$  input. It may be used as a simple operating system log, may also be a complex network data packet. Input domain and general intrusion prevention system is  $W$ , the same throughout the universe still can be divided into two mutually exclusive sets that invasion of collections are represented as  $I$ , and normal collection is expressed as  $\neg I$ .

And

$$M_{IPS} \in W \quad (30.8)$$

$N_{IPS}$  as  $\Sigma_{IPS}$  output, zero or one, respectively,  $\Sigma_{IPS}$  said no alarm or warning.  $G_{IPS}$  Expressed as between the input and output nonlinear function relationship;  $F_{IPS}$  as the immune-based intrusion detection engine internal components. From the perspective of protection level  $F_{IPS}$  can include multiple protections [4]. We can make

$$F_{IPS} = \{K_a, K_b, K_c\} \quad (30.9)$$

The  $K_a$  main means is the detection of network packet layer: detection of all incoming and outgoing network packets in Baotou, rapid and timely find problem data packets of Baotou, the network attack data flow, as well as various features of hacker attack.

The  $K_b$  mainly is to detect the network application layer: it is detected and network node to all network communication data packet. Packets of data with the host operating system protocol identical decoding and analysis. According to the data packet ports of different calls of different agents, detection of various based on application layer attacks.

The  $K_c$  main design is used to detect the host layer: it is mainly used to according to the operating system audit log, to do well the key host detection and protection of network. The test included the privileged processes and specific user system call trace, CPU using peak, the amount of available memory and disk space, as well as the key file changes and different user login event abnormal behavior.

From the specific detection agent perspective,  $F_{IPS}$  comprises a plurality of agents that

$$F_{IPS} = \left\{ \bigcup_{\substack{i=1 \sim m \\ j=1 \sim k_i}} a_{ij} \right\} \quad (30.10)$$

$M$  is detection agent types of numbers,  $K_i$  for the number of  $I$  detection agents. Detection agent including many types, such as the system call detection agent, integrity detection agent, usability testing agency, HTTP detection agent, agent FTP detection agency were detected in different characteristics, each agent has a lot, distribution network different location,. Each agent is able to independently accomplish the respective detection task, can pass through communication to a certain degree of cooperation [5].

We use the symbol RTD said detection rate, the intrusion detection system  $\Sigma_{IPS}$  detection rate can be expressed as RTD ( $\Sigma_{IPS}$ ), according to the detection rate is defined as:

$$RTD(\Sigma_{IPS}) = P(N_{IPS} = 1/M_{IPS} \in I) \quad (30.11)$$

With symbols RMD that leakage alarm rate, then the intrusion prevention system  $\Sigma_{IPS}$  leakage alarm rate can be expressed as RMD ( $\Sigma_{IPS}$ ), according to the definition of the false alarm rate

$$RMD(\Sigma_{IPS}) = P(N_{IPS} = 0/M_{IPS} \in I) = 1 - RTD(\Sigma_{IPS}) \quad (30.12)$$

With symbols RFD that false alarm rate, then the intrusion prevention system  $\Sigma_{IPS}$  false alarm rate can be expressed as RFD ( $\Sigma_{IPS}$ ), according to the definition of false alarm rate:

$$RFD(\Sigma_{IPS}) = P(N_{IPS} = 1/M_{IPS} \in \neg I) \quad (30.13)$$

Detection of engine performance with symbols that DA, the intrusion detection system testing engine performance  $\Sigma_{IPS}$  can be expressed as DA ( $\Sigma_{IPS}$ ),

$$DA(\Sigma_{IPS}) = \omega_{MD}, RMD(\Sigma_{IPS}) + \omega_{FD}, RFD(\Sigma_{IPS}) \quad (30.14)$$

$\omega_{MD}$  and  $\omega_{FD}$  as weight, according to the specific case of detection performance on false alarm rate and false alarm rate are different emphasis and the assignment, there are

$$0 \leq \omega_{MD} \leq 10 \leq \omega_{FD} \leq 10 \leq \omega_{MD} + \omega_{FD} \leq 1 \quad (30.15)$$

So it is  $DA(\Sigma_{IPS}) \in [0, +1]$ , and the smaller of  $DA(\Sigma_{IPS})$  value, the better the performance of detection, ideal for 0. Of course, this in reality is not possible.

## 30.5 Immune Principle Detection Engine Specific Algorithm Design

We have in front use of mathematics to design a model. According to the principle of immune antibody and antigen have specific and different antigen will produce different danger signal. Which corresponds to the intrusion prevention system, it must have more than one detector, different detectors of different categories of data. So is proposed the immune antigen classification algorithm, the clustering analysis method to realize the data source classification, in order to improve the efficiency of intrusion detection engine.

### 30.5.1 Cluster Analysis Methods

Cluster analysis basic idea is of the definition of similarity system or distance between samples, to represent the degree of similarity between samples, according to the similarity degree of the sample can be classified, one by one. Cluster mathematical definition for [6]:

A known  $P$  space  $R^p$ , each data usually use an attribute vector  $(d_1, d_2, \dots, d_p)$  representation, According to the similarity criterion, containing  $n$  data set for clustering, forming  $k$  cluster. Make  $V = \{X_1, X_2, \dots, X_n\}$  said a limited data sets, clustering cluster  $c_1, c_2, \dots, c_k$  by said, clustering cluster meet the following conditions:

$$\begin{aligned} c_i &\neq \emptyset, i = 1, 2, \dots, k. \\ c_i \cap c_j &= \emptyset, i, j = 1, 2, \dots, k \text{ and } i \neq j. \\ \bigcup_{i=1}^k c_i &= V, k \leq n. \end{aligned}$$

### 30.5.2 Similarity Clustering Algorithm

Whether it is for real time collection network data or network is often used for validation algorithm with KDDCUP99 data sets, the vast majority of data attributes are numerical. In addition, because it is the data pretreatment, request algorithm speed is quick and highly efficient; so this module algorithm is similar to clustering algorithm. But do the very big improvement.

**Definition 1** Similarity said two data or among a sample of similar degree or similar degree, with the reciprocal of the distance to representation, similarity can be expressed as

$$\text{sim}(X_i, X_j) = 1/d_{ij} \quad (30.16)$$

Among them:  $d_{ij}$  said the Euclidean distance between  $X_i, X_j$  on behalf of the data set two important data, they have  $p$  important properties.

**Definition 2**  $\text{class}(i) = (X_{i1}, X_{i2} \dots X_{im})$  it says in the system with  $m$  sample class, then  $C_i$  said the center for  $\text{class}(i)$  class:

$$C_i = \sum_{j=1}^m x_{ij}/m \quad (30.17)$$

**Definition 3** if  $X = (a_1, a_2, \dots a_p)$  by any one sample,  $\text{class}(i) = (X_{i1}, X_{i2} \dots X_{im})$  said this system with  $m$  sample type, either a similarity between the types of samples and can be defined as:  $\text{class}(i) = (X_{i1}, X_{i2} \dots X_{im})$ .

**Definition 4** If  $\text{class}(i) = (X_{i1}, X_{i2} \dots X_{im})$ ,  $\text{class}(j) = (X_{j1}, X_{j2} \dots X_{jm}) \frac{n!}{r!(n-r)!}$  respectively, said system with  $n$  and  $m$  instance of the two classes, the two class of the similarity between the formula:

$$\text{sim}(\text{class}(i), \text{class}(j)) = \text{sim}(C_i, C_j) \quad (30.18)$$

### 30.5.3 Clustering Algorithm Implementation Steps

The first step is to enter the training set  $V = \{X_1, X_2, \dots X_n\}$ , as the  $N$  class center; the second step is to calculate any sample and a kind of similarity, with the greatest similarity of two classes. Then is recalculated each class center, until finally all samples are divided into the  $m$  class. Its concrete implementation steps are as follows:

To initialize the  $N$  class, each class contains one instance, each instance as the center of the class.

Calculation of  $N$  class two similarities between them, and according to the similarity arranged from big to small.

With the greatest similarity of two classes as a new class, and as the  $n + 1$  class, so that you can get  $n-1$  class, then calculated for each class center.

Then started to calculate the new class and remaining each class of similarity So repeat step (30.3) and (30.4) has been to structure of  $m$ , each kind of contains several examples, and  $m$  class in each instance sum for  $n$ , finally output class of the number and kind.

## 30.6 The Algorithm Simulation

Validation of intrusion detection engine data set is the United States Department of Defense Advanced Research Projects Agency (DARPA) and MIT by Lincoln

**Table 30.1** Simulation comparisons of two algorithms

Algorithm category	Known attack		Unknown attack	
	Detection rate	Error rate	Detection rate	Error rate
Improved detection algorithm	97.82	12.3	95.4	22.1
General immune algorithm	95.21	17.8	89.3	42.3

laboratories jointly launch the intrusion detection system (IDS) evaluation plan kddcup99. Select samples from KDDCUP99 selects 10,000 records as a training sample of test1, which is connected to 9,720, occupy 97.3 %, attack to connect 280 accounted for 2.7 %, meet the normal connection is much larger than the abnormal connection requires [7]. Choose two groups test sample test2 and test3, there were 10,000 records, including normal connection and abnormal connection account for 95 % and 5 % respectively, and by test1 existing attack category and other attacks of category. For sample properties, this paper according to the need of selected 31 features simulation experiments, including basic features six, other features 25, set the number of categories 8, danger signals valve set to for 220. We will generally intrusion detection engine algorithm based on immune, and the design of the opposite sex antigen classification algorithm can come to the comparison of the results, as is shown in Table 30.1:

From the result, we can clearly know, classification algorithm based on immune antigens the design of intrusion detection engine, whether in the detection rate, or in error rate performance can be improved efficiently.

### 30.7 Summary

This paper is to design an intrusion prevention system model based on immune, and use the method of mathematical reasoning to prove its intrusion prevention system for the detection engine of the successful improvement. In reality, it reduces the false alarm rate and based on the immunity principle characteristics, we put forward a classification algorithm of immune antigen, and present the detailed design steps, the experiment proved part, and give specific experiments.

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# Chapter 31

## Research on Tourism Economic Early Warning Model

Jiagui Wang and Jianhua He

**Abstract** According to the development status of China's tourism industry to study tourism industry risk and crisis prevention mechanism, the establishment of tourism economic early warning model is proposed, the model is divided into clear warning, tracing the warning source, alarm analysis, alarm level, and the logical process of alarm suffer release. At the same time, to establish the tourism economic early warning model framework and to analyze the tourism economic early warning model factor, and then to calculate the tourism economic early warning model index factor weighting from the target layer and the rule layer. Finally, the establishment of tourism economic early warning index to improves the development of tourism industry and the defense ability to resist unexpected events.

**Keywords** SPSS statistical analysis · Comprehensive index · Evaluation system operation mechanism · Early warning model

### 31.1 Introduction

With the development of social economy, Chinese tourism industry follows the pace of the times to carry on the rapid development. China is the major tourist destination, it is large size. However, since the policy of opening to the outside world, tourism market competition is very intense, at the same time tourism market is not dominant in the capital, talent, management technology, and in other aspects. Therefore, the risk and crisis of China's tourism industry often occur

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[1, 2]. In order to reduce the development of the tourism industry, at the same time, raise our country tourism on the market volatility forecast and regulation, the establishment of tourism economic early warning system model has the important value and significance [3, 4].

## **31.2 Construction of Tourism Economic Early Warning Model**

Travel warning generally includes the following aspects: clear alarm, tracing alarm source, alarm analysis, the police had to lift and logical process, alarm level, and the logical process of alarm suffer release [5]. Therefore, the tourism warning model system carries on five categories to establish: (1) the tourism warning signal monitoring module, namely the tourism warning signal monitoring module is used as the scientific tourism early warning index system, which can reflect in a timely when the tourism industry appears the abnormal phenomena in the development of modern science, and to signal the way back to module system; (2) travel alarm source query analysis module, namely according to established tourism economic early warning model index system factor carries on alarm source query analysis system; (3) travel warning sign recognition module, namely all key aspects of the tourism warning model system carry on system analysis and warning sign identification, it can identify a variety of bad omens before occurrence warning, and judge the warning sign of type; (4) travel warning degree analysis and investigation, namely to measured and predicted the severity of travel economic model system police intelligence, and to judge the occurred alarm, warning sign and a series of forecast system. Therefore, according to the actual situation of the tourism warning, warning degree is divided into four levels: safety, mild warning, moderate warning, and serious warning [6–8] (Fig. 31.1).

## **31.3 Analysis of Tourism Economic Early Warning Model Factor**

This paper mainly uses a weighted average to process the data, then adopting SPSS statistical software to analyze the data statistics, thereby calculating tourist market boom index (CI), and constructing the CI index trend chart, these can be seen from Table 31.1 and Fig. 31.2 [9, 10].

From Table 31.1 and Fig. 31.2, the tourist market boom index can be shown tourism boom's consistent index, indicator and lagging indicators are in a state of constant change from 2007 to 2011; consistent index has rose from 108.6 in 2007 to 124.1 in 2011, however, it has decreased slightly from 2008 to 2007, and has decreased more from 2010 to 2008; the smallest consistent index is the value of



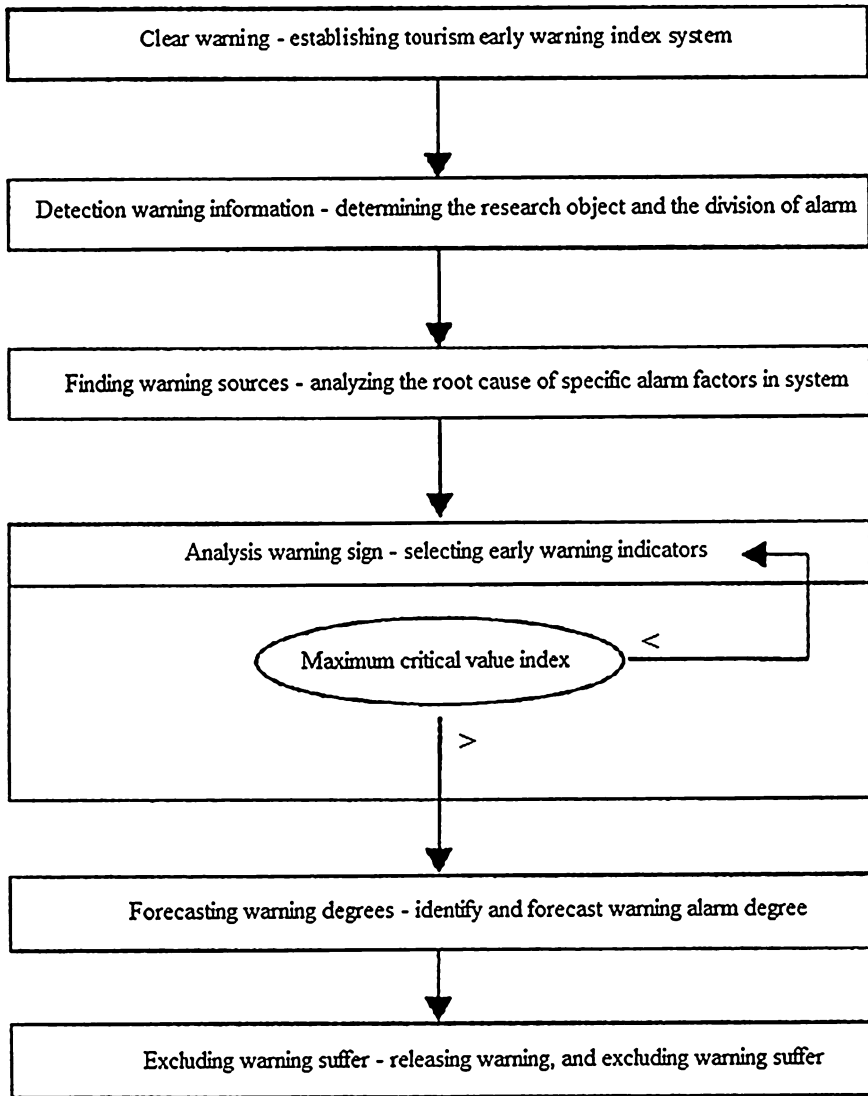


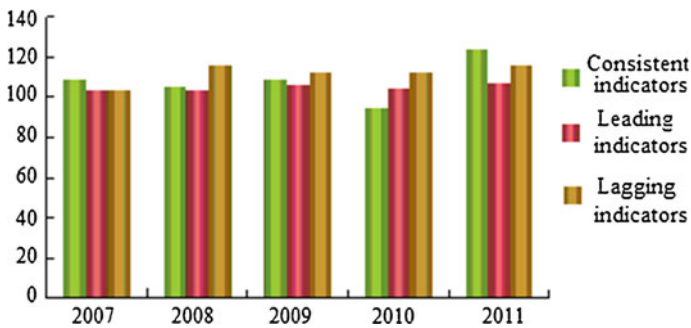
Fig. 31.1 Tourism economic early warning model framework chart

Table 31.1 Tourist market climate index (CI)

Years	Consistent indicators	Leading indicators	Lagging indicators
2007	108.6	103.1	103.5
2008	104.9	103.2	115.6
2009	109.1	106.1	112.6
2010	94.6	104.5	112.7
2011	124.1	106.9	116.1

**Table 31.2** Tourism economic early warning index table

Tourism economic early warning index	O	Industry difficulty	N7
Macro indicators	B1	Management level	N8
Micro indicators	B2	Profit	N9
View indicators	B3	Market share	N10
Overall economic income	N1	Labor productivity	N11
Total number	N2	Talent mobility	N12
State financial contribution ratio	N3	Technical innovation	N13
Equilibrium degree	N4	Credibility	N14
Policy mandatory	N5	Cooperation ability	N15
Competitive advantage concentration degree	N6	Crisis consciousness	N16



**Fig. 31.2** Tourism market climate index (CI) tendency chart

2010, the biggest is 2011 numerical. The antecedent indicators are basically showing the upper and lower fluctuation trends, the maximum value is 106.9 in 2011, the minimum value is 103.1 in 2007. The lagging indicator minimum value is 103.5 in 2011, the minimum value is 116.1 in 2007.

According to the tourism economy related literature, tourism economic early warning index system level index is constructed from three dimensions that are the macro, meso, and micro; two index has 16 indicators, including economic gross income, the total number, national finance contribution ratio, equilibrium degree, policy mandatory, competitive advantage, industry difficulty, management level, profit, market share, labor productivity, talent mobility, technology innovation, credibility, cooperation ability, and t crisis consciousness [11, 12].

According to evaluation index of the economic early warning model in Table 31.1, to analyze evaluate level factor weight:

Objective level O (Table 31.2).

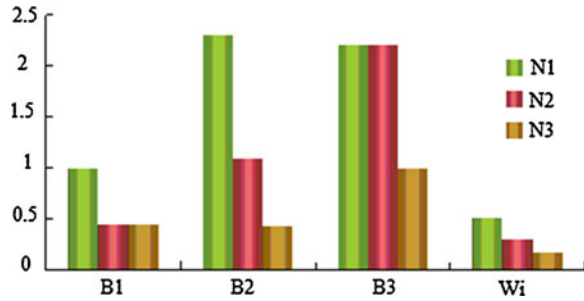
Objective level has macro early warning index factor B1, medium early warning index factor B2, and micro early warning index factor B3; its weight calculation results are shown in Table 31.3.

(1) Criteria level N1

**Table 31.3** Judgment matrixes of the tourism economy warning two indicators warning

O	B1	B2	B3	Wi
N1	1	2.3	2.2	0.52
N2	0.45	1	2.2	0.31
N3	0.45	0.43	1	0.18

**Fig. 31.3** Judgment matrix comparison of the tourism economic early warning two grade index warning



**Table 31.4** Tourism macro economic early warning judgment matrixes

B1	N1	N2	N3	N4	N5	Wi
N1	1	1.5	0.45	0.45	0.45	0.12
N2	0.68	1	0.45	0.45	0.45	0.11
N3	2.23	2.23	1	0.45	0.45	0.18
N4	2.23	2.23	2.23	1	2.23	0.34
N5	2.23	2.23	2.23	2.23	1	0.25

The criterion layer belongs to macro early warning index hierarchy, which has five evaluation factors that are respectively the economic gross income N1, the total number N2, the state financial contribution ratio N3, the equilibrium degree N4, and the policy mandatory N5. The judgment matrix calculation results are shown in Table 31.4.

The use of analytic hierarchy process in the evaluation methods, to analyze the index factor of tourism economic early warning model can obtain the weight values of every evaluation index; it can be seen in Table 31.5.

**Table 31.5** Tourism economic early warning index weight value

Overall economic income N1	0.07	Profit N9	0.01
Total number N2	0.06	Market share N10	0.01
State financial contribution ratio N3	0.1	Labor productivity N11	0.02
Equilibrium degree N4	0.16	Talent mobility N12	0.02
Policy mandatory N5	0.13	Technical innovation N13	0.93
Competitive advantage concentration degree N6	0.1	Credibility N14	0.04
Industry difficulty N7	0.05	Cooperation ability N15	0.02
Management level N8	0.16	Crisis consciousness N16	0.05

### 31.4 Comprehensive Evaluation Index of Tourism Economic Warning

The tourism economic early warning model’s comprehensive evaluation basically has the following steps:

1. On the basis of tourism economic early warning model research target, and to combine relevant design methods, to set related monitoring levels of five indicator factors in the tourism economic early warning model, namely a serious warning, mild alarm, economic security, economic good, and ideal state. Tourism economic early warning evaluation set is denoted by B, which is expressed as  $B = \{B1, B2, B3, B4, B5\}$ .
2. In the tourism economic early warning index system model, the evaluation index shows the importance degree, which need to undertake corresponding score set, namely  $Fi$ , and  $Fi$  can select the scope to take the integer index, namely  $Fi \in [1, 8]$ .
3. The tourism economic early warning comprehensive evaluation factors index value is set to K, its formula is

$$K = \sum Wi \cdot Fi / 8$$

Where,  $Wi$  is the weight value of the  $i$ -th factor

Therefore, the tourism economic early warning takes a computational approach, i.e. quantifying the effect of tourism development factor index analysis and the changes of each factor index to carry on quantitatively, which can accurately reach determine the risk probability and the purpose of comprehensive economic early warning (Table 31.6).

**Table 31.6** Early warning value of the tourism economic early warning model

Y	$0 \leq Y < 0.3$	$0.3 \leq Y < 0.5$	$0.5 \leq Y < 0.7$	$0.7 \leq Y < 0.9$	$0.9 \leq Y < 1$
X	Serious warning	Mild warning	Economic security	Economic good	Ideal state

## 31.5 Conclusion

At present, the tourism economic early warning system model also needs long-term practice research, according to foreign countries have established the complete tourism economic early warning to buy the model, to establish China's own tourism economic early warning model. It is helpful to improve the rapid development of tourism industry and defense of ability against unexpected events. At the same time, to strengthen the macrocontrol of tourism economy, the timely provision of tourism climate index and related tourism economic early warning risk signal, these give some protection to the rapid and healthy development of the tourism economy.

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# Chapter 32

## One Commutativity Condition of Jacobson Semi-Simple Ring

Hui Zhao and Xin Song Yang

**Abstract** The study of ring commutativity was beneficial for discussion of some properties about rings. At the same time, commutative rings were studied in Commutative Algebra. To study some important properties on rings, study of commutativity of rings became more and more important. He used some methods and theorems from the literature on the central element, and then gave some proof about semi-prime ring commutativity conditions. When  $R$  is the division ring or  $R$  is J-semi simple ring, he hierarchically certificate that ring is commutativity, given the final conclusions, other conclusions can be proof similarly. It is the promotion of some conclusions, by weakening conditions; it had a broader range of applications.

**Keywords** Semi-prime ring · Non-zero divisor · Commutativity

### 32.1 Introduction

As an important algebraic subject, rings are the base on Algebraic Geometry and Algebraic Number Theory [1–3]. Rings are concerned about many other subjects. With development of science and technology, theory on rings is increasingly accurate and perfect. Preliminary results of rings have been applied in practice.

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Consequence, property of rings is needed to investigate. Commutativity is one of important properties on rings. Study of commutativity is beneficial for discussion of other properties on rings [4, 5]. At the same time, commutative rings are studied in Commutative Algebra. Therefore, study of commutativity of rings becomes more and more important.

The rings in this paper are associative rings, and  $Z(R)$  is center of rings. This article was [1] the promotion of the conclusions, by weakening conditions, it had a broader range of applications.

### 32.2 Proof of Theorem

**Theorem 1** Let  $R$  be a semi-prime ring [6, 7],  $a \in R$  and  $2a$  is not zero-divisor, If  $R$  satisfies one of the following conditions in this paper, then  $R$  is commutative.

- (1)  $\left[ (xa)^2 + x^2a^2, y \right] \in Z(R), \forall x, y \in R$
- (2)  $\left[ (xa)^2 + x^2a^2, y \right] \in Z(R), \forall x, y \in R$
- (3)  $\left[ (xa)^2 + x^2a^2, y \right] \in Z(R), \forall x, y \in R$
- (4)  $\left[ (xa)^2 + x^2a^2, y \right] \in Z(R), \forall x, y \in R$
- (5)  $\left[ (xa)^2 + xa^2x, y \right] \in Z(R), \forall x, y \in R$
- (6)  $\left[ (xa)^2 + ax^2a, y \right] \in Z(R), \forall x, y \in R$
- (7)  $\left[ (xa)^2 + xa^2a, y \right] \in Z(R), \forall x, y \in R$
- (8)  $\left[ (xa)^2 + xa^2x, y \right] \in Z(R), \forall x, y \in R$

#### 32.2.1 *S If We Know $\left[ (xa)^2 + x^2a^2, y \right] \in Z(R), \forall x, y \in R$ , We Want to Proof is Commutative*

##### 32.2.1.1 $R$ is the Division Ring

If  $R$  is the division ring [8], let  $(xa)^2 + x^2a^2 = b \in R, \forall x, y \in R$ , then  $[b, y] \in Z(R), \forall x, y \in R$ . So  $[[b, y], y] = 0$ , that is  $(by - yb)y - y(by - yb) = 0$ , so

$$y^2b + by^2 = 2yby \tag{32.1}$$

Again by  $[b, y] \in Z(R)$ , knows  $[[b, y], b] = 0$ .

$$b^2y + yb^2 = 2byb \tag{32.2}$$

By  $b \times (1)$ , obtains

$$by^2b + b^2y^2 = 2byby \tag{32.3}$$

By  $(2) \times y$ , obtains

$$b^2y^2 + yb^2y = 2byby \tag{32.4}$$

(3)-(4) is

$$by^2b = yb^2y \tag{32.5}$$

If  $y = 0$ , then  $[b, y] = 0$ , so if  $y \neq 0$ , it shows that  $y$  is reversible. By the formula (1), (2), (3), we has the following calculation.

$$\begin{aligned} (b - y^{-1}by)y^2(b - y^{-1}by) &= by^2b - byby - y^{-1}yb^2yy \\ &= by^2b - byby - y^{-1}by^3b + b^2y^2 = 2byby - byby - y^{-1}by^2bb^{-1}yb \\ &= byby - y^{-1}yb^2yb^{-1}yb = byby - b(yb^{-1})b^2(yb^{-1})b = 0 \end{aligned}$$

If  $R$  is the division ring, the ring  $R$  has not zero-divisor; and  $y \neq 0$ , so we obtain  $b - y^{-1}by = 0$ , so  $by = yb$ . that is  $[(xa)^2 + x^2a^2, y] = 0 \quad x \in R, (xa)^2 + x^2a^2 \in Z(R), \forall x, y \in R$ , by the literature [1] theorem we know: division ring  $R$  is commutative division ring.

### 32.2.1.2 $R$ is J-Semisimple Ring

If  $J(R) = 0$ , then the ring  $R$  is J-semi simple ring, J-semi-ring is subdirect product of primitive ring, we know  $a \in R, 2a$  is non-zero divisor, so  $a \neq 0$  and  $J(R) = 0, a \notin J(R)$ . And  $J(R)$  is the intersection of all primitive ideals, so by  $a \notin J(R)$ , there exists a primitive ideal  $P$ , it makes  $a \notin P, P$  is primitive ideal, and know  $\frac{R}{P}$  is primitive ring.

In the ring  $R$ , we know  $[(xa)^2 + x^2a^2, y] \in Z(R), \forall x, y \in R$ , and assume  $[(xa)^2 + x^2a^2, y] \neq 0, \exists x, y \in R$ , so  $R$  is not commutative ring, by the above methods, there is another primitive ideal  $Q$ , it makes  $[(xa)^2 + x^2a^2, y] \notin Q$ , because  $0 = J(R) = \cap N_i (N_i \text{ is primitive ideal of } R), \exists \bar{x}, \bar{y} \in R/Q$  in the  $R/Q, [(\bar{ax})^2 + \bar{a}^2\bar{x}^2, \bar{y}] \neq \bar{0}$  is obtained,  $R/Q$  is not commutative primitive ring and satisfies the conditions of theorem.



But the primitive ring is isomorphic to the full matrix ring on some division ring,  $R/Q$  is non-commutative ring, so  $R/Q$  has the full matrix ring  $D_{(2)}$  satisfies the conditions of theorem.

But  $\forall a \in D_{(2)}$ , set  $a = \begin{pmatrix} a_1 & a_2 \\ a_3 & a_4 \end{pmatrix}$  there is  $x = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, y = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$ , so  $[(xa)^2 + x^2a^2, y] \neq 0$ , and  $[(xa)^2 + x^2a^2, y] = \begin{pmatrix} 0 & 2a_1a_2 + a_2a_4 \\ 0 & 0 \end{pmatrix} \notin Z(D_{(2)})$ , so  $D_{(2)}$  does not exist  $a$  to make  $[(xa)^2 + x^2a^2, y] \in Z(D_{(2)})$ ,  $\forall x, y \in Z(D_{(2)})$ . It conflict with the theorem, so there is no such primitive ring  $R/Q$  and the primitive ideal  $Q$ , to makes  $[(xa)^2 + x^2a^2, y] \notin Q$ , therefore  $[(xa)^2 + x^2a^2, y] \in J(R)$ ,  $[(xa)^2 + x^2a^2, y] = 0$ , it is a contradiction with hypothesis. That is  $[(xa)^2 + x^2a^2, y] = 0, \forall x, y \in R, [(xa)^2 + x^2a^2, y] \in Z(R)$ , by the literature [1] theorem: J-semi-simple ring  $R$  commutative ring.

If  $J(R) \neq 0, a \in J(R)$ , then  $(xa)^2 + x^2a^2 = b \in J(R)$ , that is  $1 + b$  is reversible. By the formula (32.1), (32.2), (32.3), we can obtain

$$\begin{aligned} y(1 + b)^2y &= y^2 + 2yby + yb^2y = y^2 + y^2b + by^2 + by^2b \\ &= y^2(1 + b) + by^2(1 + b) = (1 + b)y^2(1 + b) \end{aligned} \tag{32.6}$$

By (32.1), (32.2), (32.3) again, there are

$$y^2(1 + b)(1 + b)y^2 = 2y(1 + b)y \tag{32.7}$$

$$(1 + b)^2y + y(1 + b)^2 = 2(1 + b)y(1 + b) \tag{32.8}$$

By (32.6), (32.7), (32.8), there are

$$\begin{aligned} &[y - (1 + b)^{-1}y(1 + b)](1 + b)^2[y - (1 + b)^{-1}y(1 + b)] \\ &= y(1 + b)^2y - (1 + b)^{-1}y(1 + b)^3y + (1 + b)^{-1}y(1 + b)^2y - y(1 + b)y(1 + b) \\ &= y(1 + b)^2y - y(1 + b)y(1 + b) - (1 + b)^{-1}y(1 + b)^3y + y^2(1 + b)^2 \\ &= y[(1 + b)^2yy(1 + b)^2] - y(1 + b)y(1 + b) - (1 + b)^{-1}y(1 + b)^3y \\ &= y(1 + b)y(1 + b) - (1 + b)^{-1}(1 + b)y^2(1 + b)y^{-1}(1 + b)y \\ &= y(1 + b)y(1 + b) - y(1 + b) - y^{-1}y^2(1 + b)y^{-1}y = 0 \end{aligned}$$

So

$$[y - (1 + b)^{-1}y(1 + b)](1 + b)^2[y - (1 + b)^{-1}y(1 + b)] = 0 \tag{32.9}$$

$(1 + b) \times (1.9)$  is

$$[(1 + b)y - y(1 + b)](1 + b)[(1 + b)y - y(1 + b)] = 0 \tag{32.10}$$

$(1 + b) \times (1.10)$  is  $\{(1 + b)[(1 + b)y - y(1 + b)]\}^2 = 0, [(1 + b)(by - yb)]^2 = 0,$  because of  $[b, y] \in Z(R),$  that is  $(1 + b)^2(by - yb)^2 = 0,$  and because  $1 + b$  is reversible,  $(by - yb)^2 = 0.$

Because semi-prime ring is subdirect product of prime ring,  $[b, y] = 0, \forall y \in R,$  that is  $(xa)^2 + x^2a^2 \in Z(R),$  by the literature [1] theorem: J semi-prime ring R is commutative ring.

If  $a \in J(R), y \in J(R),$  so  $1 + y$  is reversible, by(32.1), (32.2), (32.3), we can obtains

$$b(1 + y)^2b = b^2by^2b + 2byb = b^2 + b^2y + yb^2y = (1 + y)b^2(1 + y) \tag{32.11}$$

And by (32.1), (32.2), (32.3), we can obtain

$$b^2(1 + y) + (1 + y)b^2 = 2b(1 + y)b \tag{32.12}$$

$$(1 + y)^2b + b(1 + y)^2 = 2(1 + y)b(1 + y) \tag{32.13}$$

So

$$\begin{aligned} & [b - (1 + y)^{-1}b(1 + y)](1 + y)^2[b - (1 + y)^{-1}b(1 + y)] \\ &= b(1 + y)^2b + b(1 + y)^2 - b(1 + y)b(1 + y) - (1 + y)^{-1}b(1 + y)^3b \\ &= 2b(1 + y)b(1 + y) - b(1 + y)b(1 + y) - (1 + y)^{-1}b(1 + y)^2bb^{-1}(1 + y)b \\ &= b(1 + y)b(1 + y) - bb((1 + y)b^{-1})^2bb \\ &= b(1 + y)b(1 + y) - b((1 + y)b^{-1})^2b^2((1 + y)b^{-1})b = 0 \end{aligned}$$

And then  $[b, y] = 0, \forall y \in J(R),$  so  $b$  and  $J(R)$  is com mutative.

$\forall z \in R, y \neq 0, y \in J(R),$  there is  $b(zy) = zyb = zby, (bz - zb)y = 0,$  because of  $bz - zb \in Z(R),$  so  $[b, z] = 0, \forall z \in R,$  that is  $b \in Z(R),$  by the literature [1] theorem: J semi-prime ring R is commutative ring.

**32.2.2 If We Know  $[(xa)^2 + x^2a^2, y] \in Z(R), \forall x, y \in R,$  We Want to Proof R is Commutative**

We only need proof that there is not a in  $D_{(2)}$  to make  $[(xa)^2 + x^2a^2, y] \in Z(D_{(2)}), \forall x, y \in R.$

*Proof*  $\forall a = \begin{pmatrix} a_1 & a_2 \\ a_3 & a_4 \end{pmatrix}$ , exist  $x = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ ,  $y = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$ , make  $0 \neq [(xa)^2 + x^2a^2, y], [(xa)^2 + x^2a^2, y] \notin Z(D_{(2)}), \forall x, y \in R$ .

### 32.3 Summary

We can proof (3)  $\sim$  (8) similarly by the same way.

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# Chapter 33

## Economic Forecasting Based on Time Series Analysis

Qiaoling Feng

**Abstract** To analyze and formulate economic development target and policy, predicting the future value of China's per capita GDP is very important. The economic time series will be pretreated for constructing prediction model by statistical software SPSS and Views through exponential smoothing method and ARIMA model. The conclusion is that China's per capita GDP from 2012 to 2016 was predicted. Statistical results show that China's per capita GDP is steadily improving.

**Keywords** Per capita GDP · Exponential smoothing method · ARIMA model

### 33.1 Introduction

The gross domestic product (GDP) refers to the final outcome of production activities of all resident units in a country or region during a given period, which is one of the most important economic indicators reflecting the national economic activities [1, 2]. Scientific prediction of the indicators has important theoretical and practical significance on the development of economic development goals, matching guidelines and policies [3].

The economic forecasting is to research objective economic process during a certain period of development trend [4]. With the aim to understand future economic activities, though the research of phenomenon of objective economic laws

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of history and current status, it can determine the level of social-economic activities' development, providing a basis for decision-making.

This paper intends to predict and analyze the future economic development of China. The data was 1952–2011 annual per capita GDP (Table 33.1, [5–7]). On basis of the data, a model will be constructed to predict and test predictions for the next 5 years' per capita GDP (from 2012 to 2016).

### 33.2 Selection of Statistical Methods

Data and information are the foundations of prediction. Generally, data and information are collected based on the set predictive goals and influencing factors. They are analyzed and pretreated by combining with the prediction models which have been preliminarily decided, and then proper prediction models will be selected.

Time series are a kind of research dealing with relevant structures which change with time [8]. It is widely applied, ranging from oceanography to economics. Most of economic time series have tendency, through which the future value can be analyzed with the current and the past value of time. As we know, time series analysis can be divided into definite time series analysis and random time series

**Table 33.1** Per capita GDP time series data (1952–2011) in China (Unit: RMB)

Years	Ave GDP	Years	Ave GDP	Years	Ave GDP
1952	119	1972	292	1992	2311
1953	142	1973	309	1993	2998
1954	144	1974	310	1994	4044
1955	150	1975	327	1995	5046
1956	165	1976	316	1996	5846
1957	168	1977	339	1997	6420
1958	200	1978	381	1998	6796
1959	216	1979	419	1999	7159
1960	218	1980	463	2000	7858
1961	185	1981	492	2001	8622
1962	173	1982	528	2002	9398
1963	181	1983	583	2003	10542
1964	208	1984	695	2004	12336
1965	240	1985	858	2005	14653
1966	254	1986	963	2006	16165
1967	235	1987	1112	2007	19524
1968	222	1988	1366	2008	22698
1969	243	1989	1519	2009	25605
1970	275	1990	1644	2010	29748
1971	288	1991	1893	2011	34650

*Data Source* Sort according to China Statistical Yearbook

analysis, which also have different subtypes according to index method and model method.

The experience of the former scholars shows that prediction of random time series analysis has fewer errors than that of definite time series analysis. In time series, prediction of model method has less error than index method. There is more than one solution to cause problems. This paper intends to choose exponential smoothing method in definite time series analysis and ARIMA model in random time series analysis.

### ***33.2.1 Exponential Smoothing Method***

Exponential smoothing method is the improvement and development of moving average method, which does not need to store much former data, but includes the importance of data at every period, and used all the historical data. The estimate of exponential smoothing method is nonlinear, whose goal is to make the variance (MSE) minimum between the predictive value and the measured value.

Predictive models of exponential smoothing can be built with exponential smoothing formulas. In principle, no matter how complex the basic trend of the series is an almost perfect model can always be built with high times exponential smoothing formulas. Because the calculation is so large, few low-order predictive models of exponential smoothing are used more often.

Exponential smoothing model predicts the future based on the present moment  $T$  as a starting point, combining time series data. Choosing the appropriate weighted coefficient  $\alpha$  is the critical thing to improve the precision of the prediction. According to practical experience, the generally advisable  $\alpha$  value scope is within 0.1–0.3. The best value of  $\alpha$  is often further determined through combining theoretical analysis and model comparison.

### ***33.2.2 ARIMA Model***

ARIMA model ( $p, d, q$ ) is also known as regression summation moving average model. Which means the AR regression,  $p$  to model regression item number; MA for moving average,  $q$  to model a moving average number; I refer to integral, and  $d$  for time series, becoming stable must take the difference between the number of times the basic idea can be summarized as follows modeling:

According to the time series of scatter plot chart, the autocorrelation function (ACF) figure and partial autocorrelation function (PACF) drawing, and ADF unit root test to observe its variance, tendency, and the seasonal change rule, identify the sequence and steadiness [9, 10].

Smooth processing of the data. If the data is not smooth series, if there are certain growth or down trend, etc., it is required to use the data processing

difference; If the data series exhibit heteroskedasticity, it is required to use data to convert or logarithm square root processing, until the data processing of the autocorrelation function values and partial correlation function value without significance differs from zero.

According to the identification rules of the time series model, set up a corresponding model.

For parameter estimation, estimate the tentative model parameters and check the statistical significance.

To test the hypotheses, diagnose white noise. Test model of residual that value and PACF value in ACF early or seasonal delay points must not be more than a confidence interval, and residual should be zero can observe the mean ideal for residual ACF figure and PACF figure, supplemented by D-W value  $t$  value and so on the inspection.

### 33.3 Process of Statistical Analysis

#### 33.3.1 Process of Exponential Smoothing Method

Before choosing a model, using Excel first look at the per capita GDP (1952–2011) of line charts for qualitative analysis, and then select the appropriate model to undertake quantitative analysis results, as shown in Fig. 33.1.

It can be seen from Fig. 33.1 that per capita GDP (1952–2011) with a clear trend, this socio-economic phenomenon can be viewed as a sample implementation of the random process in reality. The figure shows that per capita GDP (1952–2011) remains exponential growth trend, especially in 1978 after the reform

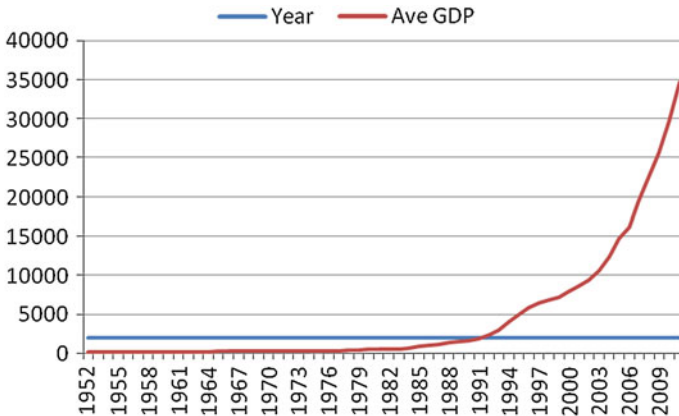


Fig. 33.1 Per capita GDP (1952–2011) time series variation of line graph

and opening up, which shows a strong growth trend. From the variation of per capita GDP, this is a nonstationary series, obviously on the rise.

The following is the exponential smoothing forecast that uses SPSS statistical software, according to the Analyze—Time series—Exponential Smoothing in order to expand the Exponential Smoothing, the main dialog box. There are four kinds of models, they are Simple, Holt, Winters, Custom. These models in its trend according to the need adopt the Custom model here.

### 33.3.2 Process of ARIMA Model Analysis

ARIMA model does not use the economic theory as the guide, but build the model based on the characteristics of time series structure and predict by using extrapolation mechanism. Per capita GDP can be seen from Fig. 33.1, with a clear growth trend, the preliminary identification is nonstationary, and unit root test results (Table 33.2) also confirmed this.

From the Table 33.2, we can see that the test *t*-statistic value 2.216880 is greater than the significant level of 1 % critical value and the results of qualitative analysis are consistent. It is that per capita GDP (1952–2011) shows a nonstationary trend.

#### 33.3.2.1 Model Identification

Using Views to make per capita GDP's (1952–2011) autocorrelation and partial autocorrelation analysis chart, we choose a lag period of  $k = 15$ , according to the of “general  $k = [n/10]$  or  $[n/4]$  ( $n$  is the sample size, and brackets indicate rounding operator)”. Differentially, autocorrelation diagram showing the nonstationary, the partial correlation was 0 when coefficient partial autocorrelation plot in  $k = 1$ , and it was in the confidence interval edge when  $k = 2$ , and values are in the range when  $k > 3$ , it can be considered that the partial autocorrelation function of series has censoring resistance. Without the difference from autocorrelation and partial autocorrelation were shown in Table 33.3:

The correlation picture is still nonstationary after the first order difference to eliminate the nonstationary sequence basing on  $k = 15$ . It is better to eliminate nonstationary by taking the natural logarithm before the first order difference. Table 33.4 shows next of correlation and partial correlation.

**Table 33.2** Result of unit root test

ADF test statistic	2.216880	1 % Critical Value <sup>a</sup>	-3.5625
		5 % Critical Value	-2.9190
		10 % Critical Value	-2.5970

<sup>a</sup> MacKinnon critical values for rejection of hypothesis of a unit root



**Table 33.3** Per capita GDP (1952–2011) to correlation and Partial Correlation No difference)

Auto correlation	Partial correlation		AC	PAC	Q-Stat	Prob
.  *****	.  *****	1	0.894	0.894	44.800	0.00
.  *****	.  .	2	0.805	0.031	81.881	0.00
.  *****	.  .	3	0.723	-0.010	112.40	0.00
.  *****	.  .	4	0.643	-0.036	136.98	0.00
.  *****	.  .	5	0.565	-0.030	156.40	0.00
.  *****	.  .	6	0.492	-0.027	171.41	0.00
.  ****	.  * .	7	0.416	-0.060	182.36	0.00
.  ****	.  * .	8	0.336	-0.072	189.66	0.00
.  ***	.  * .	9	0.257	-0.058	194.02	0.00
.  **	.  .	10	0.184	-0.031	196.32	0.00
.  *	.  .	11	0.124	0.006	197.38	0.00
.  *	.  .	12	0.080	0.036	197.84	0.00
.  .	.  .	13	0.046	0.023	197.99	0.00
.  .	.  .	14	0.019	0.007	198.02	0.00
.  .	.  .	15	0.013	0.001	201.05	0.00

**Table 33.4** Average GDP (1952–2011) autocorrelation and partial correlation (first order difference)

Auto correlation	Partial correlation		AC	PAC	Q-Stat	Prob
.  .	.  .	1	0.013	0.013	0.0089	0.925
** .	** .	2	-0.218	-0.218	2.6248	0.269
*** .	*** .	3	-0.330	-0.340	8.7558	0.033
.  * .	** .	4	-0.158	-0.260	10.194	0.037
.  *	.  * .	5	0.074	-0.142	10.514	0.062
.  **	.  .	6	0.201	-0.032	12.943	0.044
.  *	.  *	7	0.194	0.083	15.256	0.033
.  * .	.  * .	8	-0.126	-0.109	16.247	0.039
.  * .	.  .	9	-0.123	-0.014	17.218	0.045
.  .	.  *	10	0.006	0.104	17.221	0.070
.  .	.  .	11	-0.012	-0.030	17.230	0.101
.  * .	.  * .	12	-0.069	-0.159	17.557	0.130
.  *	.  .	13	0.089	0.030	18.122	0.153
.  .	.  .	14	0.019	-0.043	18.149	0.200
.  .	.  .	15	0.013	0.023	18.185	0.247

The autocorrelation of time series sample was attenuation sine wave to zero and showing for the tail. Lag three and six correlation coefficients are significantly nonzero by taking  $q = 3$  or  $4$ ; the sequence can be initially established the AR (3) because of cut-off tail for  $k > 3$ . Comprehensively, we established the ARIMA (3, 1, 3) and ARIMA (3, 1, 4).

**Table 33.5** ARMA (3, 3) parameter estimation and results of inspection

Variable	Coefficient	Std. Error	<i>t</i> -Statistic	Prob.
AR(3)	1.054002	0.028939	36.42214	0.0000
MA(3)	-0.938839	0.058032	-16.17798	0.0000
R-squared	0.020445	Mean-dependent var		0.086708
Adjusted R-squared	-0.000396	S.D.-dependent var		0.085077
S.E. of regression	0.085094	Akaike info criterion		-2.050156
Sum squared reside	0.340328	Schwarz criterion		-1.972939
Log likelihood	52.22882	Durbin-Watson stat		0.923179
Inverted AR roots	1.02	-0.51 -0.88i	-0.51 + 0.88i	
<i>Estimated AR process is non-stationary</i>				
Inverted MA roots	.98	-.49 -.85i	-.49 + .85i	

### 33.3.2.2 Model Estimation

Selecting Quick/Estimate Equation by Views, the result is shown in Table 33.5.

The results of the two parts above in Tables 33.5 and 33.6 are the same with that of OLS. But it is not as strict in the request of *t* test parameters level of significance as in the regression equation; we are likely to consider more about the whole model fitting effect. Adjusted *r*-squared figures, AIC and SC criterions are vital standards when choosing the model. The figures lagging behind the reciprocal of the polynomial roots in the chart below, utilizing the plural knowledge to identify that they are all in the circle, meet the requirement.

In Table 33.6, the figures of AIC and SC are -1.763173 and -1.685956, both bigger than -2.050156 and -1.972939; thus, we believe that the ARMA (3, 3) is more suitable.

### 33.3.2.3 Model Checking

After parameter estimation, we operate on the checking of model fit which is the residual series white noise test. Usually, we give emphasis on the inspection

**Table 33.6** ARMA (3, 4) parameter estimation and results of inspection

Variable	Coefficient	Std. Error	<i>t</i> -Statistic	Prob.
AR(3)	1.030861	0.040170	25.66216	0.0000
MA(4)	-0.933896	0.041509	-22.49864	0.0000
R-squared	-0.305160	Mean-dependent var		0.086708
Adjusted R-squared	-0.332929	S.D.-dependent var		0.085077
S.E. of regression	0.098224	Akaike info criterion		-1.763173
Sum squared resid	0.453453	Schwarz criterion		-1.685956
Log likelihood	45.19774	Durbin-Watson stat		1.344173
Inverted AR roots	1.01	-.51 -.87i	-.51 + .87i	
<i>Estimated AR process is non-stationary</i>				
Inverted MA roots	.98			

**Table 33.7** Autocorrelation and partial correlation adapting for residual error series

Autocorrelation	Partial correlation		AC	PAC	Q-Stat	Prob
. * .	. * .	1	-0.127	-0.127	0.8366	0.360
. * .	. * .	2	-0.067	-0.084	1.0746	0.584
. * .	. * .	3	-0.061	-0.083	1.2760	0.735
. * .	. * .	4	-0.136	-0.167	2.3107	0.679
. * .	. * .	5	-0.080	-0.145	2.6709	0.751
.  * .	.  * .	6	0.173	0.111	4.4123	0.621
.  * .	.  * .	7	0.069	0.076	4.6938	0.697
. * .	. * .	8	-0.104	-0.104	5.3484	0.720
.  .	.  .	9	-0.002	-0.032	5.3486	0.803
.  * .	.  * .	10	0.073	0.112	5.6895	0.841
. * .	.  .	11	-0.089	-0.031	6.2148	0.859
.  .	. * .	12	-0.051	-0.117	6.3936	0.895
.  * .	.  .	13	0.084	0.026	6.8811	0.908
. * .	. * .	14	-0.128	-0.085	8.0517	0.887
. * .	. * .	15	0.093	0.033	8.6327	0.923

residual sequence of random, that is, if  $k > 1$ , the residual sequence of sample regression coefficient should be 0 approximately in which  $m$  is for the biggest lag phase.

The last two rows in Table 33.7 are used for  $\chi^2$  test, Including  $Q$  statistics and the inspection company probability. The series sample size is 60  $m$  standing for the biggest lag phase which can take 15 here. In the row of  $k = 13$ , we can find the test statistics quantity  $Q$  is 6.8811, reading from Prob, we reject the null hypothesis as is the first kind of mistakes, that means the probability of a mistake is 0.908. This indicates that the residual series is independent for which the white noise probability is very large. So we cannot refuse the null hypothesis as sequences are independent, the test is passed.

### 33.4 Conclusion-Predicting Models

In conclusion, model testing is appropriate and practical. Per capita GDP is predicted from 2012 to 2016 by ARIMA (3, 1, 3) model after computing natural logarithm in Table 33.8.

**Table 33.8** Predictive values by ARIMA models (unit: RMB)

Years	2012	2013	2014	2015	2016
Predictive value	40359.77	47624.53	55720.70	65721.85	74265.69

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**Part IV**  
**Project Management and Applications**

# Chapter 34

## Analysis of Fishery Production Efficiency Based on the Three-Stage DEA

Shaowei Shen and Zuiyi Shen

**Abstract** In this paper, we consider empirical studies on fishery production efficiency of the Zhoushan new district based on data envelope analysis (DEA) model of three-stage. The results show that environment variables and random factors do have an effect on fishery production of Zhoushan. The increase of urbanization level and the average year of population education are the favorable factors to improve fishery production; fishermen per capita income and fishery subsidies provided by the government are the adverse factors in the improvement of fishery production efficiency. After eliminating the influence of environment variables and random factors, we get a relatively real efficiency of fishery production in Zhoushan.

**Keywords** Three-stage DEA · Fishery production · Scale efficiency

### 34.1 Introduction

The fishery production is one of the traditional industries of ocean economy of Zhoushan. How to reasonably evaluate fishery production efficiency in Zhoushan and then seek the realistic approaches of improving fishery production; which

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factors influence the fishery production efficiency, and which respects can it be improved from, all these have become the hot spot of ocean economy research.

A lot of scholars have made great contribution to fishery production efficiency research. Sharma and Leung [1] examined the level and determinants of technical efficiency for a sample of domestic longline fishing vessels operated in Hawaii in 1993, using a translog stochastic production frontier including a model for vessel-specific technical inefficiencies. Elhendy [2] estimated the aggregate and per-fishing effort stochastic production function frontier at Red Sea. Pascoe and Coglan [3] examined variations in the efficiency of trawlers operated in the English Channel through the estimation of a stochastic frontier production function. Diana et.al [4] compared stochastic production frontier and DEA approaches to work on factors affecting technical efficiency in fisheries. Herrero [5] applied four different approaches (data envelopment analysis, stochastic production frontiers, panel data, and distance functions) to the Spanish Trawl fishery operated in Moroccan waters. Oliveira et.al [6] used Malmquist index to explore the evolution of productivity of the artisanal dredge fleet operated in the south coast of Portugal. Carvalho et al. [7] used a method that is comparable between and across national/regional fishing fleets to define small- and large-scale fishing operations in the Azores. However, the existing literature on fishery production efficiency studies does not eliminate the influence of environmental and random error which leads to the failure to objectively reflect the decision-making of production units and management level. Therefore, in this paper, based on the related Zhoushan's 2003–2009 data, it is expected to more accurately describe the fishery production efficiency of Zhoushan district with the three-stage DEA model. Meanwhile, the main factors influencing the fishery production efficiency are found, which will provide reliable basis for government decision making.

The next part of this paper is organized in the following way: [Sect. 2](#) outlines model specification and source of data. In [Sect. 3](#), we study efficiency and return to scale of fishery production in Zhoushan. The conclusion and revelation of the main findings in this paper will be briefly presented in [Sect. 4](#).

## 34.2 Three-Stage DEA Model

Three-stage DEA was proposed as a valid evaluation method of DMU efficiency [3]. The most salient characteristic of this method is its ability to remove the factor of external environment and random errors influence on the efficiency. By this method, the calculated values of the efficiency can more truly reflect the internal management level of decision-making unit. Its construction and use include three stages.

The first stage: traditional DEA model (BCC model). The original data envelopment analysis (DEA) provided by Charnes et al. in [8] can be used to evaluate relative efficiency among all decision-making units (DMUs).

The second stage: the stochastic frontier model. Fried et al. (2002) put forward that the slack values got from the first stage were affected by environmental factor, random factors, and management efficiency. We eliminate environmental factors and random factors to get input surplus of DMU that is caused only by the inefficient management. Take input-orient as an example and consider a set of  $n$  DMUs, with each DMU $_j$  ( $j = 1, 2, \dots, n$ ) using  $m$  inputs. If a set of  $p$  observable environment variables make an SFA analysis to slack variable of each DMU, respectively, one could build the following SFA equations:  $s_{ik} = z_k \beta^i + v_{ik} + u_{ik}$

Where  $i = 1, \dots, m; k = 1, \dots, n$ .  $s_{ik}$  denotes slack variable;  $z_k = (z_{1k}, \dots, z_{pk})$  is  $p$  observable environment variables;  $v_{ik} + u_{ik}$  are mixed error term;  $v_{ik} \sim iidN(0, \sigma_v^2)$  denote Random disturbance term,  $u_{ik} \sim iidN^+(\mu, \sigma_u^2)$  denote inefficient Management;  $u_{ik}$  and  $v_{jk}$  are uncorrelated for all  $i$  and  $j$ ,  $j = 1, \dots, m, \gamma = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}$  is the percentage of technology inefficiency variance to total variance. Using the regression results of SFA model, we further adjust the DMU's input, namely, to increase input for those DMU which is good or better luck in environment, so as to eliminate the influence of random factors. The adjustment formula is as follows:

$$\hat{x}_{ik} = x_{ik} + [\max_k \{z_k \hat{\beta}^i\} - z_k \hat{\beta}^i] + [\max_k \{\hat{v}_{ik}\} - \hat{v}_{ik}] \tag{34.1}$$

Where  $x_{ik}$  denotes the real value of input,  $\hat{x}_{ik}$  denotes adjustment value. The first brackets adjust all decision units to the same environment, the second one representative that all random error is adjusted for the same situation, those will make each decision unit face the same business environment and luck.

The third stage: the DEA model after adjustment. With input  $\hat{x}_{ik}$  adjusted on the second phase instead of the original input  $x_{ik}$ , output  $y_{ik}$  is still primitive; we use BCC model again to evaluate efficiency, and thus the efficiency value of each DMU gained on the third stage is the efficiency which has got rid of the impact of the environment factors and random factors.

### 34.3 The Illustration Analysis

#### 34.3.1 Sources and Description of Data

We employ the DEA model of three-stage to examine the fishery production efficiency in Zhoushan new district in the period from 2001 to 2009. The four inputs selected here are Fishery Labor, Fixed assets, Breeding area, and Motor fishing vessels. The factors having effect on the fishery production efficiency cannot be subjectively controlled in range of samples, but should be selected as environment variable. We select fishermen per capita income, urbanization level



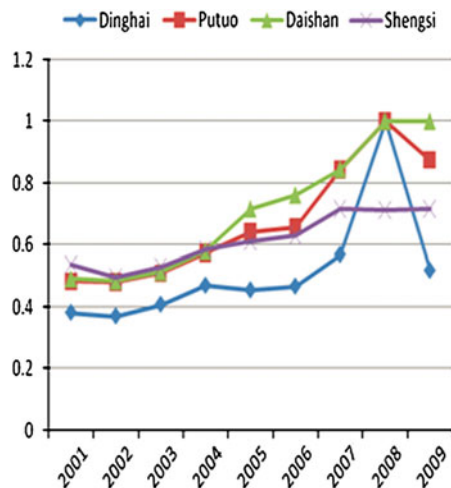
(Which is expressed as the ratio of the urban population to the total one), financial subsidies to fisheries provided by the government (It comes from the product of the financial expenditure to the agriculture provided by government and the ratio of fishery population to agriculture one), and the education level of employee (It comes from the product of the financial expenditure to the agriculture provided by government and the ratio of fishery population to agriculture one). (It is calculated according to the weighted average of population sampling data of the illiteracy, the elementary school, junior high school, high school, college or above those five types. The set of the weights is 0,6,9,12, and 15 years, respectively.) as four environment variables.

### 34.3.2 The Efficiency Under Traditional DEA Model

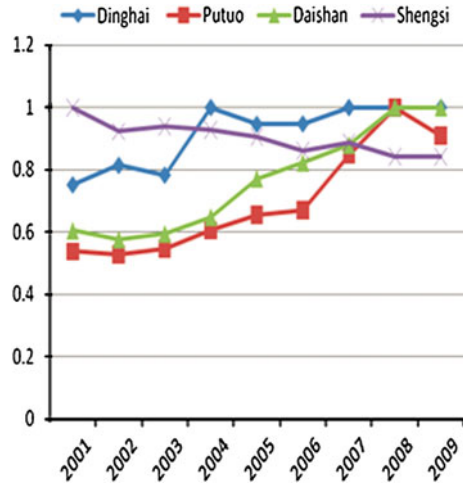
Based on traditional DEA model in the first stage, we use DEA package in the statistical software *R* to analyze fishery production efficiency level and scale state of four counties from 2001 to 2009 in Zhoushan new district. The four counties, respectively, are Dinghai, Putuo, Daishan, and Shengsi. The result of comprehensive technical efficiency (TE1), pure technical efficiency (PTE1), and scale efficiency (SE1) are shown in Fig. 34.1, 34.2, and 34.3, respectively.

If external environment and random factors are ignored, the pure technical efficiency of fishery production in Dinghai county is the highest in Zhoushan new district, with its average value being 0.92; the highest value of comprehensive technical efficiency is located in Daishan, being 0.71; the highest value of scale efficiency is located in Putuo, the highest average value is 0.96. Among them, Putuo and Daishan in 2008, Dinghai in 2008 and 2009, three efficiency values of them are all equal to one in technical efficiency frontier. Because all the results

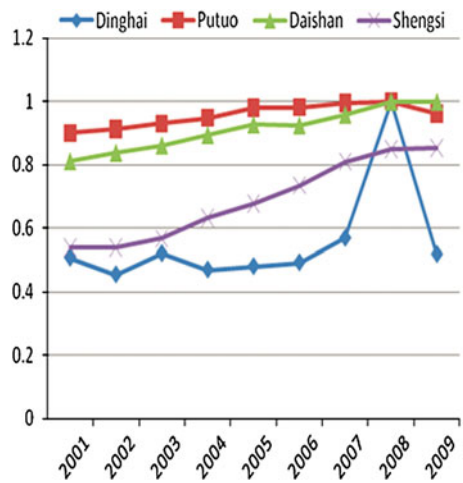
Fig. 34.1 Comprehensive Efficiency



**Fig. 34.2** Pure technical efficiency



**Fig. 34.3** Scale efficiency



contain the interference of the environmental and the random factors, and cannot reflect real level of fishery production efficiency, we next would do further adjustment and measure these inputs.

### 34.3.3 The Result of Stochastic Frontier Analysis

Taking the slack variables of inputs as explained variables, which comes from the results of the first stage have been taken logarithm. The four environment variables mentioned above as explanatory variables after logarithm, we use frontier package

**Table 34.1** The result of SFA

	Slack of labor	Slack of capital	Slack of area	Slack of vessel
Intercept	201*** (38.2)	206*** (159)	15.9*** (0.68)	176*** (176)
Urbanization level	-39.9*** (-23.4)	-24.6*** (-20)	-9.35*** (-3.46)	-18.1*** (-19.2)
Fishermen per capita income	15.3*** (1.12)	5.01*** (3.46)	7.81** (3.03)	4.27*** (4.31)
Financial subsidies to fisheries	8.89*** (3.40)	5.84*** (4.88)	3.95*** (4.72)	4.03*** (4.23)
Education level of employee	-21.3** (2.81)	-17.6*** (-10.05)	5.04*** (0.71)	-22.9*** (-23.1)
$\sigma_u^2$	525*** (524.6)	285*** (285.7)	8.28* (1.86)	259*** (259.6)
$\gamma$	1*** (1072)	1*** (221000)	0.002* (0.028)	1*** (3.9)

in the statistical software *R* to obtain the results of the SFA, which is shown in Table 34.1.

From the Table 34.1, it can be referred that the coefficients of the four environment variables to four slack variables of inputs have passed significant test, and this shows that the external environment factors significantly influence the redundancy of inputs on the fishery production. We further investigate the coefficients of the environmental factors to slack variables, and explain the influence of four kinds of environment variables to slack variables of each input one by one.

(1) As to urbanization level. The ascension of the urbanization level is beneficial to the slack variables of four kinds of inputs, its coefficient are all negative and through test at 1 % significant level. This suggests that the ascension of urbanization level can really realize effective distribution of resource, so as to improve the efficiency of fishery production; the conclusion is consistent with the expected theory.

(2) As to financial subsidies to fisheries provided by government. It is not consistent with the expected theory that the coefficients of financial subsidies provided by government to fishery production are all positive. This shows that the fisheries subsidies does not play its role on improvement of production efficiency. This result may be that the policy which is in favor of fisherman tends to increase the income expectation of the fishermen and encourage them to expand production scale, but the blind investment will cause extensive use of production factors.

(3) As to fishermen per capita income. The coefficients of this variable to slack variable of inputs are all positive, that is to say, if the fishermen per capita income increases then the slack variable of inputs will increase, which would produce adverse effect on the fishery production efficiency. This conclusion is just the opposite of expected theory, but this rightly reflects the fishery production of Zhoushan belongs to the extensive pattern of high investment.

(4) As to education level of employee. The average education level of employee is favorable to labor, fixed assets, and motor fishing vessels on fishery production; the improvement of the quality of the employee can significantly reduce waste of these three kinds of inputs, while it will make breeding area redundancy.

### 34.3.4 The Efficiency After Inputs Adjusted

According to the adjustment formula (34.3), we adjusted the value of input variables, considering adjusted input data as explanatory variables and the original output value as dependent variable and using BCC model (2) again, we obtained the new efficiency value and scale return states of all the decision-making unit. The results of comprehensive technical efficiency (TE2), pure technical efficiency (PTE2), and scale efficiency (SE2). are shown in Figs. 34.4, 34.5, and 34.6.

In order to illustrate that the DEA model of the third stage is more objective in measurement of efficiency value, and more real to show the fishing production status in Zhoushan, we made a Spearman rank correlation analysis of per capita fishery output in each city and county to the efficiency result from the first stage and the third stage, respectively. The results as shown in Table 34.2. The results show that the measurement results from the third stage than the first stage can better reflect the efficiency of management than the first stage, which further proves that the adjustment of random and environment factors in the second stage is very necessary. The application of the three-stage DEA model is more reasonable and precise in respect to measuring fishery production efficiency than that of the traditional DEA method.

Further, by contrasting Figs. 34.4, 34.5, 34.6 with Figs. 34.1, 34.2, 34.3, we observed that the efficiency of most of the counties have changed after eliminating the influence of random variables and the environment factors. The average technical efficiency of each county increases from 0.626 to 0.628, the average

Fig. 34.4 Comprehensive efficiency

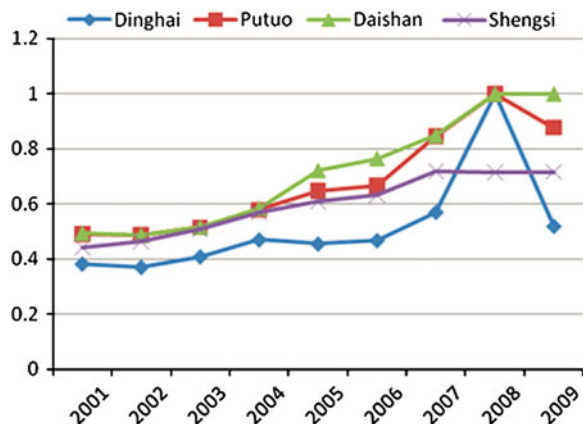


Fig. 34.5 Pure efficiency

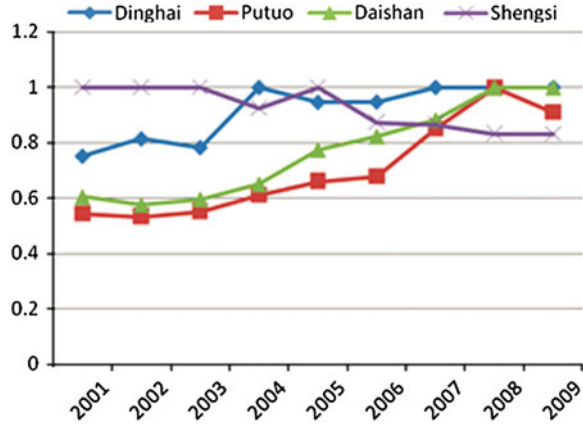
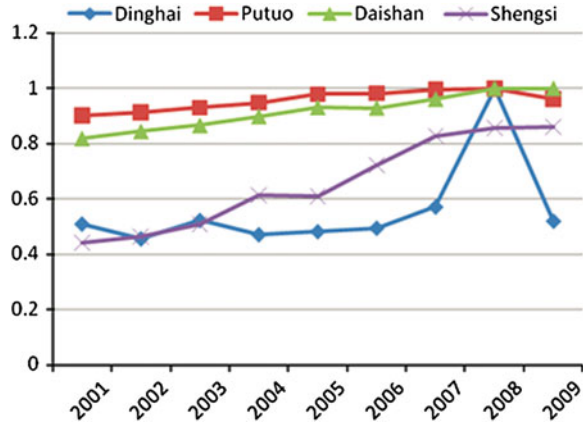


Fig. 34.6 Scale efficiency



scale efficiency increases from 0.771 to 0.778, and the average pure technical efficiency drops from 0.828 to 0.821, while the counties in efficiency frontier remain the same, which implied the fishery production efficiency of these counties has really gone well in those years.

The fishery production efficiency in the third stage has risen compared with the first stage in two counties of Dinghai and Putuo, which is due to the rise of pure technical efficiency, but mostly because of the growth of the scale efficiency. This phenomenon means that the low technical efficiency of these counties was caused before by the rather adverse environment or bad luck, and not their low technology management level.

**Table 34.2** Spearman rank correlation of per capita fishery output and efficiency

	Comprehensive technical efficiency		Pure technical efficiency		Scale efficiency	
	TE1	TE2	PTE1	PTE2	SE1	SE2
Per capita fishery output	0.77283 (0.0000)	0.82665 (0.0000)	0.42068 (0.0106)	0.42198 (0.0103)	0.42202 (0.0103)	0.45258 (0.0055)

## 34.4 Conclusion

In this paper, we used three-stage DEA model to analyze the fishery production efficiency from the year 2001 to 2009 in Zhoushan new district and drew the following main conclusion. First, the regression analysis of the stochastic frontier in the second stage proved that environment and random factors had significant influence on fishery production efficiency. Second, after the input is adjusted based on the second phase, there has been a significant change of fishery production efficiency; we found the correlations of the comprehensive technical efficiency of each county and per capita output of the fishery all have increased significantly, the same to pure technical efficiency and scale efficiency. Third, after eliminating the influence of random variables and the environment factors, the two counties of Dinghai and Shengsi have low-scale efficiency and high pure technical efficiency, while the other two counties of Putuo and Daishan have low pure technical efficiency and high-scale efficiency.

The above conclusion gives us the following two basic enlightenment: first, according to the analysis of the influence of four environmental factors, the first thing we need to do is to keep urbanization orderly, the second is to develop education, improve quality of labor, and make sure the urbanization and quality of labor play full role to promote fishery production efficiency. In addition, the negative impact of fishermen' income and financial output in fishery production do not mean that government can reduce fishermen' income and the financial output; government should strengthen guidance to fishermen, open up their effective investment channel, and make them achieve the effective distribution of income and not to blindly invest.

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# Chapter 35

## Study of Family Function and Marital Quality of Electric Power Staff in Tangshan

Chen Xin, Li Jian-ming and Zhang Ting-sen

**Abstract** The study researched 628 staffs of Tangshan Power plant, whose marriage age above 6 months were tested by FAD and ENRICH. The female workers were better than male workers on communication ( $t = 2.492, P < 0.05$ ) and role function ( $t = -2.909, P < 0.01$ ). Different age groups were significantly different on the dimension of problem solving, roles, and affective responsiveness ( $P < 0.05$ ). The electric power staffs in different age had significant difference on the dimensions of emotional response ( $F = 3.341, P < 0.05$ ). There was no significant difference among different educational level workers. The correlations between family function and marital quality of workers of electric power were significant ( $r$  from 0.082 to 0.645,  $P < 0.05$  or  $P < 0.01$ ). The family functions of Tangshan electric power staff were affected by sex, age, and the marriage age, but not by the educational level. Generally speaking, the marital quality and family function are better.

**Keywords** Psychology · Electric power staff · Family function · Marital quality

### 35.1 Introduction

Family function was the comprehensive assessment of how well the family system running, family relationship, the ability of adapting to the environment of family, and so on [1]. It was not only the important symbol of measuring how well the

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family system running, but also one of the deep variable of influencing the psychological development of family members [2, 3]. Family was produced under the promise of marriage. Marriage was the major factor of family [4]. The power industry was the most important basic energy industry of national economic development, which related to the national economy and the people's livelihood. The characteristic of power production was "produce, supply, require" finished at the same time. Electric power staffs were fast paced and heavy load. From psychological point of view, this study researched the situation and connection of the family function and the quality of the marriage of electric power staff. It provided the theory of formulating systematic, scientific and targeted marriage, and family strategies for electric power staff.

## **35.2 Paper Preparation**

### ***35.2.1 Subjects***

Using cluster sampling method, we extracted the staff and workers of Tangshan power plant as our researching objects. The standard samples involved whose marriage age was above 6 months, and divorced, separated, and widowed groups were not in the sample range. This research gave out 685 questionnaires, and acquired 628 effective questionnaires. The effective rate was 92.12 %. There were 404 men (64.33 %) and 224 women (35.67 %) involved. Their age was from 25 to 59 old, and the average age was  $41.26 \pm 7.73$  old. The marriage age was from 1 to 35 years, and the average marriage age was  $15.90 \pm 8.24$  years.

### ***35.2.2 Content and Approaches***

The experimenters had accepted the unified training before the survey. Testing in groups, the experimenters gave up questionnaires collectively. When questionnaires were finished, they recovered on the spot. The data were entered into the computer, and sorted and analyzed using SPSS13.5 statistical software packages.

### ***35.2.3 The Tools of Survey***

#### **35.2.3.1 Family Assessment Device**

FAD consists of 60 items, including 7 subscales, which were respectively problem solving (PS), communication (CM), roles (RL), affective responsiveness (AR),

affective involvement (AI), behavior control (BC), and general functioning (GF). In the scale, each entry level 4 score and the average of all entries of each subscale score is the score of the subscale. The original scale reliability was 0.66–0.76 [5].

### 35.2.3.2 Olson Marital Quality Questionnaire (ENRICH)

Olson Professor of University of Minnesota, USA compiled Olson marital quality questionnaire. The ENRICH contains 124 entries, and each entry level 5 rating. The scale contained 12 factors which were respectively idealistic distortions, marital satisfaction, character compatibility, husband and wife communication, the way of conflict resolution, economic arrangements, amateur living, sexual life, children and marriage, relationship with family and friends, and the role of equality and belief consistency [6].

## 35.3 Results

### 35.3.1 *The Comparison of Gender Difference in the Family Function of Electric Power Staffs in Tangshan*

Table 35.1 showed that the female workers were better than male workers on communication and role function.

### 35.3.2 *The Comparison of Age Difference in the Family Function of Electric Power Staffs in Tangshan*

Table 35.2 showed different age groups were significantly different on the dimension of problem solving, roles, and affective responsiveness ( $P < 0.05$ ). On

**Table 35.1** The family function of electric power staffs and the comparison of the gender differences scored in each dimension ( $\bar{x} \pm s$ )

Factors	Male ( $n = 404$ )	Female ( $n = 224$ )	$t$
PS	2.18 $\pm$ 0.51	2.24 $\pm$ 0.46	-1.432
CM	2.33 $\pm$ 0.39	2.25 $\pm$ 0.38	2.492*
RL	2.40 $\pm$ 0.34	2.32 $\pm$ 0.31	2.909**
AR	2.40 $\pm$ 0.44	2.42 $\pm$ 0.43	-0.416
AI	2.43 $\pm$ 0.50	2.36 $\pm$ 0.49	1.816
BC	2.42 $\pm$ 0.36	2.40 $\pm$ 0.29	0.473
GF	2.27 $\pm$ 0.46	2.21 $\pm$ 0.45	1.676

**Table 35.2** The family function of electric power staffs in Tangshan and the comparison of age differences scored in each dimension ( $\bar{x} \pm s$ )

Factors	A 25 ~ (n = 38)	B 30 ~ (n = 219)	C 40 ~ (n = 270)	D 50 ~ 59 (n = 101)	F	LSD
PS	2.11 ± 0.45	2.25 ± 0.44	2.23 ± 0.51	2.08 ± 0.54	3.476 <sup>a</sup>	B > C <sup>b</sup> , B > D <sup>b</sup>
CM	2.28 ± 0.43	2.31 ± 0.37	2.32 ± 0.38	2.27 ± 0.44	0.405	
RL	2.23 ± 0.38	2.37 ± 0.33	2.40 ± 0.32	2.38 ± 0.35	3.108 <sup>a</sup>	A < B <sup>a</sup> , A < C <sup>a</sup> , A < D <sup>*</sup>
AR	2.25 ± 0.50	2.36 ± 0.41	2.47 ± 0.43	2.41 ± 0.46	4.354 <sup>b</sup>	A < C <sup>b</sup> , B < C <sup>b</sup> , B < D <sup>a</sup>
AI	2.33 ± 0.60	2.35 ± 0.44	2.44 ± 0.51	2.47 ± 0.55	2.051	
BC	2.40 ± 0.40	2.39 ± 0.29	2.44 ± 0.34	2.37 ± 0.38	1.674	
GF	2.15 ± 0.51	2.24 ± 0.46	2.29 ± 0.45	2.20 ± 0.44	1.839	

Note <sup>a</sup> means  $P < 0.05$ , <sup>b</sup> means  $P < 0.01$

the dimension of problem solving, scores of workers who aged 30 ( $t = 0.167$ ,  $P = 0.005$ ) and 40 ( $t = 0.149$ ,  $P = 0.009$ ) were significantly less than that of workers aged 50 and above; On the dimension of roles, the scores of workers aged 30 and below were significantly higher than that of other age groups ( $t$  from 0.133 to 0.171,  $P < 0.01$ ); On the dimension of affective responsiveness, the scores of workers aged 40 were weaker than that of workers aged below 30 years ( $t = 0.222$ ,  $P = 0.003$ ) and that of workers aged 30 years old ( $t = 0.105$ ,  $P = 0.008$ ), the scores of workers aged 30 were stronger than that of workers aged 50 years and above ( $t = -0.169$ ,  $P = 0.040$ ).

### 35.3.3 The Comparison of Educational Level Differences of the Family Function of Electric Power Staffs in Tangshan

There was no significant difference among different educational level workers ( $F$  from 0.725 to 2.669,  $P > 0.05$ ).

### 35.3.4 The Comparison of Marriage Age Differences of the Family Function of Electric Power Staffs in Tangshan

Table 35.3 showed the electric power staffs indifferent marriage age had significant difference on the dimensions of emotional response ( $F = 3.341$ ,  $P < 0.05$ ). The scores of workers who had 5 years marital life or below were better than that

**Table 35.3** The family function of electric power staffs in Tangshan and the comparison of marriage age differences scored in each dimension ( $\bar{x} \pm s$ )

Factors	A 0 ~ (n = 90)	B 6 ~ (n = 209)	C 16 ~ (n = 244)	D 25 ~ (n = 85)	F	LSD
PS	2.15 ± 0.45	2.23 ± 0.46	2.23 ± 0.51	2.10 ± 0.53	2.043	
CM	2.30 ± 0.43	2.32 ± 0.37	2.30 ± 0.39	2.29 ± 0.40	0.207	
RL	2.30 ± 0.38	2.38 ± 0.31	2.39 ± 0.34	2.42 ± 0.33	1.966	
AR	2.30 ± 0.47	2.38 ± 0.42	2.46 ± 0.42	2.44 ± 0.47	3.341 <sup>a</sup>	A < C <sup>b</sup> , A < D <sup>a</sup>
AI	2.35 ± 0.52	2.39 ± 0.45	2.40 ± 0.51	2.51 ± 0.54	1.695	
BC	2.38 ± 0.38	2.40 ± 0.29	2.42 ± 0.33	2.43 ± 0.39	0.500	
GF	2.15 ± 0.51	2.28 ± 0.45	2.27 ± 0.45	2.25 ± 0.44	1.924	

of 16–25 years ( $t = 0.43, P = 0.007$ ) and 25 years and above ( $t = -0.136, P = 0.038$ ).

### 35.3.5 The Correlation Analysis of Marriage Quality and Family Function in Each Dimension of Electric Power Staffs in Tangshan

Table 35.4 showed the correlations between family function and marital quality of workers of electric power were significantly.

**Table 35.4** The correlation analysis of marriage quality and family function in each dimension of electric power staffs in Tangshan( $r$ )

Factors	PS	CM	RL	AR	AI	BC	GF
1	-0.298**	-0.430**	-0.212**	-0.378**	-0.129**	0.018	-0.448**
2	-0.300**	-0.512**	-0.408**	-0.440**	-0.320**	-0.154**	-0.645**
3	-0.087**	-0.355**	-0.410**	-0.351**	-0.418**	-0.184**	-0.456**
4	-0.158**	-0.478**	-0.400**	-0.441**	-0.422**	-0.240**	-0.593**
5	-0.187**	-0.481**	-0.411**	-0.473**	-0.420**	-0.259**	-0.554**
6	-0.324**	-0.466**	-0.412**	-0.343**	-0.288**	-0.149**	-0.580**
7	-0.099*	-0.122**	-0.087*	-0.184**	-0.022	-0.007	-0.072
8	-0.251**	-0.457**	-0.413**	-0.386**	-0.361**	-0.161**	-0.589**
9	-0.184**	-0.467**	-0.400**	-0.416**	-0.364**	-0.202**	-0.569**
10	-0.142**	-0.440**	-0.415**	-0.318**	-0.389**	-0.221**	-0.570**
11	0.097*	-0.092*	-0.180**	-0.062	-0.236**	-0.095**	-0.162**
12	-0.154**	-0.135**	0.023	-0.093*	0.041	0.054	-0.082*

*Note 1* idealistic distortions, *2* marital satisfaction, *3* character compatibility, *4* husband and wife communication, *5* the way of conflict resolution, *6* economic arrangements, *7* amateur living, *8* sexual life, *9* children and marriage, *10* relationship with family and friends, *11* the role of equality, *12* belief consistency

## 35.4 Conclusion

### 35.4.1 *Impact of Family Function of Tangshan Electric Power Staff*

This research showed that the family functions of the electric power of female staffs were superior to male staffs in communication and role. This was consistent with the research results of Yuan Ye and other people [7]. Compared to women, most of the men had features of aggressive, independence, dominant, competition, and adventure. Some of their damage or dangerous behavior were vulnerable to family's intervention, reducing the communication with family members. However, women had delicate feelings that were sensitive, and they could realize the interaction of family members well. The evaluation of women was superior to men.

Table 35.2 showed that it was related to different ages facing different problems. The staffs under 30 were young, just raising a family, full of passion and curiosity, and emotional reaction was better. At 30, people were mature and mostly had their own children. At this time their roles did fewer tasks. At 40, they recognized problems in a quite strength and deep way. They took the responsibility of society and family while dealing with the contradictions from study and work. At 50, they were much experienced and steadier. Their children grew up and basic shaped in career. Mature mind and reduced pressure decreased the family conflicts. While the abilities of solved issues of the family members were increasing, the abilities of solved issues of the whole family members were increasing.

It was obvious that no matter what the culture level was, everyone had their own understanding of family, and the family function which was good or bad lied in the communication and cooperation of family members in materiality and emotion. It needs further research if cultural degree and some other variable had influences on family function or not.

The emotional involvement which the marriage ages were under 5 years was obviously better than which the marriage ages were from 16 to 25 years. This was consistent with the results of Liping Chi and other people [8]. The family whose marriage ages were under 5 years, having young members and little conflicts. What is more, they still remained the passion of falling in love, more concerned with their spouses. But for the family whose marriage ages were from 16 to 25 years, their children were at school or just began to work, probably facing marital problems. Their parents increasingly grew old, and their spouses' decreased strength, and their career was at peak, so that they pay fewer attentions to their spouses.

The family functions of Tangshan electric power staff were affected by sex, age, and the marriage age, but not by the educational level.

### ***35.4.2 The Tangshan Electric Power Staff's Family Function and Marital Quality's Various Aspects are Related***

The results of this research showed that the better of the quality of marriage was, the better of the family function was. Further, regression analysis showed that marital satisfaction, communication between couples, economic arrangement, sexual life, leisure activities, conflict resolution way, children and marriage, relationship with friends, and over idealistic had obvious prediction of family function. The expectation of the marriage of a couple, the evaluation of the marriage and the attitude of solving daily affairs, and the consistency of conception and so on helped to solve problems of the family. At the beginning of the birth of a family, the communication of a couple determined the behavior of the whole family. It needs to establish a good family atmosphere to keep good emotional reaction ability of the whole family and to adapt to the each stage of life rapidly. Under this atmosphere, it was benefited to express family members' emotion and convey the message, and let children learn to express their own idea. The cooperation of family members, increasing mutual understanding, united as one, and living together played the function of family. Generally speaking, the marital quality and family function are better.

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# Chapter 36

## Study of Enterprise Organization Management Based on Fractal Theory

Daomei Zhang

**Abstract** The fractal theory is a new application in the mode of the business organization management. In order to improve the ability of enterprises to adapt to the external environment and make adjustments to cope with the changes timely, this article combined fractal theory and business organization management and established a fractal model of corporate organization management which can calculate the fractal dimension of fractal enterprises. The same time, by building a evaluation index of business organization and management and using fractal theory to make fractal evaluation of the business organization management, the management range of different organizations, the relevance of fractal theory and the linear trend of organization, and management of fractal enterprise can be finally obtained.

**Keywords** Fractal theory · Business organization management · Fractal evaluation · Fractal dimension

### 36.1 Introduction

The fractal theory has been quickly developed and improved from its inception and given a very wide range of application in various fields. The phenomena related fractal appeared in many areas, such as society, nature and human thought, and it has gradually formed fractal subjects in various fields. In the study of business organization management, most of it is based on the analysis of various

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functions of management and combined the theory with actual status of specific enterprise to analyze different problems in different ways [1]. In the aspect that fractal theory applied to business organization management, it is also the needs and important aspect of the rapid development of complex science. Hence, to explore the application of fractal theory in business organization management and to analyze characteristics of fractal enterprises are of great significance.

### **36.2 Characteristic Analysis of Fractal Theory in a Business Organization Management**

There are a number of subsystems or departments in an enterprise system. Employees of the enterprise who are based on the perspective of fractal theory are the fractal unit in the entire enterprise system. The interaction between them is regarded as nonlinear and is expressed in combination with each other, constraints, coordination, as well as mutual influence the result. For this reason, the fractal management which is combined the fractal theory and management mainly reflects the consistency of fractal unit function, structure evolution, and the way of existence.

As an enterprise with hierarchical system, each of the high-level business organization management is from the low level. The structure of business organization management will be impact due to its own unique system of each enterprise, but small differences do not affect the research on the commonness of the architecture of business organization management. In fractal theory, the system of corporate organization management is decided by the management level and management range and different management levels and management ranges from different management systems. But the management range has the role of setting management positions, management capability, and corporate management similarity. What is more, the enterprise scales as well as the enterprise management range also decide the management level of one enterprise. The system structure of business organization management is shown in Fig. 36.1 [2].

In business organization and management, the efficiency and capacity effect of the staff, knowledge, environment, organization, and other aspects can be improved by taking appropriate measures based on the fractal theory, which can be seen in Table 36.1 [3].

### **36.3 The Fractal Dimension Calculations of Fractal Organization and Management**

When faced with a comprehensive transformation of enterprises, we must build a organizational structure of enterprises system. At present, the organizational structure of enterprises and the development environment have been changed by



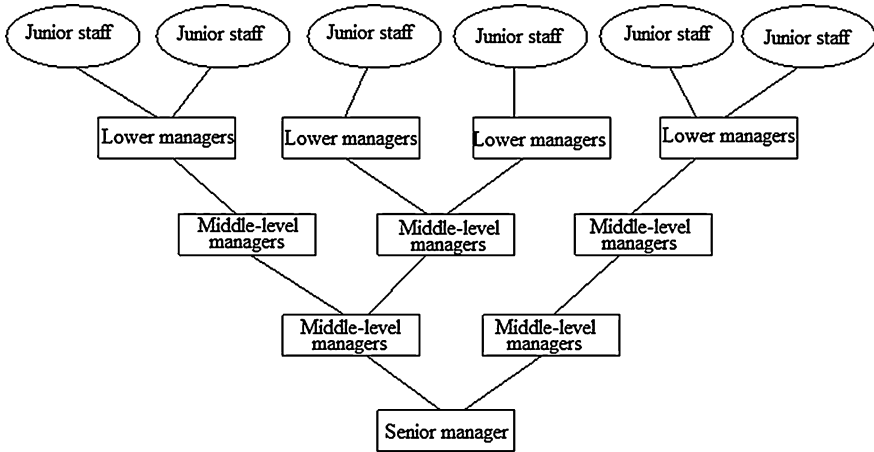


Fig. 36.1 Structure diagram of enterprise organization management

Table 36.1 Analysis of the measures and effect of fractal theory in the business organization and management

Category	Reaction speed and capacity	Effect	Innovative
Enterprise environment	Transparent	Cooperation, collaboration	Market coordination, cooperation
Organization management	Competitive, dynamic, fair, and transparent	Target, automatic optimization	Spontaneous organization, Dynamic
Staff	Building Capacity, overall situation thought	Teamwork, motivate	Overall situation thought, incentive
Data	System information	Network information	
Basic method	Dynamic structure	Teamwork	Building capacity
Knowledge books	Transparency	Open	Incentives, information systems

the rapid development of knowledge economy and globalization. For this, a new theory must be put forward to promote the practice of the business organization management. According to the economic openness of real enterprise, the enterprise can be regarded as a special kind of fractal. Therefore, we further believe that the business organization is a kind of normal fractal model to calculate the fractal dimension of the business organization.

Building a fractal category tree model of business organization and management which is a uniform Cantor collection and its determination formula that based on fractal dimension of the fractal theory is [4]:

$$d_f = \frac{\ln K}{\ln b} = \frac{\ln 4}{\ln 3} = 1.26 \tag{36.1}$$

The results show that the fractal enterprise organization and management can be regarded as the sale Verbinski bedding model. The measured formula obtained by transforming fractal dimension of 2D and 3D space is [5]:

$$d_f = \frac{\ln(d + 1)}{\ln 2} \quad (36.2)$$

$D$  is the space fractal dimension (36.2).

By viewing fractal enterprise as a two-dimensional structure and using fractal formula, fractal dimension of the fractal enterprise organization, and management is [6]:

$$d_f = \frac{\ln(d + 1)}{\ln 2} = \frac{\ln(3 + 1)}{\ln 2} = 2 \quad (36.3)$$

From the results, the greater the amplitude of business organization and management is, the larger the dimension of the fractal enterprise is, then the business organization and management structure is flattened; and the smaller the magnitude of the business organization and management is, the larger the dimension of the fractal enterprise is, then the structure of corporate organization and management is at the bottom of the pyramid structure.

If the Cantor set of fractal enterprise organization management is defined as a line segment and divided into  $(2N + 1)$  equal parts without the even number parts. Then re-equalize the rest part  $(2N + 1)$  times with an infinite loop, finally we can get a collection of points. According to the basic formula, we have the following determination formula [7]:

$$d_f = \frac{\ln N(\delta)}{\ln \delta} = \frac{\ln N(\delta)}{\ln(\frac{1}{\delta})} = \frac{\ln(N + 1)}{\ln(2N + 1)} \quad (36.4)$$

According to the business organization and management structure, when the management scope is 20, the enterprise fractal dimension is [8]:

$$d_f = \frac{\ln N(\delta)}{\ln \delta} = \frac{\ln N(\delta)}{\ln(\frac{1}{\delta})} = \frac{\ln(9 + 1)}{\ln(19 + 1)} = \frac{\ln 10}{\ln 20} \quad (36.5)$$

The above calculations show that through the fractal theory, we can make fractal analysis of an enterprise and determine the analysis dimension of the business organization and management. Moreover, it has a relationship with the changes of the amplitude of business organization and management.

### 36.4 Applications of Fractal Evaluation of Fractal Theory on Enterprise Organization and Management

Through the fractal theory and the assumption model, fractal theory evaluation index system is established and shown in Table 36.2 [9].

From Table 36.2, the fractal evaluation index of business organization and management includes: process management  $x_1$ , organizational behaviour  $x_2$ , competitiveness  $x_3$ , market reaction and other factors. Create a formula [10]: (Fig. 36.2)

$$G = (x_1, x_2, x_3, \dots, x_i, \dots) \tag{36.6}$$

We make an organization and management evaluation analysis of three companies in one province by using fractal theory. First standardized indicators of three corporate, according to the evaluation formula of fractal theory [11]:

$$C(r) = \frac{2}{N(N-1)} \sum_{ij} (\gamma - d_{ij}) \tag{36.7}$$

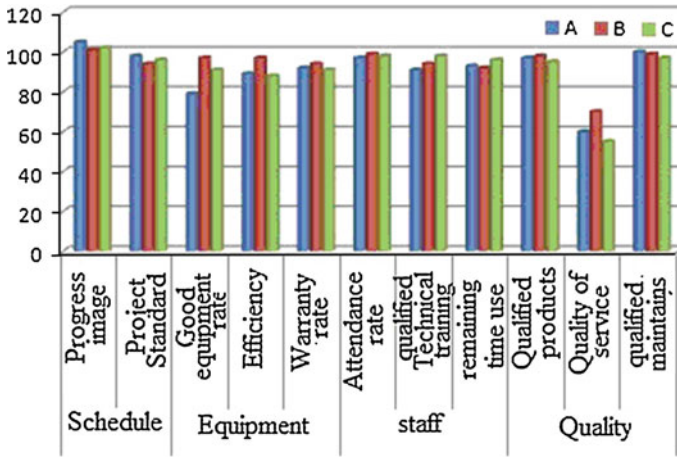
According to Table 36.3, the relevance equation of data index is [12, 13]:

$$\begin{aligned} A : \ln C(r) &= 7.23 \ln r + 0.98 \\ B : (r) &= 4.25 \ln r + 1.4 \\ C : \ln C(r) &= 2.31 \ln r + 0.64 \end{aligned} \tag{36.8}$$

It can be seen from the data table between  $\ln C(r)$  and  $\ln r$  in Table 36.3 and Fig. 36.3 that when  $r$  increases in a straight line,  $\ln r$  is basically showing a linear

**Table 36.2** Evaluation of fractal theory on the process module of business organization and management

Control project	Content	A	B	C
Security	Loss of management accident	0	0	0
	Casualty rate	0.01	0.03	0.001
	Economic losses	4	2.5	2.1
Schedule	Progress image	105	101	102
	Project standard	98	94	96
Equipment	Good equipment rate	79	97	91
	Efficiency	89	97	88
	Warranty rate	92	94	91
Staff	Attendance rate	97	99	98
	Qualified technical training	91	94	98
	Remaining time use	93	92	96
Quality	Qualified products	97	98	95
	Quality of service	60	70	55
	Qualified maintains	100	99	97



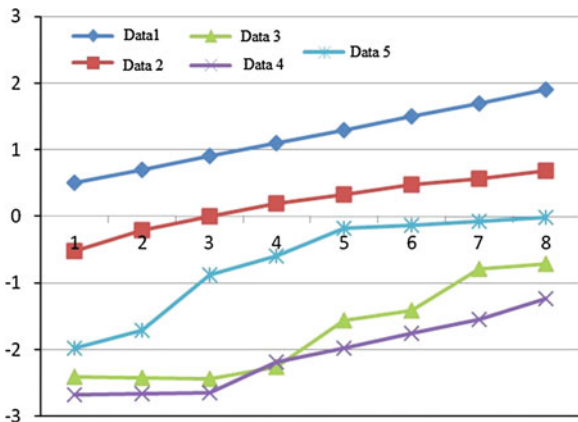
**Fig. 36.2** The comparison chart of fractal theory in module evaluation of enterprise management process

**Table 36.3** Relational data table between  $\ln C(r)$  and  $\ln r$

Data 1	$r$	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9
Data 2	$\ln r$	0.52	0.21	0	0.19	0.33	0.48	0.57	0.68
Data 3	$\ln C(r)$	2.41	2.42	2.43	2.26	1.56	1.41	0.79	0.72
Data 4	$\ln C^2(r)$	2.67	2.66	2.65	2.19	1.97	1.75	1.55	1.24
Data 5	$\ln C^3(r)$	1.97	1.71	0.87	0.59	0.18	0.14	0.08	0.02

increase trend.  $\ln C(r)$ ,  $\ln C^2(r)$  and  $\ln C^3(r)$  are also in a growing trend but in different growth rate. When  $r$  is less than 0.9,  $\ln r$  is negative. The  $r$ -value is in the range of 0.5–1.9.  $\ln C(r)$ ,  $\ln C^2(r)$  and  $\ln C^3(r)$  are all negative. In that range, the value of A is the largest followed by B, then there is C and finally D.

**Fig. 36.3** Data comparison chart between  $\ln C(r)$  and  $\ln r$



## 36.5 Conclusion

Fractal theory, as well as the fully use of its methodology has an important significance for the development of society and the progress of science. The various complex features of the outside environment of the enterprise and the nonlinear role between the organization and management department indicate that business organization and management is an open, dynamic fractal system. For this, we should combine the fractal theory and business organization management and propose management model of business organization management objectives, in order to let all levels of management staff of the business organizations to use fractal management methods, to feedback timely, to coordinate and to improve the capacity of enterprises to adapt to the competitive environment. At the same time, based on fractal theory methods, establishing learning organization of an enterprise and improving motivation and autonomy of the employees on learning are the best ways to maintain the development of one enterprise, its innovation ability, market competitiveness, as well as the rapid sustainable development capacity.

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# Chapter 37

## Analysis on the Factors of Improving Competitiveness in Tourism Management

Wenzhuan Yin

**Abstract** At present, there are a lot of elements in the study of addressing the competitiveness of tourism destinations, but rarely from a management point of view to systematic and comprehensive study the competitiveness of the environment. The competitiveness model of Calgary tourism brought a systematic approach to tourism competitiveness study; this paper chose it as a tool selectively. Combined with the management element of competitiveness and environmental management, we divided the model of management by objective into two parts: (1) management; (2) marketing. From the environmental point of view, this paper studies the factors of tourism competitiveness. First, through appropriate management of the objective of environmental competitiveness, the management of tourism environmental impact (EI) and environmental quality (EQ) can be enhanced. Second, the competitiveness of destination can be improved through marketing activities in certain environments. In addition, effective measures should be taken to enhance tourism competitiveness through implementing and assessing the environmental attractiveness of tourist destinations Calgary model.

**Keywords** Tourism management · Calgary model · Objective management · Environmental management

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## 37.1 Introduction

At present, in the most types of tourist destinations, the quality of the tourism environment is viewed as the most basic and important factor of travel theory. Travel managers are willing to integrate environment into the measures of current management strategy, and this can not only bring about a lower cost, but a better way to increase revenue. Of course, raising the environmental awareness, meeting the higher quality of travel demands, and changing environmental conditions are the ways to increase the competitiveness of the tourist attractions [1, 2]. Hence, the quality of the environment has also become an important issue in the current tourism management.

In the study of tourism competitiveness, the research of tourism environment is in the perspective of eco-tourism and other green brand which is relatively less than the study of environmental quality (EQ). Hence, the view of overall EQ for tourism in this chapter is not only through controlling the impact of tourism on the environment, but also minimizing the various environmental problems, including the protection of investment environment as well as degenerated environment. Therefore, this has great practical significance for the whole society.

## 37.2 Overview of Tourism Management and Research Methods

The emphasis of tourism management is starting from the point of view of its own tourist attractions, fully and effectively using the effective resources, increasing the quality of the environment, and the attractiveness of tourist attractions and increasing the degree of environmental impact (EI) of the tourism industry. Only to strengthen the efficient management, can the minimization of cost and maximization effect of revenue be achieved. But only to enhance the tourist attractions of their own conditions, coupled with the collection of the sales model, and to take a variety of marketing tools such as launching events for the festival or doing some theme promotions for tourist attractions. Of course, in reality situation, in order to prevent the sales and price fluctuations, we must take the management strategy of the tourism market and competitive manner into account (Fig. 36.1).

Tourism management is a comprehensive system management. It is not only related to the ways of tour operations, but also to the management of the tourist attractions, as well as the marketing of tourist attractions. The current premise is to ensure the quality of environment, which is not only related to soil and water quality, but to the quality issues of construction and to the cultivation and protection of environment vegetation. In this way, tourist environment can be improved and more tourists will be attracted [3].

Calgary model is designed for tourist attractions, which is combined with its geography and geographical advantages, as well as the human environment. By

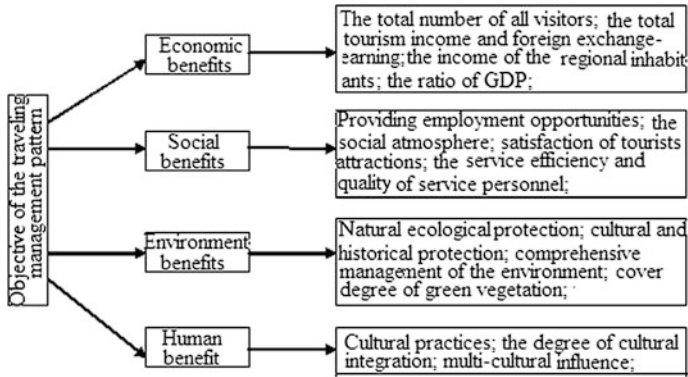


Fig. 37.1 The purpose and benefits of tourism management model

using its advantages, allocating and optimizing the resources efficiently, it has not only become a place of tourism and entertainment, but also the place of athletic competition. Moreover, it is also an Olympic movement place. And it has not only achieved economic and social benefits, but achieved the objectives of the environmental benefits and the purpose of the development of cultural characteristics.

In this paper, we use the method of factor analysis which is designed to analysis and evaluate various elements of tourism competitiveness. Then we get the idea of how to improve attractiveness of tourist attractions in tourism management and generate revenue.

In factor analysis, first of all is to set the evaluation factors. In this paper, five variables can be set directly [4]:

$$X = (x_1, x_2, x_3, x_4, x_5) \tag{37.1}$$

And there is [5]:

$$X_i = \mu_i + a_{i1}f_1 + a_{i2}f_2 + a_{i3}f_3 + a_{i4}f_4 + a_{i5}f_5 + e_i \tag{37.2}$$

In the equation,  $f = (f_1, f_2, f_3, f_4, f_5)$  and  $e_i$  are their common and specific factors respectively.

Average value of each factor of tourism competitiveness indicators [6]:

$$\mu = (\mu_1, \mu_2, \mu_3, \mu_4, \mu_5) \tag{37.3}$$

Factor matrix of tourism competitiveness evaluation index is [7]:

$$A = (a_{ij})_{5 \times 5} \tag{37.4}$$

The standard deviation of the tourism competitiveness index factors is as follows [8]:

$$Var(x_i) = 1 = a_{i1}^2 + a_{i2}^2 + a_{i3}^2 + a_{i4}^2 + a_{i5}^2 + \delta_i \tag{37.5}$$



The overall sample data that obtained through the research will be put into the formula with variable  $X$ , and then we can seek out the mean and standard deviation of the overall tourism competitiveness factors index. At the same time, after the standardized accounting we can process data; so, the matrix formula of correlation coefficient of the overall tourism competitiveness is as follows [9]:

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{15} \\ r_{21} & r_{22} & \dots & r_{25} \\ \vdots & \vdots & \vdots & \vdots \\ r_{51} & r_{52} & \dots & r_{55} \end{bmatrix}, r_{ij} = \frac{\sum_{k=1}^5 (x_{5i} - \bar{x}_i)(x_{5j} - \bar{x}_j)}{\sqrt{\sum_{k=1}^5 (x_{5i} - \bar{x}_i)^2(x_{5j} - \bar{x}_j)^2}} \quad (37.6)$$

$$F = \frac{w_1F_1 + w_2F_2 + w_3F_3 + w_4F_4 + w_5F_5}{w_1 + w_2 + w_3 + w_4 + w_5}$$

After determining the total number of public tourism competitiveness index factor and the load rotation of tourism competitiveness, more accurate indicators of tourism competitiveness factor can be calculated. Then set the contribution rate of standard deviation as the weight of the various elements of the tourism competitiveness index factors. By doing that we can work out a formula of comprehensive return evaluation of tourism competitiveness index

In this formula,  $w_i$  indicates the contribution rate of the standard deviation of the tourism competitiveness factors which has been rotated. At last, the scores of tourist attractions can be calculated and sorted according to these comprehensive evaluation equations.

### 37.3 Evaluation and Analysis of Tourism Management on Tourism Competitiveness

Considering the literature of tourism competitiveness, the questionnaire of this research selected all visitors of one attraction. First, we summarized evaluation index factors of comprehensive tourism competitiveness and the corresponding evaluation indicators to do some pre-survey. Finally, we get the conclusion that the evaluation factors of the tourism competitiveness is composed of regional competitiveness, the competitiveness of tourism management, out-put competitiveness of tourist attractions, EQ competitiveness, and marketing competitiveness.

It can be seen from Table 37.1 and Fig. 37.2, the mean of the evaluation index of tourism competitiveness is between 4.07 and 4.86, the largest is the regional competitiveness, the minimum is the EQ competitiveness. This shows that tourists agree the extent of the impact of these indicators for tourism competitiveness, but the highest specific degree of influence should be the regional competitiveness. Second is the out-put competitiveness of tourist attractions, the third is the tourism management competitiveness and the last is the EQ competitiveness.

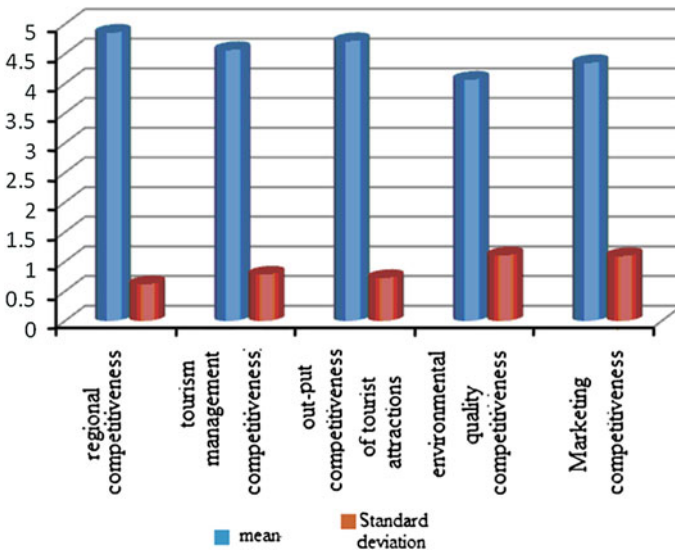
**Table 37.1** The evaluation index of constructing tourism competitiveness

Evaluation factors	Total	Mean	Standard deviation
Regional competitiveness	150	4.86	0.621
Tourism management competitiveness	150	4.57	0.785
Out-put competitiveness of tourist attractions	150	4.72	0.727
Environmental quality competitiveness	150	4.07	1.108
Marketing competitiveness.	150	4.35	1.096

Figure 37.2 shows a fluctuations trend of the mean and standard deviation, but the difference is not obvious. It also reflects the degree of recognition of these indicators. Table 37.1, the standard deviation is from 0.621 to 1.108, which indicates that these indicators are very important factors, but the degree of importance is not the same. The standard deviation for the region, tourism management, and out-put competitiveness of tourist attractions is less than 1, which indicates that the tourists have a high degree of recognition for this comparison. When the standard deviation is greater than 1, it means that investigators have a different recognition for this indicator project.

According to the regression analysis of the each index factors of tourism competitiveness from Table 37.2 and Fig. 37.3, the *p* value of the five indicators of tourism competitiveness factors is all zero and less than a significant standard level of 0.05. This represents a significant and positive regression relationship between the variables

Table 37.2 and Fig. 37.3 shows the regression calculations of regional competitiveness, tourism management competitiveness, out-put competitiveness of

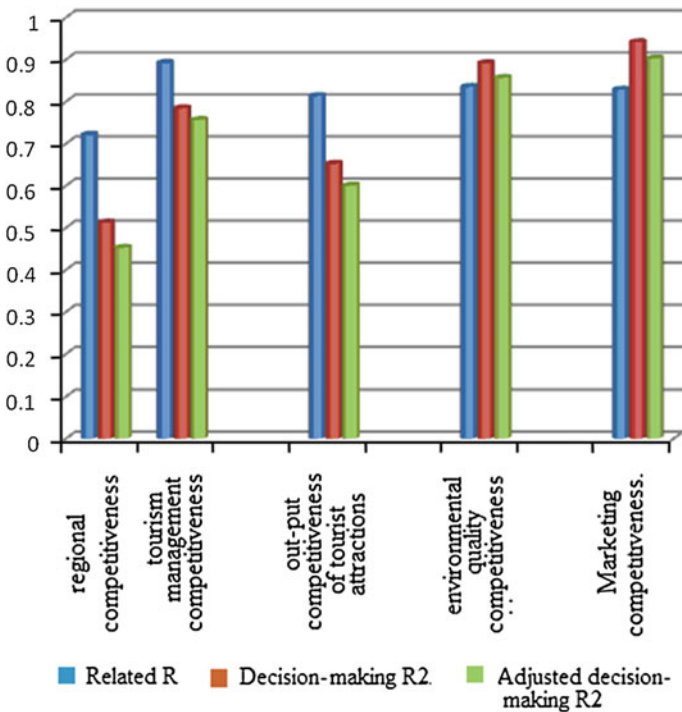


**Fig. 37.2** The evaluation index of constructing tourism competitiveness

**Table 37.2** The regression analysis table of tourism competitiveness index factors

	Related <i>R</i>	Decision-making <i>R</i> <sup>2</sup>	Adjusted decision-making <i>R</i> <sup>2</sup>	Tested statistics	<i>P</i> value
Regional competitiveness	0.722	0.513	0.453	29.343	0.000
Tourism management competitiveness	0.893	0.785	0.757	15.905	0.000
Out-put competitiveness of tourist attractions	0.814	0.653	0.601	18.986	0.000
Environmental quality competitiveness	0.836	0.892	0.857	20.523	0.000
Marketing competitiveness	0.829	0.942	0.903	27.568	0.000

tourist attractions, EQ competitiveness, and marketing competitiveness. Regional competitiveness which compared to several other variables can explain. For regression analysis of the tourism management competitiveness and the other four kinds of competitiveness, it can explain 78.5 % of the difference value. EQ competitiveness can explain 89.2 % of the difference value. Finally, marketing competitiveness can explain 94.2 % of the difference value. The value of decision *R*<sup>2</sup> is between 0.513 and 0.942. From the biggest to the smallest, the corresponding



**Fig. 37.3** Regression analysis of the tourism competitiveness index factors

evaluation factors of tourism competitiveness is: marketing competitiveness, EQ competitiveness, tourism management competitiveness, out-put competitiveness of tourist attractions, and regional competitiveness. It also reflects the importance of marketing, EQ, and tourism management in tourism competitiveness. So only to strengthen the management of these factors, we will achieve a better development of tourism industries, attract more visitors, create more benefits, and provide the best service.

## 37.4 Conclusion

In today's era of tourism so prevalent, more and more tourism attractions are considering how to attract the attention of visitors, how to provide a better service and create more value. Starting from the tourism management theory, this paper found that tourism management, marketing capabilities, as well as the quality of the environment, all have a great impact on tourism competitiveness. So tourist attractions need to work hard on these factors, pay fundamental attention to the EQ, strengthen tourism management from the inside and combine with a rich and effective marketing tool. Only in these ways, the tourist's heart can be deeply moved, better services tourists can enjoy and greater benefits will bring to the tourism attractions.

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# Chapter 38

## Study of Sunshine State Under the Ice Caps Melting

Desheng Li

**Abstract** A model is established to discuss the problem of the melting ice caps in the arctic. The result shows that the sea level would rise up 12–36 cm relatively in the next 50 years. The detailed discussion of the used data is an important part of the answer.

**Keywords** Sea level rise • Regression fitting

### 38.1 Problem Restatement

Study the arctic melting ice caps' influence on the mainland caused by global warming. Specifically, making model every 10 years for the influence on the Florida coast due to melting for the next 50 years put forward some appropriate response to deal with these problems.

### 38.2 Problem Analysis

Through satellite images provided by the national oceanic and atmospheric administration (NOAA), we can see the arctic ice caps is on large atrophy by comparing the arctic ice volume between the 1950s and the 2000s. Data show, Since the 1950s, the data collected for the first time have shown that the arctic ice cap has lost its volume nearly 22 %.

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We analyzed the arctic melting ice caps' influence on the Florida coast for the next 50 years after considering a few cities in the Florida. This problem can be broken down to the following two questions [1]:

The melting of the ice caps on the influence of rising sea levels;

What influence does rising sea levels have on Florida City and how to eliminate it?

The preliminary discussions of the ice caps in the Polar Regions The polar ice caps are divided into two kinds:

The solid sea ice like sea ice over the arctic,

The fresh water land ice distributed in Greenland, Canada, and Alaska solid sea ice.

The melting of solid sea ice almost has no effect on the rise of the sea level because it always floats in the sea. According to law of Archimedes buoyancy, the gravity of objects immersed in liquid is the same as its own gravity. About 10 % sea ice is out of the water, but the density of water and solid ice is 1,026 and 919, respectively [2]. Thus if the ice melts, there will be 10 % of the original volume into the ocean. Therefore, it will have almost no influence on relative rise of sea level [3].

Even if the arctic ice caps is melting. Although the ice caps will not have significant effect on sea levels rising, if they are lost, the following problems will happen:

The average temperature of the sea in Northern Hemisphere will have the tiny drop; ice caps can reflect lot sunshine, and have certain effect on reducing regional temperature. Once they disappear, the excess energy will be absorbed. After period of time, we can see the global temperature has a significant rise, Including marine and atmospheric. This is also promoting global warming in another respect [4].

Land fresh water will have a substantial increase as the land fresh water ice melts and be into the sea. The total volume of the Greenland ice is about  $2.624 \times 10^6 \text{ km}^3$ . This ice will all melt and be into the sea if it is without considering the rise of the ocean floor and the increase of the ocean surface area. Data show that the global average elevation will rise. This is just the results in considering Greenland ice. If fresh water land ice in Alaska and Canada is all melting, the rise of sea level will bring about irreparable consequences [5].

The problem we talk about will become:

What influence will the melting land fresh water ice have on the sea levels' rise in the next 50 years?

### 38.3 Model Building

Model 1: Simple regression fitting of historical data

On the assumption that the ocean expands their size and changes surface area without considering the influence of the global warming.

**Table 38.1** Model summaries and parameter estimate

Model summary and parameter estimate							
<i>The dependent variable: sea level</i>							
Equation	Model collect					Parameter estimation	
	R power	F	df1	df2	Sig.	Constant	b1
Linear	.934	9199.729	1	647	.000	-6301.501	3.158

The independent variable is the year

**Table 38.2** The height of the sea level rise in 50 years

Years	2012	2022	2032	2042	2052	2062
Height of sea level rise (cm)	5.299	8.458	11.616	14.775	17.933	21.0915

We found that the most appropriate fitting degree is linear regression by using SPSS statistical software regression. Physical meaning is that the  $y$  represents a rise in sea level height,  $x$  stand for the corresponding year, it is simple and feasible. Relevant images and parameters valuations are as follows (Table 38.1):

$$y = 3.1583x - 6301.5 \tag{38.1}$$

and:  $R^2 = 0.9343$  Meet statistical data requirement.

According to the above model, we get the height of the sea level rise in the Florida coast area shown in the list below (Table 38.2):

Model 2: The geographical factors superposition model.

(1) The polar ice caps melt-the sea level rise  $h_1$ .

In order to predict the influence of ice caps melt on Florida, we build the model which can predict the situation of sea level rise fast. Among them, we assume that:

The melting rate of ice caps is fixed value. The water caused by melting ice caps is in the sea plane uniformly. Global temperature and climate had no significant change. Sign convention: % Melt = the proportion of the land ice caps melt every 10 years;  $V_1$  = the land ice’s volume of the Northern Hemisphere at present;  $C_i - w$  = the situation of the volume that ice transform into water =  $0.919$  Global sea level’s area =  $3.611 \times 10^8 \text{ km}^3$ .

Use 10 years as a unit of time, equation can be turned into:

$$h_1 = \frac{\% \text{ Melt} \times V_1 \times C_i - w}{\text{Sea surface}} \tag{38.2}$$

Data shows, the ice of Greenland reduces about  $239 \text{ km}^3$  every year, it is known that the sea level rise about  $3.3 \text{ cm}$  after 50 years by linear regression analysis for data. With considering the influence of the melting ice in Alaska and Canada on sea levels rise, their melting makes the sea levels rise between  $0.025$  and  $0.007 \text{ cm}$  each year. They will make the sea levels rise by  $1.6 \text{ cm}$  50 years later. Thus, the global sea level will rise by about  $4.9 \text{ cm}$  in 2062. Namely:  $h_1 = 4.9 \text{ cm}$

(2) The global temperature changes—the sea level rise  $h_2$ .

The influence of temperature changes on the melting of ice caps should be further considered.

Global average temperature raised by about  $1^\circ\text{C}$  in the twentieth century, but the temperature alteration ratio over the past 25 years has been close to the temperature alteration ratio in the past a century. In addition, extra quantity of heat as carbon dioxide discharged will be absorbed by the oceans and will improve the ocean temperature.

Therefore, scientists have predicted global will rise by  $0.7\text{--}2.9^\circ\text{C}$  in the next 50 years. The whole temperature rise will aggravate the speed of the fresh water land ice melt. This will increase the degree of sea levels rise by comparing the constant temperature model.

We discuss the influence of the condition of the temperature rise on sea levels rise. We process the linear handle after the analysis of the best and the worst scene. For example, when the temperature raises minimum, the temperature rises by  $0.7^\circ\text{C}$  and it is also that rising is of  $0.14^\circ$ ?

When the temperature raises minimum: the temperature rises by  $0.7^\circ$  in 50 years.

Ice caps will absorb more calories and melting will speed up. Calculate the situation of the sea level rise with 10 years as the calculating unit.

The equation of the heat absorbed extra is:

$$Q_x = msT, \quad (38.3)$$

Among them,  $x$  represents the time length,  $m$  represents the quality of ice caps,  $s$  represents the rate of change which ice caps absorb heat, and  $T$  represents the change of the global temperature conditions calculation found:

$$Q_{50} = 4.85 \times 10^{18} \text{ kJ} \quad (38.4)$$

In order to calculate the influence which creates the temperature change of  $0.7^\circ$  in 50 years on the status of fresh water land ice melt, we calculated the condition of the heat absorbed by ice caps. It is  $344 \text{ kJ/kg}$  at  $0^\circ\text{C}$ , there is  $1.45 \times 10^{16} \text{ kg}$  will be melted.

The total volume of the water increased in the ocean is  $1.45 \times 10^{16} \text{ kg}$  because the water quality is  $1000 \text{ kg}$  each meter. If we put this water rationing the ocean surface, the sea level will rise  $h_2 = 4.0 \text{ cm}$ .

In model 1, the height of sea levels rises to  $4.9 \text{ cm}$ , so when the temperature raises minimum, after 50 years, the temperature will be:

$$\min = h_1 + h_2 = 4.9 + 4.0 \approx 9 \text{ cm} \quad (38.5)$$

When the temperature raises maximum: the temperature rises by  $0.7^\circ$  in 50 years.

In this case, we can calculate using the same method: after 50 years, the height of sea levels rises to.

$$\max = h_1 + h_2 = 4.9 + 16.13 \approx 21 \text{ cm} \quad (38.6)$$



### 38.4 Model Improvement

The volume thermal expansion of the ocean—the sea level rise  $h_3$ .

The previous two models are not considering the temperature change for the volume of the melting fresh water land ice flowing into the sea. And, the relative area of the Northern and Southern Hemisphere is not considered here. The different area ratios between sea and land of two hemispheres have influence on the result of model.

Background material: the area of the northern ocean, the ocean area of Northern and Southern Hemisphere is, respectively, 44 and 56 % of the global sea area. That is, the ocean area of the Northern Hemisphere is about  $1.58 \times 10^8 \text{ km}^2$ .

The proportion of water is caused by ice caps melt in the Arctic Ocean; it is also occurred in the Southern Hemisphere. Thus, the Southern Hemisphere has all the condition of sea levels rise.

The problem of increasing volume caused by ocean temperatures rise.

Several major factors for ocean temperatures rise:

Atmospheric temperature rise will ascend ocean temperature.

Due to the melting of the ice caps, they will reflect less sunlight, this means that the ocean will absorb more heat.

More carbon dioxide will be absorbed by the oceans.

The pressure and sunshine factors will make water temperature transform small in the place 215 m below sea level . That is to say, only the water below the ocean surface 215 m will be heat to produce volume expansion. The volume rate of sea in  $15 \text{ }^\circ\text{C}$  is  $2.00 \times 10^{-4} \text{ K}^{-1}$ . We estimate the best and most bad scene through the following formula:

$$V_{\text{change}} = V_{\text{start}} \times B \times T_{\text{change}} \quad (38.7)$$

Among them

$$\begin{aligned} V_{\text{start}} &= \text{Initial volume}; V_{\text{change}} = \text{Volume change}; \\ B &= \text{Volume rate}; T_{\text{change}} = \text{Temperature change}. \end{aligned} \quad (38.8)$$

We conclude that the overall degree of rise of sea level after total volume change distributed in the ocean surface area; after 50 years, the smallest sea level rise is  $h_3 = 2 \text{ cm}$  and the largest is  $h_3 = 12.5 \text{ cm}$  stack again—sea level rise  $H$

$$H = h_1 + h_2 + h_3 \quad (38.9)$$

50 years later, also is in 2068:

Model 1 is improved: the sea level near Florida will rise  $H = 33.26 \text{ cm}$ .

Model 2 is improved: the sea level near Florida will rise  $H = 12\text{--}36 \text{ cm}$ .

## 38.5 The Impact Analysis

### 38.5.1 Port and Dock Engineering

Because of the relative sea level rise and the enhanced wave's effects, it will not only cause the wave port building increased risk, but also lead to the scour and pop of hydraulic structures caused by wave enhanced; it will threaten the safety and service life of the wharf and breakwater. This reduces the engineering original design standards greatly; it increases the frequency of flooding of dock, port container storage facilities, and roads.

The influence of rising sea levels and the composition of the loss damaged.

Because sea levels rise is a gradual process, it does not pose an instantaneous threat to human lives. The influence of rising sea levels can be divided into the following several aspects: first, the economic losses and human assets, and various production activities damage and loss; second, it affects society and social stability and forcing coastal population migration;

Third, it affects resources and environment sea level rise may drown the land resources, put the output value at a loss, destruct water resources and affect ecological environment. Because of rising sea levels is slow, the influence of the economy, society, resources, and the environment is long and profound.

When rising sea levels is less than or equal to 1 m, part of the ports and airports of Arc GIS is submerged and shown in table. The dark red parts is the flooded area when rising sea levels is less than or equal to 1 m.

### 38.5.2 Port and Dock Engineering

The created value produced by submerged land in different activities calculates loss: coastal areas are divided into agricultural land, forest land, land, and land for tourism services; different places have different loss, forecast per unit area value of various types of land:  $C_{i1} = C_{01} \cdot (1 + r)^n$ . In formula,

$C_{0i}$  – the output per unit area value of some kind of activities in Benchmark years;

$r$  – Economic growth rate;

$n$  – year

(38.10)

Use the social output or GDP of the drown land to calculate the loss:  $C_{i2} = C_{02} \cdot (1 + r)^n$ . In formula:

$C_{i2}$  – GDP,  $C_{02}$  – social output in benchmark year (38.11)

Thus, the calculation formula of the economic loss caused by sea level rise is:

$$L = A_0 \cdot a \cdot C_0 \sum (1 + r)^n \tag{38.12}$$

$C_0$  can be  $C_1$ , and also be  $C_2$ .

The social problem of sea level rise is mainly survival problems. After the land people life drowned, these people will be forced to migration, the influence of rising sea levels will be shown with the loss of land area and the transfer population quantity:

$$\begin{aligned} L_n & \text{--Affected population n years;} \\ S_n & = S_0 \cdot (1 + r)^n / (1 - n \cdot a) \end{aligned} \tag{38.13}$$

In formula:

$$\begin{aligned} L_s & \text{--Affected population n years;} \\ A_n & \text{--Inundation area n years} \\ S_n & \text{--Unit area population n years} \\ S_0 & \text{--Unit area population in initial year} \\ r_p & \text{--Population growth rate} \end{aligned} \tag{38.14}$$

By the above formula and analysis, we can see that the social impact of rising sea levels and economic loss are bound up with the development of the local economy. Adopting the related protective measures is particularly important.

### 38.6 Conclusion

Our model uses the current consumption of the fresh water land ice as the breakthrough point, and considers the following questions:

The melting rate of the ice caps caused by the rise of global temperature increases exponentially.

The relative proportion between sea and land in the Northern and Southern Hemisphere.

Because of ocean reason of currents, the proportion in the Northern Hemisphere after the melting of the fresh water land water.

The problem of the thermal expansion volume of the ocean surface because of the temperatures rise.

After analyzing the best and the worst case, we found that sea level would rise up to 12–36 cm relatively in the next 50 years.

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# Chapter 39

## Study on Measure Solution Acidity or Basicity Based on Using Acidity AG

Liang Yongfeng

**Abstract** pH is a widely-used concept and physical quantity in chemistry and related disciplines. However, many studies found that this concept has numerous shortcomings. For instance, in the theoretical world, no consistent definition has been given to it; its concepts are disorderly characterized without theoretical significance; its physical significance also is not undefined and has no universality; in the practical application, the concepts of pH reference, pH standard and pH scale all are highly unclear, and pH is impacted by the temperature, concentration and pressure of solutions as well. This paper proposes to use AG to measure the acidity or basicity of solutions and proves this method can overcome all the shortcomings of pH through theoretical derivation and experiment, further showing that using AG to measure the acidity or basicity of solutions is scientific in theories and feasible in practices, and also owns its advantages.

**Keywords** Acidity AGH · The acidity or basicity of solutions · Scientific · Study

### 39.1 Introduction

PH is a widely-used concept and physical quantity in chemistry and related disciplines. However, pH is found to have numerous shortcomings in scientific research or in chemical teaching, and especially its concept lacks the theoretical significance in depth and has no consistent definition all the times [1, 2].

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Furthermore, in practical application, it has the difference between concentration and activity measurements, and also volume activity and quality activity are different in the measurement of concentration or activity, or the volume amount-of-substance concentration and quality amount-of-substance concentration are different.

## 39.2 Problems of pH to Measure the Acidity or Basicity of Solutions

No consistent definition has been given to pH. In the chemical teaching materials of higher educational institutions, the expressions about pH concept definitions are as shown below:

$$\text{pH} = -\lg[\text{H}^+] \quad (39.1)$$

$$\text{pH} = -\lg[m_{(\text{H}^+)}] \quad (39.2)$$

$$\text{pH} = -\lg[\text{H}^+]/\text{mol} \cdot \text{L}^{-1} \quad (39.3)$$

$$\text{pH} = -\lg[a_{\text{H}^+}] \quad (39.4)$$

$$\text{pH} = -\lg[m_{\text{H}^+}r_{\text{H}^+}] \quad (39.5)$$

$$\text{pH} = -\lg[C_{(\text{H}^+)}y_{\text{H}^+}] \quad (39.6)$$

$$\text{pH} = -\lg\{m_{(\text{H}^+)}r/m\} \pm 0.02 \quad (39.7)$$

$$\text{pH} = -\lg\{C_{(\text{H}^+)}y/C\} \pm 0.02 \quad (39.8)$$

$$\text{pH}(x) = \text{pH}(s) + (E_s - E_x)F/(RT \ln 10) \quad (39.9)$$

In the above, there are nine expressions, and the quantity and quantity's symbol of pH do not comply with international standards.

In the theoretical world, pH concepts are characterized differently. However, in the practical world, there are problems that the concepts of pH references, pH standards and pH scale are highly unclear [3].

Using pH to measure the acidity or basicity of solutions lacks the universality, but only with limitation [4]. Namely, pH can be used to only measure the acidity or basicity of solutions with different hydrogen ion concentrations under the same temperature.

From the strict meaning of mathematics, it is unreasonable for non-dimensional  $[\text{H}^+]$  to take the logarithm, because it has no definite physical meaning.

pH does not comply with the habit of thinking. In the teaching practices, it is hard for students to understand it, and it easily results in the directional mistakes of high and low pH corresponding to the acidity or basicity of solutions.

pH is impacted by temperature, pressure and concentration. Even in the pure water, values of pH are also different under the different temperature and pressure. As impacted by the habit of thinking, students are easy to absolute the  $\text{pH} = 7$  base, and often neglect the disorders generated from the impacts of temperature, pressure and concentration on pH.

There is no necessary connection between pH and the acidity or basicity of matters, and the meaning of orientation remains unknown.

Using pH to measure the acidity or basicity of non-aqueous solutions is easier to make students confused. Students are often impacted by the pH range (0–14.0 pH) of aqueous solution, and hence mistake that the pH range of other solutions is 0–14.0 pH as well and the pH of neutral solutions all is 7.

The application of pH is restricted by 0–14.0 pH.

### 39.3 Acidity AG

In 1999, Dutch scientist Henk Von Lubeak proposed to use the acidity AG to measure the acidity or basicity of solutions and defined it as the following [5]:

$$\text{AG} = \lg \frac{[\text{H}^+]}{[\text{OH}^-]} \quad (39.10)$$

In the equation (39.10),  $[\text{H}^+]$  and  $[\text{OH}^-]$  are the amount-of-substance concentrations of hydrogen ion and hydroxide ions.

### 39.4 Study on the Scientific Meaning of Using Acidity AG to Substitute for pH

#### 39.4.1 AG Activity Expression Form

Due to the interactive action between ions of solutions, the activity should substitute for concentration from the strict sense in the Eq. (39.10).

$$\text{AG} = \lg \frac{a_{m(\text{H}^+)}}{a_{m(\text{OH}^-)}} \quad (39.11)$$

$$\text{AG} = \lg \frac{a_{C(\text{H}^+)}}{a_{C(\text{OH}^-)}} \quad (39.12)$$

In the Eq. (39.11),  $a_{m(\text{H}^+)}$  and  $a_{m(\text{OH}^-)}$  mean that solvent qualities are used to measure the activities of hydrogen ions and hydroxide ions in the solutions of amount-of-substance concentration. In the Eq. (39.12),  $a_{C(\text{H}^+)}$  and  $a_{C(\text{OH}^-)}$  mean

that solution volumes are used to the activities of hydrogen ions and hydroxide ions in the solutions of amount-of-substance concentration.

Relationships among  $a_m$ ,  $a_c$ ,  $m$  and  $C$ :

Equations of  $m_{(B)}$  and  $C_{(B)}$  matter B volume amount-of-substance Concentration.

In analytical chemistry and inorganic chemistry, the solution concentrations are often measured by the solute B amount-of-substance contained in 1 L solvent, namely, the volume amount-of-substance concentration. Its equation is shown as  $C_{(B)} = \frac{1000n_B}{V}$  (mol/L).

In the above equation,  $n_B$  is the matter B amount-of-substance and  $V$  is the volume (ml) of solution.

Matter B quality amount-of-substance concentration.

In physical chemistry, the solution concentrations are often measured by the solute B amount-of-substance contained in 1000 g solvent, namely the quality amount-of-substance concentration. Its equation is shown as  $m_{(B)} = \frac{1000n_B}{w}$  (mol/kg).

In the above equation,  $n_B$  is the solute B amount-of-substance and  $W$  is the quality (g) of solvent.

Relationships among  $a_m$ ,  $a_c$ ,  $m$  and  $C$ :

The activity of a constituent in solvent can be defined as its concentration multiplying its activity coefficient, which is shown as  $a_m = r \cdot m/m^\theta$ ,  $a_c = y \cdot C/C^\theta$ .

Based on the above, the acidity AG can be expressed respectively below:

$$AG = \lg \frac{y_{H^+} \cdot C_{(H^+)}}{y_{OH^-} \cdot C_{(OH^-)}} \quad (39.13)$$

$$AG = \lg \frac{r_{H^+} \cdot C_{(H^+)}}{y_{OH^-} \cdot C_{(OH^-)}} \quad (39.14)$$

Relationships among  $m(B)$ ,  $C(B)$ ,  $r(B)$  and  $y(B)$ :

In the solution, the chemical equations of solute B can be expressed by the activity below [6]:

$$\mu_B = (\mu_B^0)_m + RT \ln(a_B)_m \quad (39.15)$$

$$\mu_B = (\mu_B^0)_c + RT \ln(a_B)_c \quad (39.16)$$

In the closed system, the chemical equations of solute B should be the same, and have no connection with the used concentrations, and then the following equitation can exist:

$$(\mu_B^0)_m + RT \ln r_B m_B / m^\theta = (\mu_B^0)_c + RT \ln y_B C_B / C^\theta \quad (39.17)$$

For the weak solution, there is  $r_{(B)} = y_{(B)} = 1$  and the Eq. (39.18) can be expressed below:



$$(\mu_B^0)_m + RT \ln m_B/m^\theta = (\mu_B^0)_c + RT \ln C_B/C^\theta \quad (39.18)$$

For the infinite weak solution, there are the following equations are  $m_{(B)} = \frac{1000n_B}{n_s M_S}$ ,  $C_{(B)} = \frac{1000n_B P_S}{n_s M_S}$ .

In the above equations,  $n_B$  is the amount of substance of solute B;  $n_S$  is the amount of substance of solvent;  $M_S$  is the relative molecular mass of solvent.  $P_S$  is the density of solvent. If the density of solution is close to that of solvent, "the relative molecular mass of solution" can be replaced by the relative molecular mass of solvent  $M_S$ . Then, the standard equations expressed by the two concentrations have the relationship below:

$$(\mu_B^0)_m + RT \ln(1000/M_S) \approx (\mu_B^0)_c + RT \ln(1000y_B P_S/M_S) \quad (39.19)$$

Then:

$$(a_B)m \cdot p_s \approx (a_B)c \quad (39.20)$$

$$r_B \cdot m_B/m^\theta \cdot P_S \approx y_B \cdot C_B/C^\theta \quad (39.21)$$

Therefore, the relationship between the activities coefficients of the two concentrations can be expressed by the equation is  $\frac{r_B}{y_B} = \frac{C_B}{m_B \cdot p_s}$ .

In the extremely weak solution, there is  $r_{(B)} = y_{(B)} = 1$ , and then

$$m_B/m^\theta \cdot P_S \approx C_B/C^\theta \quad (39.22)$$

Pool the Eqs. (39.13), (39.14), (39.21) and (39.22), and then  $AG = \lg \frac{a_{C(H^+)}}{a_{C(OH^-)}}$   
 $= \lg \frac{a_{m(H^+)}}{a_{m(OH^-)}}$ .

### 39.4.2 Mean Activity ( $a_{\pm}$ ) and Mean Activity Coefficient ( $r_{\pm}$ )

The activity and activity coefficient of a single positive ion and negative ion is unable to be measured, and only the mean activity ( $a_{\pm}$ ) and the mean activity coefficient ( $r_{\pm}$ ) can be obtained. If an electrolyte is ionized in the solution according to the equation is:  $MmNn = mM^{n+} + nN^{m-}$ .

The mean activity ( $a_{\pm}$ ):

$$a_{\pm}^{(m+n)} = a_+^m \cdot a_-^n \text{ or } a_{\pm} = (a_+^m \cdot a_-^n)^{\frac{1}{m+n}} \quad (39.23)$$

The mean activity coefficient ( $r_{\pm}$ ):

$$r_{\pm} = (r_+^m \cdot r_-^n)^{\frac{1}{m+n}} \quad (39.24)$$

Relationships among  $r_{H^+}$ ,  $r_{OH^-}$  and  $r_{\pm}$ :

Ionic Strength The ionic strength in the electrolyte solution:  $I = \frac{1}{2} \sum m_j Z_j^2$ .

In other words, the ionic strength only has something to do with the concentrations and charges of all ions of the solution, but has no connection with the nature of ions.

Relationships among  $r_{\text{H}^+}$ ,  $r_{\text{OH}^-}$  and  $r_{\pm}$ :

In accordance with the equation Debye-Hückel [7, 8], there are the following equations at 25 °C aqueous solution.

$$-\lg r_{\text{H}^+} = \frac{0.509Z_{\text{H}^+}^2\sqrt{I}}{1 + Ba\sqrt{I}} = \frac{0.509\sqrt{I}}{1 + Ba\sqrt{I}} \quad (39.25)$$

$$-\lg r_{\text{OH}^-} = \frac{0.509Z_{\text{OH}^-}^2\sqrt{I}}{1 + Ba\sqrt{I}} = \frac{0.509\sqrt{I}}{1 + Ba\sqrt{I}} \quad (39.26)$$

In the above equation,  $B = 3.3$ ; hydrogen ion  $a = 0.9$ ; hydroxide ion  $a = 0.35$ ; their mean  $a = 0.3$  is usually taken in the calculation, because  $I$  is identical in the same solution and  $Z_{\text{H}^+} = Z_{\text{OH}^-} = 1$

$$r_{\text{H}^+} \approx r_{\text{OH}^-} \quad (39.27)$$

The equation of the ionic mean activity coefficient ( $r_{\pm}$ ) is below:

$$-\lg r_{\pm} = \frac{0.5Z_+Z_-\sqrt{I}}{1 + \sqrt{I}} = \frac{0.5\sqrt{I}}{1 + \sqrt{I}} \quad (39.28)$$

Compare the Eqs. (39.25), (39.26), (39.27) and (39.28), and then

$$r_{\text{H}^+} \approx r_{\text{OH}^-} \approx r_{\pm} \quad (39.29)$$

Calculations of  $r_{\text{H}^+}$ ,  $r_{\text{OH}^-}$  and  $r_{\pm}$ :

The  $r_{\text{H}^+}$ ,  $r_{\text{OH}^-}$  and  $r_{\pm}$  of different concentrations of all matters can be calculated according to Eqs. (39.25), (39.26) and (39.28), and they are shown in the following (Tables 39.1, 39.2, 39.3, 39.4, 39.5 and 39.6).

### 39.4.3 Comparison on AG Calculated by Different AG Equations

Different AG of the same matter under the same condition can be calculated according to Eqs. (39.10), (39.13) and (39.14), and they are shown in Table 39.7.

**Table 39.1** Activity coefficients of HCl solution under different concentrations

Concentrations of HCl (m)	0.001	0.005	0.01	0.05	0.1
$r_{\text{H}^+}$	0.967	0.926	0.914	0.854	0.826
$r_{\text{OH}^-}$	0.965	0.925	0.901	0.813	0.763
$r_{\pm}$	0.965	0.927	0.903	0.811	0.759

**Table 39.2** Activity coefficients of  $\text{H}_2\text{SO}_4$  solution under different concentrations

Concentrations of $\text{H}_2\text{SO}_4$ (m)	0.001	0.005	0.01	0.05	0.1
$r_{\text{H}^+}$	0.946	0.901	0.874	0.810	0.783
$r_{\text{OH}^-}$	0.941	0.882	0.846	0.731	0.675
$r_{\pm}$	0.942	0.882	0.844	0.725	0.665

**Table 39.3** Activity coefficients of  $\text{NaOH}$  solution under different concentrations

Concentrations of $\text{NaOH}$ (m)	0.001	0.005	0.01	0.05	0.1
$r_{\text{H}^+}$	0.967	0.926	0.914	0.854	0.826
$r_{\text{OH}^-}$	0.965	0.925	0.901	0.813	0.763
$r_{\pm}$	0.965	0.927	0.903	0.811	0.759

**Table 39.4** Activity coefficients of  $\text{Ba}(\text{OH})_2$  solution under different concentrations

Concentrations of $\text{Ba}(\text{OH})_2$ (m)	0.001	0.005	0.01	0.05	0.1
$r_{\text{H}^+}$	0.946	0.901	0.874	0.810	0.783
$r_{\text{OH}^-}$	0.941	0.882	0.846	0.731	0.675
$r_{\pm}$	0.942	0.882	0.844	0.725	0.665

**Table 39.5** Activity coefficients of  $\text{NH}_4\text{Cl}$  solution under different concentrations

Concentrations of $\text{NH}_4\text{Cl}$ (m)	0.001	0.005	0.01	0.05	0.1
$r_{\text{H}^+}$	0.967	0.926	0.914	0.854	0.826
$r_{\text{OH}^-}$	0.965	0.925	0.901	0.813	0.763
$r_{\pm}$	0.965	0.927	0.903	0.811	0.759

**Table 39.6** Activity coefficients of  $\text{NaAc}$  solution under different concentrations

Concentrations of $\text{NaAc}$ (m)	0.001	0.005	0.01	0.05	0.1
$r_{\text{H}^+}$	0.967	0.926	0.914	0.854	0.826
$r_{\text{OH}^-}$	0.965	0.925	0.901	0.813	0.763
$r_{\pm}$	0.965	0.927	0.903	0.811	0.759

From the above tables, the followings can be proved:

$r_{\text{H}^+}$  is “ $B = 3.3, a = 0.9$ ” calculated based on Eq. (39.25)

$r_{\text{OH}^-}$  is “ $B = 3.3, a = 0.35$ ” calculated based on Eq. (39.26)

$r_{\pm}$  is “ $B \cdot a = 1$ ” calculated based on Eq. (39.28)

From Table 39.7, the followings can be proved:

AG ● is the value calculated based on the Eq. (39.10) (i.e. the concentration equation);

AG ●● is the value calculated based on the Eq. (39.13) (i.e. volume amount of substance activity equation);

AG ●●● is the value calculated based on the Eq. (39.14) (i.e. quality amount of substance activity equation).

**Table 39.7** Different AG of the same matter under the same condition calculated by different

Solution	AG	Concentration				
		0.001	0.005	0.01	0.05	0.1
HCl	AG ●	8.0	9.4	10.0	11.4	12.0
	AG ●●	8.0	9.4	10.0	11.4	12.0
	AG ●●●	8.0	9.4	10.0	11.4	12.0
H <sub>2</sub> SO <sub>4</sub>	AG ●	8.6	10.0	10.6	12.0	12.6
	AG ●●	8.6	10.0	10.6	12.0	12.6
	AG ●●●	8.6	10.0	10.6	12.0	12.6
NaOH	AG ●	-8.0	-9.4	-10.0	-11.4	-12.0
	AG ●●	-8.0	-9.4	-10.0	-11.4	-12.0
	AG ●●●	-8.0	-9.4	-10.0	-11.4	-12.0
Ba(OH) <sub>2</sub>	AG ●	-8.6	-10.0	-10.6	-12.0	-12.6
	AG ●●	-8.6	-10.0	-10.6	-12.0	-12.6
	AG ●●●	-8.6	-10.0	-10.6	-12.0	-12.6
NH <sub>4</sub> Cl	AG ●	1.8	2.5	2.8	3.5	3.8
	AG ●●	1.8	2.5	2.8	3.5	3.8
	AG ●●●	1.8	2.5	2.8	3.5	3.8
CH <sub>3</sub> COONa	AG ●	-1.8	-2.5	-2.8	-3.5	-3.8
	AG ●●	-1.8	-2.5	-2.8	-3.5	-3.8
	AG ●●●	-1.8	-2.5	-2.8	-3.5	-3.8

### 39.5 Conclusion

Through theoretical derivation or mathematical computation, AG expressed by concentration or activity has been proved to have the same result. Namely, the result can be described as  $AG = \lg \frac{[H^+]}{[OH^-]} = \lg \frac{a_{C(H^+)}}{a_{C(OH^-)}} = \lg \frac{a_{m(H^+)}}{a_{m(OH^-)}}$ .

The acidity  $AG = \lg \frac{[H^+]}{[OH^-]}$  is consistent, exclusive and rigorous in theories, experiments and actual operations [9, 10]. That is to say, the differences between concentration and activity or analytical concentration and physical chemistry concentration are needless when AG is used to measure the acidity or basicity of solutions.

Using  $AG = \lg \frac{[H^+]}{[OH^-]}$  to measure the acidity or basicity of solutions is always consistent in the chemistry of middle schools or the inorganic chemistry and analytical chemistry of higher educational institutions.

In conclusion, in theories or practical applications, using the acidity AG to substitute for pH to measure the acidity or basicity of solutions is scientific and feasible, and also has strong operability [11]. Therefore, it is suggested to use the AG to measure the acidity or basicity of solutions in future chemical teaching and scientific researches [12].

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# Chapter 40

## Study on Recycling of Silicate Contained Wastes for Fiber Cement Board

Cheng-Kuo Hsieh, T. H. Ueng and Jyh-Herng Chen

**Abstract** In this study, silicate contained wastes, such as spent refractory materials, cutting sludge of dimension stone, or waste glass, were used in the traditional fiber cement board process to replace the conventional raw material of silica sand. It was demonstrated that the recycled materials could be prepared with good fire resistance and heat insulation properties. Materials tested according to CNS13777 regulation showed that recycled silicate contained materials could meet the commercial product specifications. Above-mentioned industrial wastes are suitable as the raw materials for fiber cement board.

**Keywords** Industrial wastes · Fiber cement board · Recycling

### 40.1 Introduction

In this study, silicate contained wastes, such as spent refractory materials, cutting sludge of dimension stone, or waste glass, are intended to be developed as recycling materials for replacing the silica sand materials used in the traditional fiber cement board [1, 2]. After the silicate contained wastes were processed through the

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high-pressure molding and high-temperature maintenance of fiber cement board production process, the difference of hydration reaction products was analyzed with XRD and SEM [3, 4]. Simultaneously, the physical properties of board materials were detected according to CNS13777, and also the usability of various silicate contained wastes in fiber cement board production process is discussed.

### 40.2 Fiber Cement Board Production Process

Commercial production process of typical fiber cement board is as shown Fig. 40.1. In this study, the raw materials ratio and production process conditions provided by Germany SIEMPELKAMP Company that is in the leading position in fiber cement board factory equipment and technology were used as reference, as shown in Table 40.1. Silica sand is the primary raw material of fiber cement board, accounting for 52 % of the total materials.

### 40.3 Characteristics of Silicate Contained Raw Materials

In this study, silicate contained wastes, such as granite material and sludge, spent refractory materials of silicon and aluminum, or waste glass, are attempted to be developed as recycling materials for replacing the silica sand materials used in the

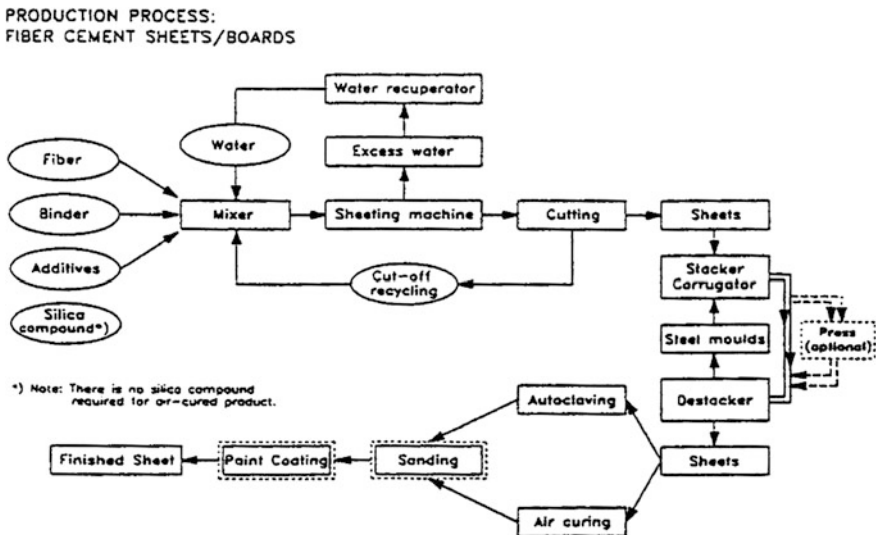


Fig. 40.1 Production process of typical fiber cement board (provided by SIEMPELKAMP Company)

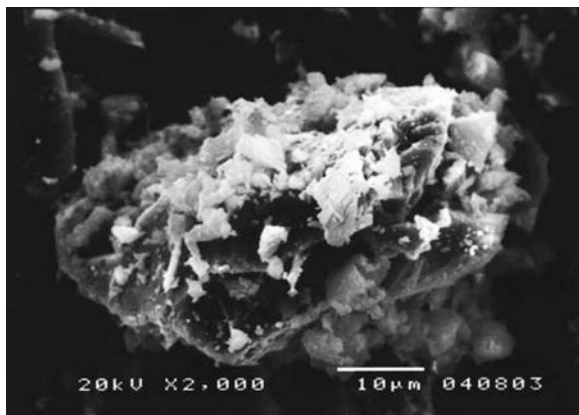
**Table 40.1** Conditions for the production process of typical fiber cement board

Items	Conditions for production process	%
I. Ratio of raw material	1. Paper fiber (cellulose, virgin pulp)	9
	2. Silica sand (silica sand,-320 mesh)	52
	3. Cement	33
	4. Kaolin	6
II. High-pressure molding	5. 0 kgf/cm <sup>2</sup> -200 kgf/cm <sup>2</sup>	
III. High temperature steam health care	180 °C, 10 kgf/cm <sup>2</sup> , 6 h	

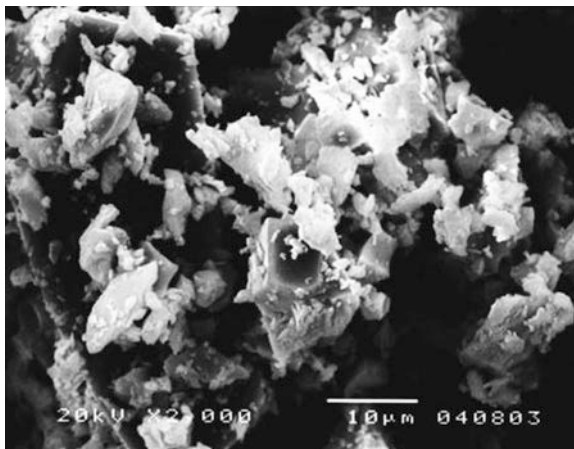
*Note* Fiber cement board production process conditions provided by Germany SIEMPELKAMP company

traditional fiber cement board. The characteristics of all raw materials containing silicate are shown as follows. Silica sand is the general name of quartz sands with high SiO<sub>2</sub> content; natural silica mixes with clay between the sands of sand layer, and can be separated into clay and washed-out silica sand after washing (splashing) [5, 6]. Granite mainly comprises of quartz, mica, and feldspar, and belongs to siliceous rock with a good crystalline property. Spent refractory brick of silicon and aluminum is made of powder raw materials containing silicates and alumina after high-temperature agglomeration of over more than 1500 °C and belongs to semi-silica ceramic body with a good crystalline property. Waste glass mainly comprises of silicate and belongs to silicon material with a non-crystalline form. Figures 40.2 and 40.3 respectively shows the SEM observation forms of traditional silica sand raw material and waste glass powder, and both materials were crushed and screened by machine. Table 40.2 shows the chemical compositions of all silicate contained raw materials.

**Fig. 40.2** SEM observation form of traditional silica sand raw material







**Fig. 40.3** SEM observation form of waste glass powder

**Table 40.2** Chemical compositions of all silicate contained raw materials (%)

Material type	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO
Silica sand	93.2	2.1	1.6	2.8	0.7
Granite material and sludge	69.4	13.3	3.2	0.5	0.1
Spent refractory material of silicon and aluminum	43.1	48.8	3.6	0.8	0.2
Waste glass powder	72.5	1.7	0.4	8.6	1.2

## 40.4 Experimental Discussion on the Hydration Reaction of Silicate Contained Waste as Recycling Material

In this study, the difference of the hydration reaction of silicate contained recycling material is analyzed and discussed with XRD and SEM (Fig. 40.4).

The difference of the hydration reactions of the produced plate samples is discussed respectively with XRD analysis and SEM observation. The main experimental results are introduced as follows.

### 40.4.1 XRD Analysis Results of Hydrates

XRD detection images of the silica sand cement pastes maintained at room temperature for 28 days and at 180 °C with steam are shown in Figs. 40.5 and 40.6, respectively. The results show the crystalline property of quartz (principal component of silica sand) was good, and its XRD characteristic peak strength (labeled as *Q*) was very high and almost covered the characteristic peaks of other components.

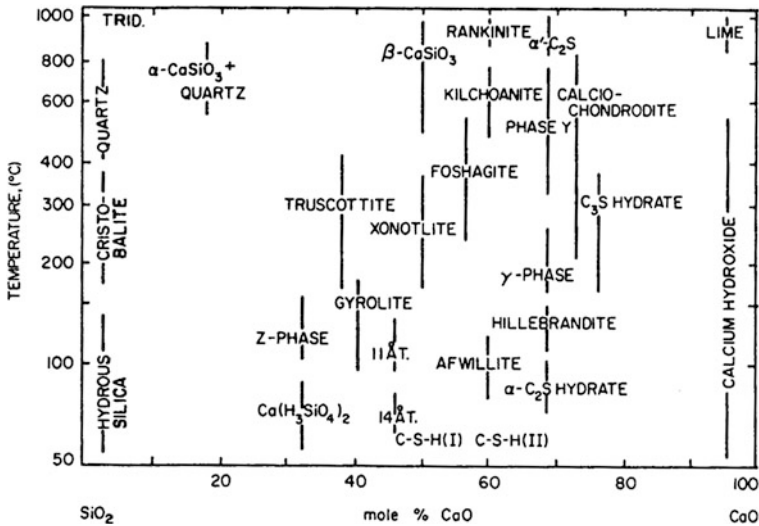
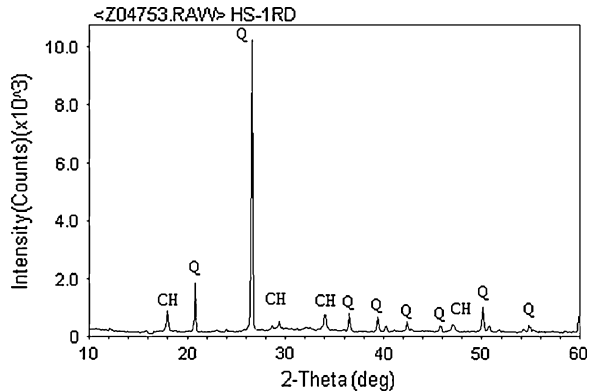


Fig. 40.4 Composition of calcium silicate hydrate

Fig. 40.5 Silica sand (Q) cement paste maintained at room temperature for 28 days

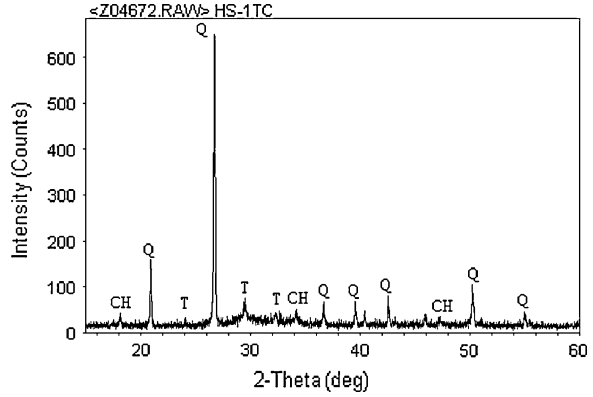


XRD detection images of the granite cement pastes maintained at room temperature for 28 days and at 180 °C with steam are shown in Figs. 40.7 and 40.8, respectively. The results show the crystalline property of granite was good, and its XRD characteristic peak strength (labeled as Q) was very high and almost covered the characteristic peaks of other components.

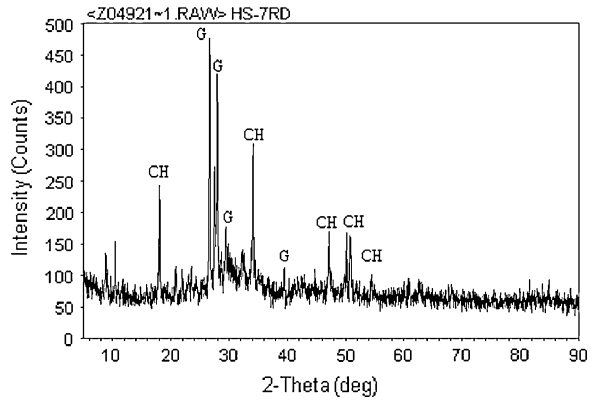
XRD detection images of the spent refractory material cement pastes maintained at room temperature for 28 days and at 180 °C with steam are shown in Figs. 40.9 and 40.10, respectively. The results show the crystalline property of spent refractory material was good, and its XRD characteristic peak strength (labeled as R) was very high and almost covered the characteristic peaks of other components.

XRD detection images of the waste glass powder recycled material and its cement paste maintained at 180 °C with steam are shown in Figs. 40.11 and 40.12,

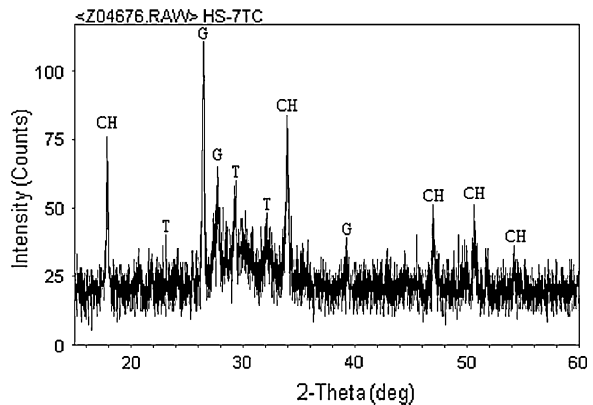
**Fig. 40.6** Silica sand  
(Q) cement paste maintained  
at 180 °C



**Fig. 40.7** Granite  
(Q) cement paste maintained  
at room temperature for  
28 days

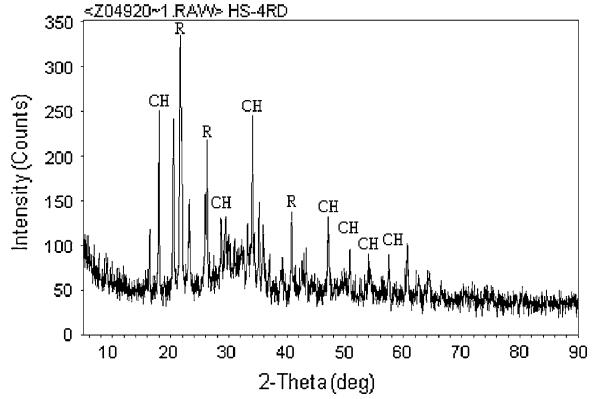


**Fig. 40.8** Granite  
(Q) cement paste maintained  
at 180 °C

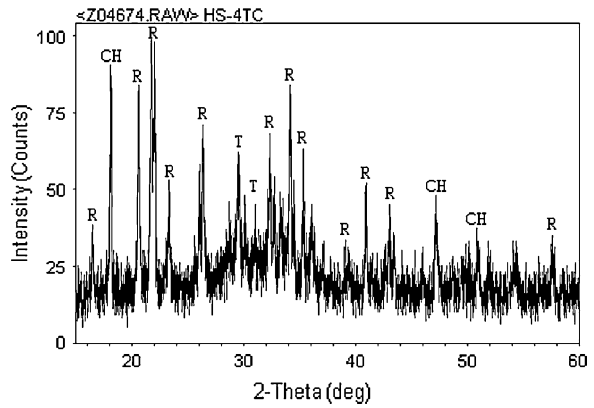


respectively. The results show the non-crystalline component of waste glass powder was mixed and disorder in XRD detection image and had no significant XRD characteristic peak.

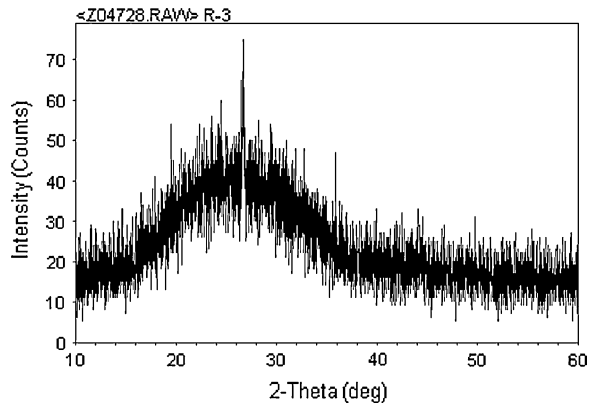
**Fig. 40.9** Spent refractory material (R) cement paste maintained at room temperature for 28 days



**Fig. 40.10** Spent refractory material (R) cement paste maintained at 180 °C

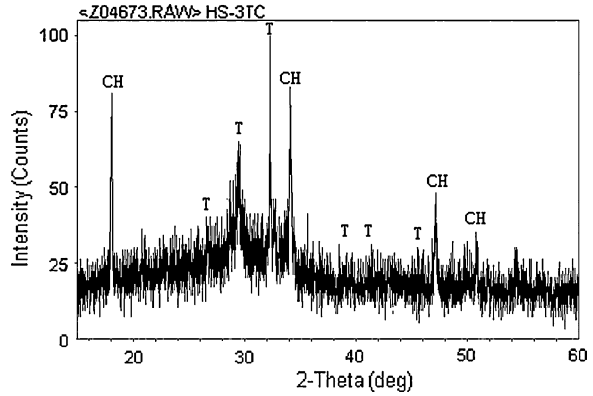


**Fig. 40.11** XRD detection of waste glass powder



By integrating the above-mentioned XRD detection results, it can be seen that all siliceous components will be involved in the hydration reaction of high-temperature maintenance, and also will make part of crystalline structure of the

**Fig. 40.12** Waste glass powder cement paste maintained at 180 °C



recycling material damaged by erosion and decreased in XRD characteristic peak strength.

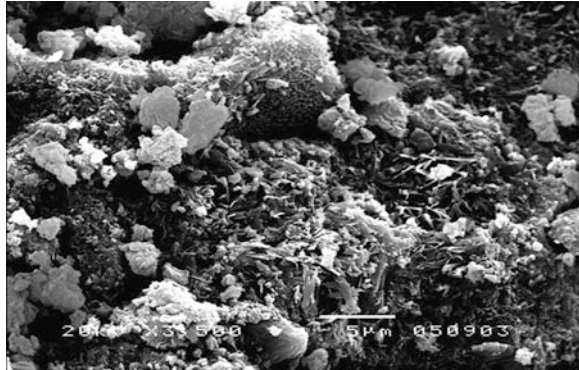
#### 40.4.2 SEM Analysis Results of Hydrates

In this experiment, the morphology of hydrates between powder particles was further observed with SEM, so as to provide a clearer discriminatory analysis. Fig. 40.13 shows the hydrates of the silica sand cement paste maintained at room temperature, and the hydrates comprised of thin and rod-like calcium vanadium stone, solid calcium hydroxide, well-structured hexagonal laminated calcium sulpho-aluminates, superfine and needle-like calcium silicate products, etc. Figure 40.14 shows the appearance of the hydrates of the silica sand cement paste maintained at 180 °C with steam, and the hydrates comprised of closely and crossed leaf-like calcium silicate products, and also were distributed in all places of cement paste.

**Fig. 40.13** SEM image ( $\times 5000$ ) of silica sand cement paste maintained at room temperature for 28 days



**Fig. 40.14** SEM image ( $\times 10000$ ) of silica sand cement paste maintained at 180 °C

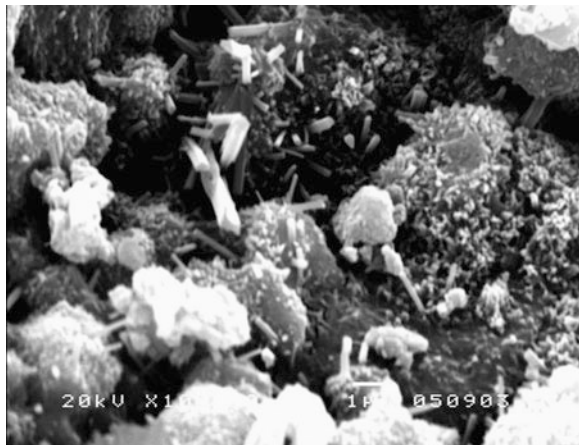


The hydrates of the granite cement paste maintained at room temperature are shown in Fig. 40.15, and the hydrates comprised of calcium vanadium stone, solid calcium hydroxide, calcium sulpho-aluminates, low-temperature calcium silicate hydrates, etc. The appearance of the hydrates of the granite cement paste maintained at high temperature with steam is shown in Fig. 40.16, and the hydrates mainly comprised of mesh calcium silicate products with a good growth.

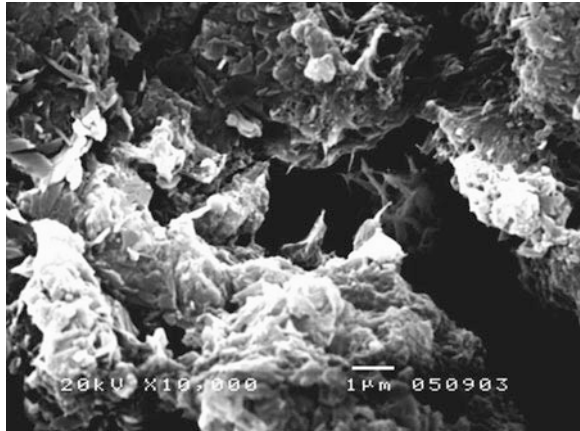
The hydrates of the spent refractory material cement paste maintained at room temperature for 28 days are shown in Fig. 40.17, and the hydrates comprised of low-temperature needle-like calcium silicates. The appearance of the hydrates of the spent refractory material cement paste maintained at 180 °C is shown in Fig. 40.18, and the hydrates comprised of leaf-like calcium silicates with a good growing structure.

The hydrates of the waste glass powder cement paste maintained at room temperature for 28 days are shown in Fig. 40.19, and the hydrates mainly comprised of local solid calcium hydroxide and low-temperature calcium silicate products. However, the appearance of the hydrates of the waste glass powder

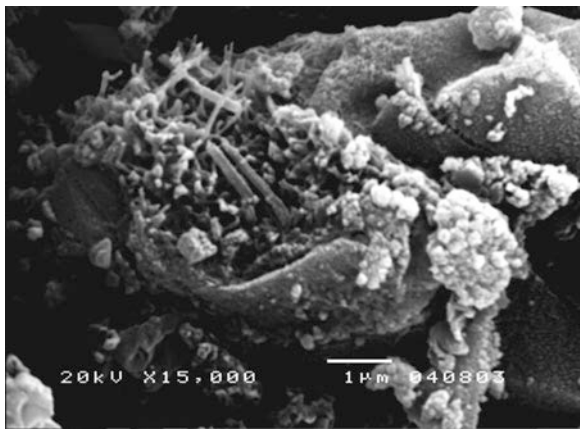
**Fig. 40.15** SEM image ( $\times 10000$ ) of granite cement paste maintained at room temperature for 28 days



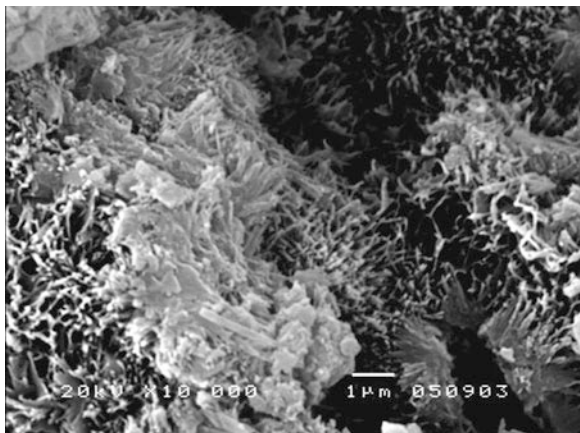
**Fig. 40.16** SEM image ( $\times 10000$ ) of granite cement paste maintained at 180 °C



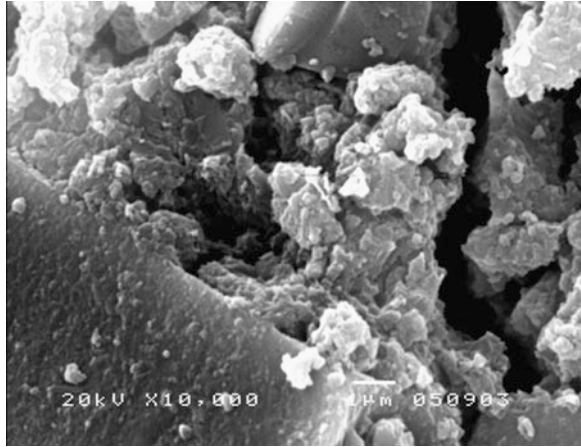
**Fig. 40.17** SEM image ( $\times 15000$ ) of spent refractory material cement paste maintained at room temperature for 28 days



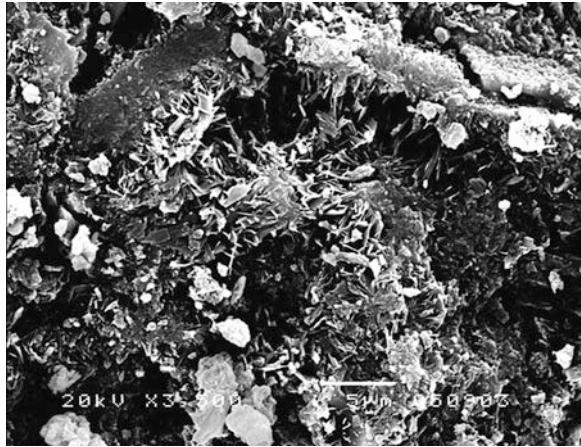
**Fig. 40.18** SEM image ( $\times 10000$ ) of spent refractory material cement paste at 180 °C for 6 h



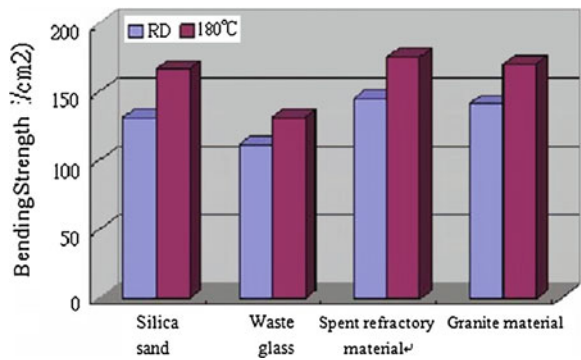
**Fig. 40.19** SEM image ( $\times 10000$ ) of waste glass powder cement paste maintained at room temperature for 28 days



**Fig. 40.20** SEM image ( $\times 3500$ ) of waste glass powder cement paste maintained at 180 °c for 6 h



**Fig. 40.21** Bending strengths of recycling boards





**Table 40.3** Comparison on the tested physical properties of all recycling materials samples

Material type	Flame resistance CNS 6532	Shock resistance CNS 13777	Soaking length change rate (%)	Water absorption (%)	Water permeability CNS 13777	Workability CNS 13777
Market sales specification	The highest	Un-cracked board	<0.15	<28	No water-drop on the back	Meeting workability
Silica sand powder	The highest	Un-cracked board	<0.15	25.6	No water-drop on the back	Meet workability
Waste glass powder	The highest	Un-cracked board	<0.15	26.2	No water-drop on the back	Meet workability
Spent refractory material	The highest	Un-cracked board	<0.15	24.9	No water-drop on the back	Meet workability
Waste granite sludge	The highest	Un-cracked board	<0.15	25.2	No water-drop on the back	Meet workability

cement paste maintained at 180 °C with steam mainly comprised of leaf-like calcium silicate products with a good growth. From Fig. 40.20, in the high-temperature maintenance process, the high water-solubility of non-crystalline silicon oxidation was helpful for the growth of calcium silicate hydrates and also for enhancing the physical properties of cement paste.

## 40.5 Physical Properties of Recycling Fiber Cement Board

The comparison on the bending strengths of the fiber cement boards produced from silica sand and all silicate contained wastes recycling materials is shown in Fig. 40.21; the bending strengths of boards after maintained at 180 °C were better than those after maintained at room temperature, and the result can be attributed to the generation of high-temperature calcium silicate hydrates. Besides, the bending strengths of the boards produced from spent refractory material and granite material tend to be better than that of silica sands, and the result is speculated to have a direct tie with the properties of powder materials.

In this study, various silicate contained raw materials mentioned above were produced into boards respectively according to fiber cement board production process, and also the results of physical properties of the fiber cement board products (as reference) sold at market tested according to CNS13777 are shown in Table 40.3. Therefore, it becomes certain that the silicate contained recycling material developed in this study is of usability in market operation.

## 40.6 Conclusion

First, calcium silicate hydrate belongs to hypo-crystalline form, and also its appearance is without a specific shape. Therefore, it is difficult to identify calcium silicate hydrate with XRD and SEM. Second, XRD research result shows that tobermorite calcium silicate hydrates cemented body can be generated from silicate contained recycling materials via hydration reaction, and also is applicable to replacing the silica sand materials used in traditional fiber cement boards. Third, through the SEM observation, silicate contained recycling materials after maintained at high temperature can generate leaf-like calcium silicate hydrates of high temperature phase on the surface between particles, and this is the major source of board strength. Fourth, test results of physical properties show that recycling fiber cement boards accord with the physical property specifications of CNS13777 and pass the highest flame resistance standard of CNS6532. Besides, there is a direct tie between board strength and powder particles strength. Finally, after all results in this study are comprehensively considered, it is found that the feasibility of developing and utilizing silicate contained wastes as recycling material of producing fiber cement board for replacing silica sand is definite and obvious.

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# Chapter 41

## Optimization Management Based on Distribution Parameter

Qun Wang

**Abstract** This Paper analyzes the scheduled operation process of taxi service by using distribution parameter control theory and method, and establishes distribution parameter control model of taxi management and administration. The solution of the model is found by applying operator semigroup theory and fundamentals of Pontryagin maximum. Meanwhile, the space accompanying function, optimization control, and the analytic expression formula of the optimization control locus is given.

**Keywords** Automatic control · Distribution parameter · Operator semi group

### 41.1 Introduction

Generally, the operation and management of taxi company will include purchase, maintenance, and ejection of cars, and all these activities are involved in the process of operation [1]. The operating situation of taxi, the maintenance cost, and the year of ejection are highly related with the time of being used [2, 3]. It is difficult to describe this kind of problem by using ordinary differential equation, for the reason is that these methods are only related with time, but they need to define the situation variables and control variables with time and space dimension in this problem, so a group of differential equations is needed to describe system [4, 5]. These characters are justly existed in distribution parameter system [6].

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Generally, the situation equation of distribution parameter system can be described as:

$$x = f\left(t, \sigma, x, \frac{dx}{d\sigma}, u\right) \tag{41.1}$$

In this equation,  $x$  is the situation variable of distribution parameter system,  $u$  is the control of system, initial value  $x(0, \sigma)$  and boundary value  $x(t, 0)$  is known,  $t$  represents time,  $\sigma$  is space coordinate [7]. It satisfy the restrict that  $t \in [0, T]$ ,  $\sigma \in [0, h]$ ,  $u \in \Omega$  and  $x \in H$ .  $\Omega$  Is permitted control set,  $H$  is a divided Hilbert space [8]. In the operating time interval of the system, the economic index of the system can be measured by the following function:

$$J = \int_0^T \int_0^h F d\sigma dt + \int_0^T Q(t)x(t, h) dt + \int_0^h G(\sigma)x(T, \sigma) d\sigma \tag{41.2}$$

The optimal controlling issue of distribution parameter is to find an admission control  $u^*$  that satisfies the upper situation, which makes the object functional  $J$  get the maxim value, that is to calculate admission control  $u^*$ , make

Maxim {J}

Subject to  $x = f(t, \sigma, x, \frac{dx}{d\sigma}, u)$  the initial and boundary value  $x(0, \sigma)$   $x(t, 0)$  are known.

### 41.2 The Operation and Management Optimal Control of Taxi

Applying Pont regain maximum principle, constructing Hamiltonian function  $H_1$ :

$$H_1 = -M(u - \bar{u})^2 - C_1u + (P - C_2)x + \lambda\left(-\frac{\partial x}{\partial \sigma} + u\right) \tag{41.3}$$

$$\begin{aligned} \frac{\partial}{\partial t} \lambda(t, \sigma) &= -\frac{\partial}{\partial x} H_1 + \frac{\partial}{\partial t} \left( \frac{\partial}{\partial (\frac{\partial x}{\partial t})} H_1 \right) + \frac{\partial}{\partial \sigma} \left( \frac{\partial}{\partial (\frac{\partial x}{\partial \sigma})} H_1 \right) \\ &= -\frac{\partial}{\partial \sigma} \lambda(t, \sigma) - (P(t, \sigma) - C_2(t, \sigma)) \end{aligned} \tag{41.4}$$

It satisfies the boundary condition

$$\lambda t, h = H(t), \quad \lambda(T, \sigma) = G(\sigma)$$

In order to get the solution  $\lambda^*(t, \sigma)$  of space accompanying function, the integral area  $D = [0, T] \times [0, h]$  will be divided into three areas  $D1, D2$  and  $D3$ . The 450 line segments from origin  $(0, 0)$  to point  $(h, h)$  satisfy linear equation  $t - \sigma = 0$ , this line segment is located between  $D1$  and  $D2$ . The 450 line segment from point  $(T - h, 0)$  to point  $(T, h)$  satisfies linear equation  $t - T + h - \sigma = 0$ , which is the closed set between  $D2$  and  $D3$ .

Taking the strong continuous operator semigroup with differential operator  $\frac{\partial \lambda}{\partial \sigma}$  as infinitesimal generator as parallel moving operator semigroup, noted it as  $S(t)$ , applying operator semigroup theory, the solution of space accompanying function  $\lambda(t, \sigma)$  is

$$\lambda^*(t, \sigma) = \begin{cases} S(\sigma - h)\lambda(t - h) - \\ \int_h^\sigma S(\sigma - \tau)[P(t, \tau) - C_2(t - \tau)]d\tau \\ S(t - T)\lambda(T, \sigma) - \\ \int_{T-t+\sigma}^\sigma S(\sigma - \tau)[P(t, \tau) - C_2(t - \tau)]d\tau \end{cases} \tag{41.5}$$

$$\begin{cases} c\lambda(t - \sigma + h, h) + \\ \int_\sigma^h [P(t - \sigma + \tau, \tau) - C_2(t - \sigma + \tau, \tau)]d\tau \\ \tau \geq t - T + h \\ \lambda(t, \sigma - t + T) + \\ \int_\sigma^{T-t+\sigma} [P(t - \sigma + \tau, \tau) - C_2(t - \sigma + \tau, \tau)]d\tau \\ \sigma < t - T + h \end{cases} \tag{41.6}$$

$$\begin{cases} H(t - \sigma + h) + \int_\sigma^h [P(t - \sigma + \tau, \tau) - C_2(t - \sigma + \tau, \tau)]d\tau \\ \sigma \geq t - T + h \\ G(\sigma - t + T) + \int_\sigma^{T-t+\sigma} [P(t - \sigma + \tau, \tau) - C_2(t - \sigma + \tau, \tau)]d\tau \\ \sigma < t - T + h \end{cases} \tag{41.7}$$

The optimal control  $u^*$  can be get after getting space accompanying function  $\lambda^*(t, \sigma)$  so get derivation of Hamiltonian function  $H1$  on the base of  $u$ , and let it be equal to zero, the optimal control can be get:

$$u^*(t, \sigma) = \bar{u}(t, \sigma) - \frac{1}{2M}[C_1(t, \sigma) - \lambda^*(t, \sigma)]$$

$$\begin{aligned}
 &= \begin{cases} \bar{u}(t, \sigma) - \frac{1}{2M}[C_1(t, \sigma) - H(t - \sigma + h)] \\ \bar{u}(t, \sigma) - \frac{1}{2M}[C_1(t, \sigma - G(\sigma - t + T))] \\ \frac{1}{2M} \int_0^h [p(t - \sigma + \tau, \tau) - C_2(t - \sigma + \tau)] \\ \hspace{10em} d\tau (\sigma \geq t - T + H) \end{cases} \\
 &= \begin{cases} \frac{1}{2M} \int_{\sigma}^{T-t+\sigma} [p(t - \sigma + \tau, \tau) - C_2(t - \sigma + \tau)] \\ \hspace{10em} d\tau (\sigma < t - T + H) \end{cases} \tag{41.8}
 \end{aligned}$$

Because there is the same differential operator in the conditional equation and space accompanying function equation, so they have the same operator semigroup, so the optimal control path can be get by using operator semigroup theory again:

$$\begin{aligned}
 x^*(t, \sigma) = \begin{cases} S(t)x_0(\sigma) + \int_0^t S(t-\tau)u^*(\tau, \sigma)d\tau \\ \int_0^s S(\sigma-\tau)u^*(t, \tau)d\tau \\ \begin{cases} x_0(\sigma-t) + \int_0^t u^*(\tau, \sigma-t+\tau)d\tau, & \sigma \geq t \\ \int_0^s u^*(t-\sigma+\tau, \tau)d\tau, & \sigma < t \end{cases} \end{cases} \tag{41.9}
 \end{aligned}$$

Thus we can get the optimal control of taxi operation and management and the optimal control path.

### 41.3 Economic Meaning of the Model

From the above-mentioned division of integral area  $D = [0, T] \times [0, h]$ , we will know that

$$D1 = \{(\sigma, t) \mid (\sigma, t) \in D, \sigma \geq t\}$$

$$D3 = \{(\sigma, t) \mid (\sigma, t) \in D, \sigma \leq t - T + h\}$$

But

$$D2 = \{(\sigma, t) \in D, t - T + h \leq \sigma \leq t\}$$

So we can explain the above-mentioned question: the solution of  $x^*(t, \sigma)$  on  $D1$  is the initial operating strategy of the taxi company, which can be described by the initial distribution  $x_0(\sigma)$  of the taxi. The solution of space accompanying function  $\lambda^*(t, \sigma)$  on  $D3$  is the terminal strategy, the taxi will not be abandoned in  $D3$ , but in the terminal time  $T$ , all the taxi will be checked at the price of  $G(\sigma)$ , in order to assess the operation performance of the company in period  $[0, T]$  The accompanying function  $\lambda^*(t, \sigma)$  and optimal control path  $x^*(t, \sigma)$  in area  $D2$  is middle strategy, which is irrelative with the beginning and the end, belongs to normal operating part.

The result of space accompanying function  $\lambda^*(t, \sigma)$  indicates, the taxi that operating time is  $\sigma$  at time  $t$ , will be abandoned at time  $t + h - \sigma$ , its abandoning value is  $H(t + h - \sigma)$  and from time  $\sigma$  to time  $h$ , the income of taxi operation is:

$$\int_{\sigma}^h (t - \sigma + \tau, \tau) d\tau \tag{41.10}$$

The cost of maintenance is:

$$\int_{\sigma}^h c_2(t - \sigma + \tau, \tau) d\tau \tag{41.11}$$

Thus, the result of  $\lambda^*(t, \sigma)$  in  $D1 \cup D2$  is the pure profit  $\sigma$  of taxi at time  $t$ , that is



$$H(t - \sigma + h) + \int_{\sigma}^h p(t - \sigma + \tau, \tau) d\tau - \int_{\sigma}^h c_2(t - \sigma + \tau, \tau) d\tau \quad (41.12)$$

While on  $T$ , the taxi that operating time is  $\sigma$  at time  $t$  will arrive at the terminal time  $T$  after time period  $T-t$ . Now the operation time is  $\sigma - t + T$  checking value is  $G(\sigma - t + T)$ , and the maintenance cost is:

$$\int_{\sigma}^{T-t+\sigma} c_2(t - \sigma + \tau, \tau) d\tau \quad (41.13)$$

The operation income is

$$\int_{\lambda}^{T-t+\sigma} P(t - \sigma + \tau, \tau) d\tau \quad (41.14)$$

Thus, the operation pure profit of one taxi in  $D3$  is

$$G(\sigma - t + h) + \int_{\sigma}^{T-t+\sigma} p(t - \sigma + \tau, \tau) d\tau - \int_{\sigma}^{T-t+\sigma} c_2(t - \sigma + \tau, \tau) d\tau \quad (41.15)$$

Thus, we will find that the economics meaning of accompanying function  $\lambda(t, \sigma)$  is the operation pure profit of one taxi. The optimal control  $u^*(t, \sigma)$  can be explained, when purchasing cost  $C1(t, \sigma)$  is larger than operating income, the purchasing quantity should less than object. On the contrary, when purchasing cost is less than income, the purchasing quantity should be larger than object.

## 41.4 Conclusion

There is more wider applying scope in distribution parameter theory than concentrated parameter theory; especially in past years, people have applied distribution parameter theory in economy and management. There are several papers [1] which can be regarded as the achievement on products quality, and the issue of stockbreeding management was discussed in such paper. We believe that the application of distribution parameter control method on such issue as production and management, education, capital accumulation, and consumption will be wider.

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**Part V**  
**Innovative Education and Applications**

# Chapter 42

## Research on University Physical Education's Teaching Based on the Theory of Multiple Intelligence

Meng Xue

**Abstract** In the age of emphasizing the national sport now, university sports' teaching has also received more and more attention. How to translate the university sports' teaching could be the passive acceptance into active development and initiative learning to take exercise by the students, and the problem is worth thinking by all people. While most of the research on university sports' teaching should be only limited to the analysis of the original content and course of sports teaching, and there is no element of the social epochal integration authentically in it. From the perspective of multiple intelligence, this paper combines it with the comprehensive developmental characteristics of the age, then does qualitative and quantitative analysis, and according to the theory of multiple intelligence, we construct the steps of university sports' teaching to study the effects on university sports' teaching. Through the statistical analysis of the *t*-test, to explore the most effective way of university sports' teaching and to make teaching benefit teachers as well as students, meanwhile, to improve the quality of teaching and the integrated development of students.

**Keywords** Multiple intelligence theory · University physical education's teaching · *t*-test

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## 42.1 Introduction

University education is a critical stage to acquire knowledge and skills in life. It is a very critical part that evaluating the university sports' teaching, and this is a good standard to measure the quality of teaching. It could constantly find the lack of PE teaching and make it improved, so that there is better arrangement of the university sports' teaching. On the university sports' teaching, many are still from a single way to carry on the teaching now, and the evaluation mode is limited to the category of the general PE teaching's content, How can we provide the quality of university sports' teaching and how to teach sports effectively? Which is worthwhile everyone think deeply [1, 2].

The theory of multiple intelligence includes a wide range of concepts, which was introduced in the past simple teaching mode, and it is the effective way to achieve all-round development. To change the simple pursuit of the examination-oriented education in the past, integrate with the theory of multiple intelligence, and make them all-around development of moral, intellectual, physical, esthetics, and labor education. It is limited to the theory of PE's curriculum and movement in previous study of university sports' teaching. The theory of multiple intelligence is applied and researched more in English and mathematics or other teaching fields, instead of rare research in university sports' teaching [3–6]. From the angle of the theory of multiple intelligence, this chapter evaluates the effect and function to the university sports' teaching in order to find the more appropriate and effective way for university sports' teaching and students' all-round development.

## 42.2 The Theory of Multiple Intelligence and Research Methods

The theory of multiple intelligence emphasizes the plurality of intelligence, while people basically accepted the intelligentized development toward the lingual literature and the mathematical logic in the past (Table 42.1). Under the background of comprehensive quality education at the current stage, people need to undergo an intellectual education to realize the comprehensive and integrated development, so putting forward the theory of multiple intelligence is closer to the social progress [7].

This paper targets at university sports' teaching for university students under the theory of multiple intelligence. It can record the PE performance's changes of students before and after using the theory of multiple intelligence teaching, forming contrast, and analyze it by combining with the *t*-test statistics to determine the influencing degree of the theory of multiple intelligence on the university sports' teaching. Inspection, namely, it is the process to inspect whether it has the significant difference sample between two experiments, which is average relative

**Table 42.1** Factors and main contents of the theory of multiple intelligence

Factors of multiple intelligence	Main contents
Intelligence of language	Main is the ability of listening, speaking, reading, and writing, which reflects a people the skills of effective expression and words using on language
Intelligence of logical mathematics	Skills of doing digital logical-inference skillfully, accurately, and effectively
Intelligence of limb operation	Effective body controlled, and do rich and flexible expression of body’s language on thought and feeling, etc.
Intelligence of music	High sensitivity on musical melody, rhythm, tone and timbre, the ability of expressing emotion through music
Intelligence of human relations	Skills of the interpersonal communication and relationship’s maintenance and treatment, etc.
Intelligence of introspection	Skills of finding own shortcomings, improving themselves continuously and learning from each other through autocriticism
Intelligence of natural exploration	Skills of the further research on nature and society, maintaining curiosity and the insight into essence of things
Intelligence of space	With great sensitivity, a strong perceptibility of spacial vision and perception in terms of space, color, shape, and so on.

to their whole. According to the related laboratory samples, *T*-test can use the following expressions to show [8]:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sigma_{X_1}^2 + \sigma_{X_2}^2 - 2\gamma\sigma_{X_1}\sigma_{X_2}}{m-1}}} \tag{42.1}$$

Among them, two experimental samples are expressed as  $\bar{X}_1$  and  $\bar{X}_2$ , the standard deviations are showed as  $\sigma_{X_1}^2$  and  $\sigma_{X_2}^2$ , the population variance’s estimation is represented as *S*, and the correlation coefficient is showed as  $\gamma$ .

### 42.3 Evaluation and Analysis of University Physical Education’s Teaching by Using the Theory of Multiple Intelligence

There are many evaluations and studies of university sports’ teaching now, the university sports’ teaching’s evaluation under the theory of multiple intelligence teaching is designed for pluralistic evaluation of teaching objects, teaching goals, teaching contents, and methods. As to teaching objects, students should not only achieve the teachers’ points system, but also need self-evaluation and mutual evaluation, which not only realizes self-understanding but also can promote harmony between the students’ relationship. It is not just taking students’ grades into account for teaching aim, but it needs to consider the improvement of students’

learning attitude, classroom performance, the ability-enhanced, treating people and other aspects, which should be focused on the all-round development of students instead of considering score as very important part. It needs to enrich teaching courses for the teaching content and method, and take diversified teaching modes. Teaching could combine with multimedia to realize the informationalized progress, which can implementate the situation with a combination of indoor and outdoor activities [9] (Fig. 42.1).

According to the Table 42.2, we realize that it can make extensive use of the multiple intelligence in university sports' teaching only in the learning process, while in middle using; the number of learning passed is less than the number of

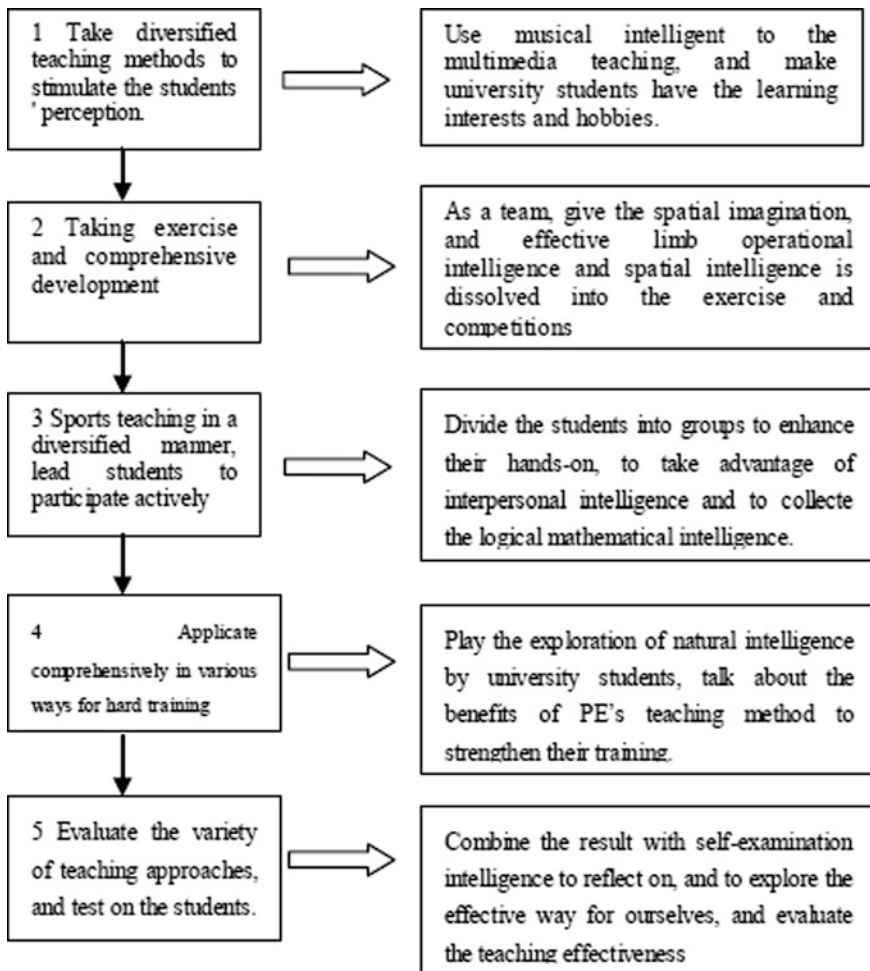
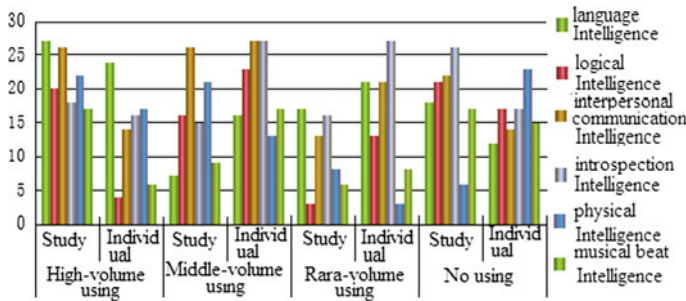


Fig. 42.1 Five steps and contents of the physical education under the theory of multiple intelligence for university students

**Table 42.2** The rogatory datasheet on the multiple intelligence's application

	High-volume using		Middle-volume using		Rare-volume using		No using	
	Learning	Individual	Learning	Individual	Learning	Individual	Learning	Individual
Intelligence of language and word	27/42	24/42	7/42	16/42	17/42	21/42	18/42	12/42
Intelligence of logical mathematics	20/42	4/42	16/42	23/42	3/42	13/42	21/42	17/42
Intelligence of interpersonal communication	26/42	14/42	26/42	27/42	13/42	21/42	22/42	14/42
Intelligence of introspection	18/42	16/42	15/42	27/42	16/42	27/42	26/42	17/42
Intelligence of limb operation	22/42	17/42	21/42	13/42	8/42	3/42	6/42	23/42
Intelligence of musical beat	17/42	6/42	9/42	17/42	6/42	8/42	17/42	15/42





**Fig. 42.2** Result of tests on university sports' teaching before and after applying the theory of multiple intelligence

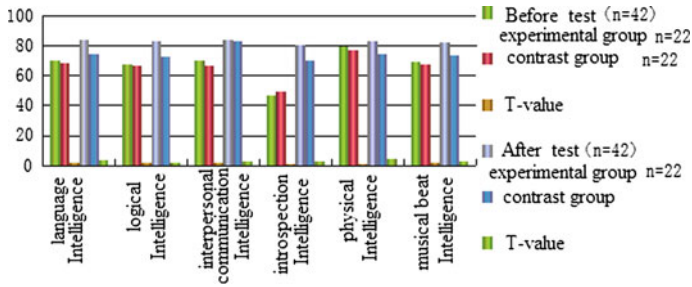
individual. In rare using, the remaining intelligent number is less than the individual situation in addition to the case that the number of limb operational intelligence is greater than the number of individual.

According to the Fig. 42.2 and Table 42.3, the situation of using the intelligence of language and word is learning and individual extensive using firstly. Then it is the rare learning and personal using, and the intelligence of logical mathematics is mainly learning and personal middle-volume using; Interpersonal intelligence is used a lot both in learning and personal study, while many do not use it as well. The intelligence of introspection is similar to the interpersonal intelligence in learning and personal using relatively. The intelligence of limb operation belongs to the high volume and the using in learning and personal using; the intelligence of musical beat is personal middle volume or no using relatively.

According to Table 42.3 and Fig. 42.3, we can see that, before and after the test, the results of the experimental group increase significantly, especially in the intelligence of introspection, then follows the intelligence of logical mathematics, while there is no significant raise of the results in the corresponding contrapositive group. Some intelligence of introspection is to the downward trend instead. This shows that it can play a great role in introspection by applying the multiple intelligence for the university students' sports' teaching. Before the test, on the level of  $p$ -value being greater than 0.06, the  $T$ -value is between 0.72 and 2.1, which indicates that there is no significant difference between them. While after the application of the theory of multiple intelligence, on the condition that the value of  $p$  is less than 0.02, the  $T$ -value is between 2.19 and 4.21, which shows that there is significant difference between them, and this expresses that the theory of multiple intelligence has a positive effect on university physical education's teaching well.

**Table 42.3** The rogatory data of the multiple intelligence's application

Projects	Before the test (n = 42)			After the test (n = 42)		
	Experimental group (n = 22)	Contrapositive group (n = 22)	Value of T	Experimental group (n = 22)	Contrapositive group (n = 22)	P
Intelligence of language and word	70.4	68.6	2.10	84.2	74.6	<0.02
Intelligence of logical mathematics	67.3	66.9	1.55	83.1	72.5	<0.02
Intelligence of interpersonal communication	70.1	66.5	1.71	84.2	83.1	<0.02
Intelligence of introspection	47.2	49.4	0.72	80.1	60.3	<0.02
Intelligence of physical function	79.2	77.1	1.42	83.1	74.3	<0.02
Intelligence of musical beat	69.2	67.8	1.64	82.3	73.5	<0.02



**Fig. 42.3** Result of tests on university sports' teaching before and after applying the theory of multiple intelligence

## 42.4 Conclusion

Blending the theory of multiple intelligences into the university sports' teaching, which not only makes sports' teaching more colorful for students, also leads schools and teachers to create a good atmosphere more actively, so that students are allowed to actively take in the university sports' teaching, and it mobilizes the students' subjective activeness adequately. Moreover, for the tests' results of the students' PE, or even each element of the multiple intelligence also has a great deal of promotion, so it is effective to use the theory of multiple intelligence in university sports' teaching. And we should strengthen the application of it in teaching and find more appropriate and effective methods to achieve students' full development constantly, which also makes the activities of teaching and learning be efficient and in perfect order.

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# Chapter 43

## Analysis on the Harmonious Development of Sport in University and the Community

Zemin Xiao

**Abstract** The overall qualifying rate of our national constitution is not very high at present; the community's sport cannot be blended well with the university's sports, which result that non-school staff cannot take full advantage of the urban sport's facility and other sport's resource. Not only leads that our national constitution is not high in general, but also results sports not are combined with city's development, which result in the unsustainable development of the city. Based on this situation, this paper analyzes the present situation of the community's and the university's sport in China form the point of the urban development, and finally using the fuzzy mathematics method to analyze the effect to the urban development if combining university's with community's sport.

**Keywords** University's sport · Community's sport · Urban development · Fuzzy mathematics method

### 43.1 Introduction

By the end of 2011, the results of our national physique monitoring show that our national physical qualifying rate is not very high at present. Although its trend is rise, but the slope is very low and this may contains many main reasons. However, one reason cannot be ignored is that there are not enough sport's resource for the community's residents to exercise, while the sport's resource of the university is abundant though, but the course of sport is not be valued by the teachers and

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students. Just to cope with the policy of the government, which leads to those who need to use these sports' facilities but cannot achieve, while those classmates who can use the sports' facilities but ignore the physical exercise, which finally appears that the result of our national constitution is on the low side in the mass. The life of community's residents is gradually improved and they realize the way to keep in good health, so they do exercise initiatively, in other words, they would use the sports resources, while owing to the pressure of the university entrance exam, the university's students do not have exercise time basically, and their physical quality is decline. To university stage, they continue the inertia of high school, and still do not pay attention to exercise. On the other hand, because a lot of universities' sports education adopt the club system now and many projects is optional, so that university's students take part in physical exercise entirely by their interests and hobbies, and this waste sports resources [1, 2]. This paper is based on this situation exactly, and analyze the present situation of university's sport and community's sport respectively from the view of urban development point, finally, using the fuzzy evaluation method to analyze the combination of the university's sport and the community's sport and its promoting function to the urban development.

### 43.2 The Situation of PE in Universities

In order to understand the current situation of PE, through the way of extending questionnaires to several universities, which issued 2000 questionnaires and 1500 valid questionnaires were received, and the validity inspection of the regained questionnaires' contents were done by ten experts, which contain six experts, four associate professors, and the inspection results of those questionnaires by them are as follows Table 43.1:

Then use the following formula to calculate the correlation coefficient [3],

$$r = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum (X - \bar{X})^2 \sum (Y - \bar{Y})^2}} \tag{43.1}$$

The result is  $r = 0.857$ , through the significant test that  $P$  is less than 0.01, which can explain these questionnaires are reliable.

First, the option of the paper's survey is the area of the universities' sports. According to the investigation data of our country's the fifth countrywide sports field shows that, by the end of 2011, there are 6,32,014 various sports fields totally

**Table 43.1** The check result

Result	Higher	High	Common	Low	Lower
Frequence	5	5	0	0	0
Proportion (%)	50	50	0	0	0

accorded with the survey request in our country’s universities, which contain 3,65,741 standard and 2,54,315 unstandard sports fields [4, 5]. The area of per capita sports field is 0.85 m<sup>2</sup>. This paper aim to those universities which are surveyed, and there are seven universities surveyed totally. The statistics results are as follows (Table 43.2):

Then the author surveys the teaching situation of the universities’ PE education, and find that the seven schools use the same scheduling, in the morning, the first class begins at 20 past 8–10 o’clock, the second class is 20 past 10–12 o’clock, and the afternoon’s lessons start at 2 PM, the start of the second class is 3:50, and PE education is frequently arranged in the morning’s second class and the afternoon’s third and forth lesson. So we discover that sports venues are vacant in the morning, and the communities’ residents can make use of them in the morning and evening.

Besides, there is the investigation of qualification of the school PE’s teachers, although there are many PE’s teachers, but the professors are just one part, the specific is as below Table 43.3 (Fig. 43.1):

Finally, there is the investigation of the imparted education in PE class of the seven school: which mainly includes badminton, basketball, boxing, football, gymnastics, handball, judo, swimming, taekwondo, tennis, table tennis and volleyball.

### 43.3 The Present Situation of Community’s Sport

Aiming at a large community, this paper surveys from the following aspects, the reason of residents participate in sports as well as power, the statistics number of the community residents participating in the community sports activities, the time quantum of community residents taking part in community sports activities each time, the location of the community residents participating in the community sports activities and the actual needed number of fitness place which author estimated that the community residents participate in community sports activities finally.

First of all, the motive force of the community residents taking part in physical exercise mainly is improving their physical and mental health, lose weight to fitness, keeping their body and mind comfortable, at the same time, it could also create social opportunities. Specific statistical results in the list are as below [6, 7] Table 43.4.

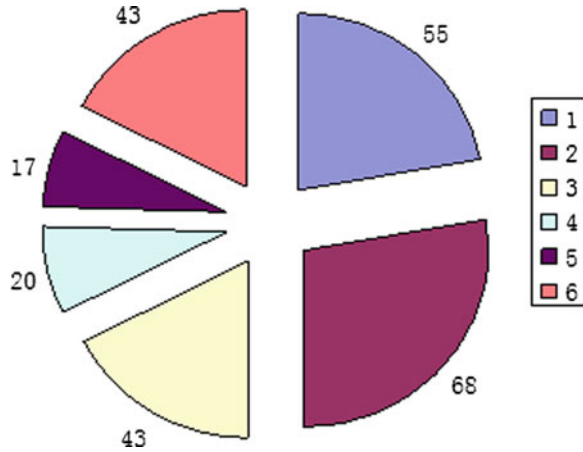
**Table 43.2** The check result

University	1	2	3	4	5	6	7
Gym’s area	325482	235478	96541	24800	85147	65488	45867
Indoor’s area	25000	19000	5000	4500	8000	10657	12600
Average area	6.96	4.67	5.21	3.69	5.81	3.98	5.67

**Table 43.3** The teacher's ratio

University	1	2	3	4	5	6	7
Teacher	55	68	43	20	17	43	37
Title	Professor 3, Associate professor 10	Professor 8, Associate professor 21	Professor 7, Associate professor 12	Professor 3, Associate professor 14	Professor 1, Associate professor 6	Professor 5, Associate professor 15	Professor 4, Associate professor 9

Fig. 43.1 The ratio chart



Then there is the statistics number of the community residents taking part in sports, we find that a lot of retired community residents do exercise 3–4 times once a week, and the working community residents just do exercise 1–2 times once a week, and the time of teenagers doing exercise appears more average, which is 2–3 times mostly, and the specific statistical result can be seen as following Table 43.5.

For retired community residents, they insist the habit of morning exercise, and going out for a walk in the evening or doing the Yangko. While for the on-the-job staff, the only opportunity to do exercise is the weekends' time while the company has a holiday, such that most people do exercise in the weekends. But for teenagers, they do exercise in their free time. The table below is the specific statistical result Table 43.6 (Fig. 43.2).

Table 43.4 The purpose of community sports exercise

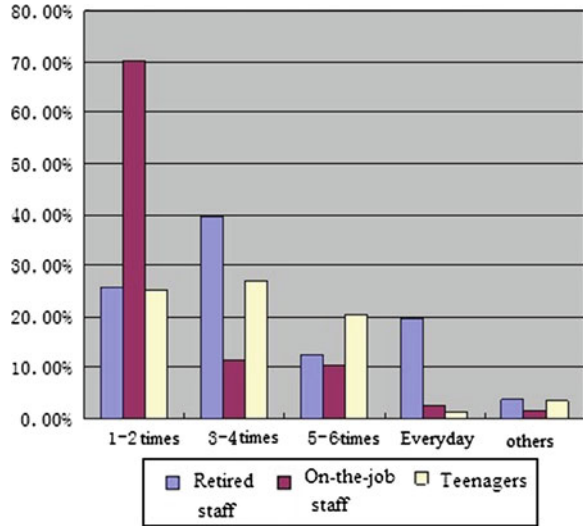
Driving source	Retired staff (%)	On-the-job staff (%)	Teenagers (%)
Sound mind and body	32.4	15.6	20.1
Strengthen the body	25.6	24.7	19.8
Learning sports skills	16.8	15.2	24.7
Fitness lose weight	18.7	17.1	34.6
In a cheerful mood	8.5	7.4	13.4
Creating social opportunities	14.6	26.7	30.4
Other	6.7	9.4	2.4

Table 43.5 The frequency of community sports exercise

Exercise's frequency	Retired staff (%)	On-the-job staff (%)	Teenagers (%)
1–2 times	25.6	70.2	25.3
3–4 times	39.4	11.4	27.1
5–6 times	12.4	10.3	20.3
Everyday	19.7	2.5	1.2
Other	3.6	1.6	3.5



**Fig. 43.2** Exercise proportion



This section is a part of the conflict with the university sports resources, since community personnel cannot have university sports resources as students, and they could do exercise only in the square, public places or spending money to fitness place more. So the key is that the sharing degree of university and community sports resources then we will combine both tightly to realize the combination of the both sides [8]. The ways of exercise to community residents mainly are flying

**Table 43.6** Time of the community sports exercise

Participation time	Retired staff (%)	On-the-job staff (%)	Teenagers (%)
Early morning	23.4	14.6	6.1
Evening	28.6	2.7	4.8
Weekend	7.8	35.2	12.7
Holiday	21.7	12.1	8.6
Morning	4.5	5.4	7.4
Afternoon	5.6	4.7	24.5
Other	2.7	6.4	5.2

**Table 43.7** Places of community sports

Sports sites	Retired staff (%)	On-the-job staff (%)	Teenagers (%)
School	15.4	7.6	19.7
Park	23.6	20.2	16.2
Charging stadium	15.8	6.2	6.7
Family sports equipment	10.7	7.8	21.4
Unit sports venues	7.5	14.8	15.5
None	14.4	13.7	13.4
Other	9	5.4	2.8

kites, setting-up exercises to music, bocce, fitness dance, tai chi chuan, playing drum, croquet, qigong, social dancing, fishing, tennis, rope skipping, yangge dancing, Tai Chi sword, badminton, mulan boxing, soft ball, kicking shuttlecock, table tennis, body mechanics, peg-top, health ball, shaking diabolo, jogging and so on Table 43.7.

### 43.4 Fuzzy Evaluation on the Harmonious Development of University Sports and Community Sports

When we realize the harmonious development of university sport and community sport, our city will be the biggest beneficiary, because there are great potential in the sports industry and it can make our government aware of the need of the sports facilities, which can improve the city’s infrastructure and improve the comfort of life to local residents in urban planning [9]; What is more, the sports industry has been driving many other third industries, such as catering and tourism, which has a great business opportunity, and the biggest advantage of it is non-polluting that promotes the sustainable development of the city. From another angle, the sports industry increase jobs for a city and alleviate the burden of the government [10].

For China in the twenty first century, the sustainable development has become an important prerequisite of the development of our country, and every detail of life factors is non-ignorable if a city wants to development better. Based on the harmonious development of university sports and community sports in the urban development, this paper just about makes a study of it. But there is no specific model to reference for the evaluation of this issue, and it cannot be evaluated with a simple score. The evaluation result is a fuzzy subset on the evaluation set, so we use fuzzy comprehensive evaluation. The fuzzy comprehensive evaluation is based on the knowledge of fuzzy mathematics, and it cause comprehensive evaluation of multiple interacting factors in system. The concept of fuzzy set theory was raised by professor Chad who was an auto control expert in the United States in 1965, and it was used to express the uncertainty of things [11].

Integrating our current evaluation system and the balanced scoring method, we selected three indicators to reflect the key of the results. These indicators were reflected with the accurate rate indicator originally, but it could reflect more actual and objective effect of the harmonious development of university sports and community sports if it was properly blurred.

To build the model:

$$A = \begin{bmatrix} -z^{(1)}(2) & 1 \\ -z^{(1)}(3) & 1 \\ \dots & \dots \\ -z^{(1)}(n) & 1 \end{bmatrix}, \quad B = \begin{bmatrix} x^{(0)}(2) \\ x^{(0)}(3) \\ \dots \\ x^{(0)}(n) \end{bmatrix} \tag{43.2}$$

$$A = (B^T B)^{-1} B^T Y_n$$

Through the above description of the fuzzy comprehensive evaluation method, we did the list and calculation for it about the harmonious development of the university and community sports.

$$A = \begin{bmatrix} -\frac{1}{2} [x^{(1)}(1) + x^{(1)}(2)] \\ -\frac{1}{2} [x^{(1)}(2) + x^{(1)}(3)] \\ -\frac{1}{2} [x^{(1)}(3) + x^{(1)}(4)] \\ -\frac{1}{2} [x^{(1)}(4) + x^{(1)}(5)] \\ -\frac{1}{2} [x^{(1)}(5) + x^{(1)}(6)] \end{bmatrix} = \begin{bmatrix} -5.375 \\ -6.357 \\ -15.249 \\ -12.366 \\ -14.952 \end{bmatrix} \tag{43.3}$$

$$B = \begin{bmatrix} x^{(0)}(1) \\ x^{(0)}(2) \\ x^{(0)}(3) \\ x^{(0)}(4) \\ x^{(0)}(5) \end{bmatrix} = \begin{bmatrix} 5.24 \\ 5.67 \\ 6.01 \\ 4.95 \\ 4.24 \end{bmatrix} \tag{43.4}$$

The result shows that our university and community sports are still far away from reaching the degree of integration at present, which will go against the development of our cities.

### 43.5 Conclusion

In this paper, we analyze the status of university sports and community sports from the perspective of urban development, and analyze the anxio-action for the urban development if the integration of university sports and community sports by the method of the fuzzy evaluation finally, and the final result shows that the university and community sports are still far from reaching the degree of combination, so we should strengthen their participation both in the university and community sports, as well as increasing resources in community sports through government unilaterally, and at last we should inoculate the resources of the university and community sports, and increase the degree of resources sharing.

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# Chapter 44

## Research on Influence of Physical Exercise Pattern on University Students' Physique Based on Statistical Regularity

Yuan Zhang

**Abstract** In the face of declining phenomenon of University Students' physique, it has aroused a widespread concern in experts and scholars. Under the multiple pressures of study, work, life, employment, the opportunities for university students to participate in physical exercise is becoming less and less. How to get more students to participate in physical exercise actively is a problem to be solved, which this paper sets out to do. Through building a pattern of physical exercise and encouraging university students to participate in outdoor sports and by verifying the changes in University Students' physique, we can make a comparison and significant differences in physical exercise mode to find an effective physical exercise model that better guides the students participating in physical exercise, for improving their physique and physical fitness.

**Keywords** Physical exercise pattern · Sun sport · Physique · Comparative analysis · Significant difference · Statistical regularity

### 44.1 Introduction

Facing more and more competitive pressures, university students now continue to strengthen their own learning and to recharge themselves [1]. Meanwhile, in the era of rapid development of sociotechnology, more and more university students indulge in the Internet [2]. Due to arduous study, work pressure, as well as social competition, the time that students participate in physical exercise is less and less. Besides their participation in school sports programs, there is not much time and

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opportunities for university students to do physical training. For a very long time students' physical fitness has been constantly reducing. In the face of a gradual decline in the physical body condition of university students, this has become a major social concern. Students as successors of a new era should not only be superior in knowledge skills and moral qualities, but also have a healthy, strong body [3]. Therefore, the physique of university students has also been a general concern of the community. How to improve the physique and physical fitness of university students is an important aspect of thinking. The many factors for the decline in university students' physique are not only due to unreasonable time to plan for university students' physical exercise, but also inadequate power and ineffective physical exercise.

In the modern society, the way and content of physical activity are varied and colorful, but the declines do not stop. Part of the reason is that university students do not really actively participate and the exercise time plan is unreasonable. This paper aims to find a more effective way to guide university students more actively to participate in physical exercise, and to respond to the "healthy first" call, starting from physical exercise mode to analyze the impact of the University Students' physique. So as to integrate into society, for jobs, and to contribute and create benefits for the society and the State, we should exercise more actively, reinforce our body, and improve our physical qualities [4, 5].

## **44.2 Concept of Physical Fitness of University Students and Analysis of the Present Situation**

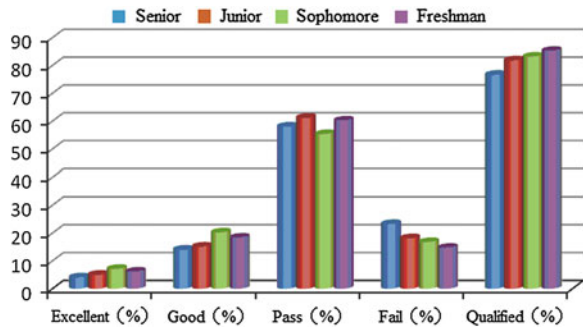
The physique is the result of congenital heredity and physical exercise reflects the quality of the human body. Physical evaluation includes not only morphology, function, and physical quality, but also capacity. Each indicator corresponds to a secondary index, such as height, weight, chest, upper arms, and other indicators. Capacity indicators include running, jumping, throwing, etc. The survey of university students' physique is a physical fitness test carried out from one particular university [6].

University students' physique displayed in Table 44.1 and Fig. 44.1 shows that sophomore university students' excellent proportion is the highest at 7.16 %, followed by freshman university students, with an excellent 6.2 %, and then juniors and seniors. In good percentage level, it is also rendered by law, sorted by ratio from largest to smallest: sophomore, freshman, juniors, and seniors. But sorted by passing ratio from largest to smallest is junior, freshman, senior, and sophomore. The passing ratio is only 55 to 60 %, where nearly half the students did not pass the physical health status, where senior accounted for 23.3 %, followed by junior at 18.16 %, sophomore, and finally freshman [7]. This reflects that the higher the grade of university students, the worse the physical condition they will be in. It also fully reflects that university students do not pay enough attention and participate less in physical exercise.

**Table 44.1** Examination table on physical constitution of university students

	Excellent (%)	Good (%)	Pass (%)	Fail (%)	Qualified (%)	Number of students
Senior	4.12	14.07	58.07	23.30	76.70	410
Junior	5.05	15.16	61.19	18.16	81.84	387
Sophomore	7.16	20.24	55.37	16.79	83.21	367
Freshman	6.20	18.41	60.24	14.71	85.29	416
Total	5.63	17.01	58.72	18.24	81.76	1580

**Fig. 44.1** The result of university students' physical health status



### 44.3 Construction of Physical Training Mode and Research Methods

Physical exercise mode is not simply a movement, but also a model with a combination of physical, psychological, as well as life study. The university students' physical exercise mode also should not only take exercise purposes into account, but allow university students to fully join in and enjoy the fun of exercise. Finally, it should result as a rise in the life of habits [8].

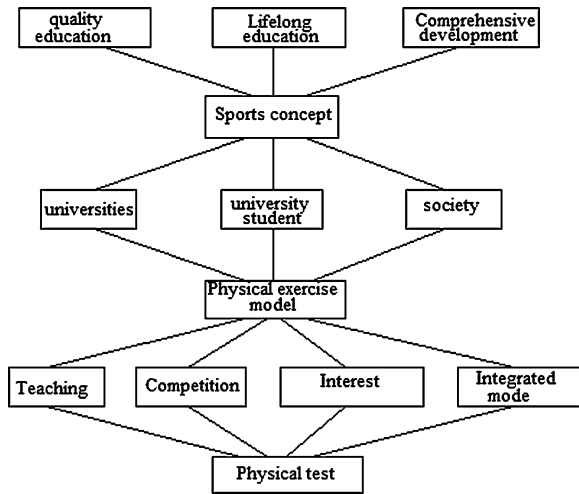
University students' physical exercise is mainly based on personal interests and hobby forms. Physical education, friends, activities, and social activities of the organization are the ways that dominate, as shown in Table 44.2. In contrast, the ratio of female university students in these ways is less than the male's. This also reflects that there are relatively fewer opportunities for female students to participate in physical exercise. In these ways, the main method to do physical exercise is Physical Education, the second is friend's activities, and the last is accorded to their personal interests. Men are involved in social organization activities.

Considering the "healthy first" summons that society advocates and following the requirements of society, quality education, life-long education, as well as comprehensive development, in order to allow university students to actively participate in physical training, rather than mandatory and discretionary participation which is not stable and will not achieve long-term purpose of enhancing the physique, we have established the physical activity diagram, shown in Fig. 44.2.

**Table 44.2** Analysis of physical training mode for university students (%)

Gender	Interest	Physical education	Competitions	Social activities
Female	9.3	9.9	10.1	7.2
Male	11.5	21.6	17.7	14.6

**Fig. 44.2** Students' Physical exercise diagram



Relatively speaking, the integrated model takes advantage of the four models. Sun sports which obtains much more attention at this stage is a good comprehensive physical exercise mode [9].

The Sun Sports Model is not only a response to the government's call but to enhance the students' physical constitution called by the community. This can not only play a good role of promotion, but also cause widespread concern in society and schools. By giving the proper manner to carry out of the Sun Sports Model, there are more university students involved. What is more, it brings many benefits such as enjoying the fun of physical exercise, strengthening exchanges between people, and enhancing their interpersonal skills.

This paper measured, compared, and analyzed the physical and morphological indicators that university students did before and after the Sun Sports exercise. The result can be used to determine the impact of physical exercise on the body mass index of university students.

The analysis of significant differences is to take the form of the *t* test to determine the difference between various indicators. The first step is based on assumptions to determine the standard value of  $\alpha$ . In the two-sided test, test standard value of  $\alpha$  is 0.05. Next step is the examination of the test statistic,  $v = m - 1$ , then determine values of *P* according to the Marginal value table and derive the analytical results. In general, when judging linear algebra, we usually adopt the correlation coefficient way to determine statistical result between the



linear correlation scope degrees of the two target variables. The expression of the correlation coefficients is as follows. The greater  $t$ -value is, the stronger the correlations between the variables are. Under the condition of the  $p$  value, the differences between variables are relatively significant [10].

$$t = \frac{1}{m-1} \sum_{i=1}^m \left( \frac{X_i - \bar{X}}{S_X} \right) \left( \frac{Y_i - \bar{Y}}{S_Y} \right) \tag{44.1}$$

### 44.4 Analysis of the Impact of the Comprehensive Physical Exercise Mode on University Students

Taking the desirability of testing into account, when testing the comprehensive physical exercise mode on university students, we select the 150 students. According to university students morphological evaluation test, we record the results before and after exercise in the following table. Under the condition that  $t$ -value is 0.05; the result is 1.96, equal to 2.58 at the 0.01 level. Therefore, by the following table shows, the results of university students' physical condition, height, weight, BMI, and body size are not significant differences before and after physical exercise (Table 44.3).

As in Table 44.4, before and after physical exercise, physical indicators of university students such as grip strength, standing long jump, 800-run, and the shuttle run all, to some degree, have changed, and the magnitude of change varies. Under the conditions of 0.05, 0.01, 0.001, the  $t$ -value is 1.96, 2.58, and 3.30. It can be seen from the result that there is no significant differences in grip strength. On the contrary, it makes differences in the standing long jump and 800-run indicators project. What's more, when the  $t$ -value is 4.412 in the shuttle run, the contrast is more obvious.

According to the comprehensive physical training and analysis of university student physique appraisal target in Table 44.5, \*\* reflects a very significant correlation when the  $P$  is less than 0.01. There is a strong relationship between the physical exercise and students' lung capacity, vital capacity index values as well as body flexion, but no remarkable correlation between BMI and step test and standing long jump.

**Table 44.3** Analysis of the impact of university students' morphological index before and after the comprehensive training mode

Evaluation factors	Weight (kg)	Height (cm)	BMI (kg m <sup>2</sup> )	Body volume (m <sup>3</sup> )
Before	52.188 ± 7.225	162.284 ± 5.78	20.69 ± 2.50	89.041 ± 0.007
After	52.464 ± 7.194	162.384 ± 5.71	20.794 ± 2.416	89.042 ± 0.007
$t$	0.225	0.000	0.273	0.221
$P >$	0.05	0.05	0.05	0.05

**Table 44.4** Analysis of the impact of university students' physical factors before and after the comprehensive training mode

Evaluation factors	Standing long jump (m)	Grip strength (k)	800-run (m/s)	The shuttle run (s)
Before	1.757 ± 0.146	28.508 ± 4.814	240.173 ± 16.894	15.870 ± 0.986
After	1.800 ± 0.159	28.584 ± 5.004	244.239 ± 19.317	15.430 ± 0.775
<i>t</i>	2.460	0.129	1.968	4.412
<i>P</i>	<0.05	>0.05	<0.05	<0.001

**Table 44.5** Analysis of the correlation between comprehensive training mode and university students' physical evaluation

	BMI/ (kg m-2)	Vital capacity/(ml)	Vital capacity values	Step value	Body bending	Standing broad jump
Physical exercise	0.005	0.225**	0.336**	0.008	0.135**	0.134

## 44.5 Conclusion

Under the grim situation that university students' physical body is beginning to decline, the community and schools should pay further attention to the exploration of the Physical Training model. This paper established a new model of exercise named as integrated physical exercise mode. Meanwhile, it also verified a significant relation between Physical exercise and University Students' physique. The Sun sports cultural atmosphere created by our nation and society may stimulate university student's positive initiative, improve their interests in sports, expand and strengthen the teaching team, make university students have sufficient conditions to participate in physical exercise, switch a passive model to a positive one, improve physical fitness, and finally achieve the comprehensive development of individuals.

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# Chapter 45

## Research on Taichiquan Teaching Based on Information Technology

Rui Li and Xiaohong Wang

**Abstract** This paper introduces an education theory in which Information Technology acts as a platform and involves science. It uses Information Technology to arrange the knowledge of Taichiquan field and makes a summary of multi-disciplinary knowledge integration. Taichiquan teaching, as well as teaching quality assessment, can be further realized and traditional mode of teaching can be changed according to human visual characteristics, the expression of image signaling, and human–computer intelligent interaction activities. Thus Taichiquan teaching efficiency, as well as teaching effect, can be improved. At the same time, it can stimulate study interest and develop study potential.

**Keywords** Information technology · Taichiquan · The expression of image signal · Quality assessment

### 45.1 Introduction

Tai chi chuan is a traditional Chinese sport. It is formed of multi-disciplinary, multi-technology cross movement that has unique training methods after several thousand years of development of Chinese culture [1]. Due to a variety of limited factors, dispersed, individual, partial research results, and technical experience are more. Integrity, systematicness, comprehensiveness, operability, and strain are not strong enough in the whole field of teaching. Formation of faster computer skills, strong reasoning ability, enhancement of education and teaching systematicness,

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and practicability in the Taichiquan teaching field make a great contribution in deepening Tai Chi fist in scientific research and improving Taichiquan scholar's own technical level by analyzing human visual characteristics and representing image signal digitization of Taichiquan [2, 3].

## 45.2 The Prospects of Information Technology's Application in Teaching Field

### 45.2.1 *The Present Situation of Foreign Information Technology's Application to Teaching Field*

In developed America, President Clinton's Council of Advisers Organization, sets up an educational technology expert group in 1996. They proposed a special report on how to apply modern educational technology, especially computer and Interact networking, and provided recommendations to reform the U.S. primary and secondary education that attention should be paid to IT education from primary school to the entire school stage, as is shown in Table 45.1.

Foreign IT education started very early. Information Technology was applied to education and teaching filed in different forms [4]. The computer and IT education in British primary and secondary schools mainly took the method of government planning, social organizations' wide anticipation and support, education departments, and schools specific implementation. In 1979, British Ministry of Industry invests £ 250,000 to hold a primary and secondary school computer competition to encourage schools to purchase computer. From 1980 to 1986, Ministry of Education invests £ 35 million to run out microelectronics education and accelerate the use of primary and middle schools computer. In 1988, the local education department sets up the Educational Technology Committee to develop and support the application of new technologies in education, with donation of £ 5 million per

**Table 45.1** The measures and methods of Information Technology education in USA middle school

School-age level segment	Applied measures and methods
Primary school	IT education course varies form different schools, centers on stimulating students' interest and does not emphasize on disciplinary system.
Middle school	①Not setting complete IT course, only inducing some knowledge about computer and IT in the course of math or physics ②Setting an IT compulsory or elective course ③Setting a series of IT compulsory or elective courses, such as computer applications and programming language.
High school	A majority of high schools set programming elective course to developed students' logic element count and thinking ability.

year. The Ministry of Education has invested £ 8 million to establish computer education fund to support local education departments and school teachers to use new technologies in the educational process, popularize the education, and the application of the IT since 1989.

### ***45.2.2 The Present Situation of Domestic Information Technology's Application in the Field Of Teaching***

The application of China's information technology in teaching filed started late. Up to now, it has gone through the experimental stage of the 1980s, the stage of development in the 1990s, and it is entering the basic popular stage. In October 2000, the Ministry of Education convened a national primary and secondary IT education meeting, put forward the aim and program of the popularity of Information Technology education in primary and secondary school. The Ministry of Education has decided to carry out the project of communication from school to school, promoted modernization of education by informatization, and took efforts to achieve the leaping development of China's basic education. This indicated that China's IT education became mature. Modern educational technology, of which the core is computer multimedia network technology, developed unprecedentedly. The field of education and teaching gets support from high-tech. Therefore, it provides a wide developed space and research platform for Information Technology's application to teaching field.

## **45.3 The Digital Process of Information Technology's Application to Taichiquan**

### ***45.3.1 The Advantages of Information Technology's Application in the Teaching Field***

Information Technology's application to teaching field produced a pattern of traditional martial arts teaching mode and modern martial arts teaching mode which promotes essential changes in the patterns of physical education teaching, updating the concept of teaching, and improve teaching efficiency. The use of IT in the teaching of Tai chi makes unity of Tai chi theory of knowledge more significant. It is more likely to judge the quality and extent of learners through digital spectral images of Tai chi chuan [5]. As a result; Tai chi teaching is more operational, more targeted. Compared to the traditional teaching model, this method is more conducive for the majority of Tai chi enthusiasts to learn and coaches to make teaching program according to different learners, develop students' potential, and teach Tai chi better.

### 45.3.2 *The Inspiration of Visual Characteristics to Tai Chi Teaching*

Human's eyes make different visual perceptions toward different wavelengths. According to the Standard Comfort Curve, specially recommended by International Commission on Illumination, the relative visual acuity is 1000 when wavelength is 250 nm, the relative visual acuity is 0.0010 when wavelength is 340 nm, and the relative visual acuity is 0 when wavelength is 390 nm. As the wavelength changes, visual acuity degree changes; thus, color and brightness of the feeling is changing. Training of capturing the image of Tai chi, promotion of Tai chi information acquirement, and improvement of teaching can be conducted according to different visual sensitivities of the Tai chi learners. The combination of movement and motionlessness and step-shaped transformation were put into Tai chi expert system which made it have certain intelligence.

### 45.3.3 *Image Digitization of Tai chi chuan*

Tai chi chuan is stationary in the Spectrum of Tai chi chuan. Tai chi chuan is a continuous movement in actual teaching. According to Tai chi chuan, what human eyes perceive is continuous and formed images are continuous images. However, a continuous image signal cannot be conveyed or stored directly in digital systems [6]. Therefore, a continuous Tai chi chuan image signal needs to be converted into a discrete digital signal; that is, dynamic Tai chi chuan is converted into motionless digital Tai chi chuan which is named as digitization of Tai chi images signal. The transformation of Tai chi chuan image signal is the same as general image signal. It needs three measures: sampling, quantization, and coding.

#### 45.3.3.1 *Sampling of Tai Chi Teaching Image*

Tai chi teaching sampling is the sampling of discrete image signal space of Tai chi, thus, discrediting continuous Tai chi chuan. A complete set of Tai chi chuan action is made up of many routines, such as the false step in the footwork, solid step, independent step, curved step, boxing fist, palm, hook, left and hold, right and hold, and encircle break up in the Walk transformation. The image of a Tai chi is composed of many finite sized pixels; each pixel is a function of time and space. It also owns optical properties. Therefore, every pixel  $P$  in the image usually can be represented with eight physical that is [7]

$$P = f(x, y, z, L, H, S, R, t) \quad (45.1)$$

Among these, ( $x$ ,  $y$ , and  $z$ ) stand for the space variables of pixel.  $L$ ,  $H$ , and  $S$  stand for the brightness of the pixel, tone, and saturation, respectively.  $R$  stands for

the definition of image. “*t*” stands for time that Tai chi chuan pixels need to produce the above-mentioned physical.

The image communication system is a two-dimensional information system. Therefore, bounded signal Fourier transform definition can be conducted. The relationship between two-dimensional function  $f(x, y)$  and its spectrum  $F(x, y)$  is [8]:

$$F(\mu, \nu) = \frac{1}{2\pi} \int_{-\infty}^{+\infty} f(x, y) e^{-j2\pi(\mu x + \nu y)} dx dy \quad (45.2)$$

$$f(x, y) = \frac{1}{2\pi} \int_{-\infty}^{+\infty} f(\mu, \nu) e^{-j2\pi(\mu x + \nu y)} d\mu d\nu \quad (45.3)$$

According to the analysis, complexity of pixels in Tai chi image is limited. In general, the basic skills of a Taichiquan are the same. As a result, the change of content transformation in pixel of Taichiquan image is not large. Human eyes have a limit of resolution of space frequency complexity. In most cases, the spectrum was restricted to a certain range when observing Tai chi images from frequency. In this way, it does not undermine the integrity of its stature footwork on the basis of Taichiquan pattern sampling.

#### 45.3.3.2 Quantification of Taichiquan Teaching Images

Tai Chi images which are produced by sampling from Taichiquan combat boxing are made up of a series of spatially discrete sample value sequence. Each sample value is a continuous variable which has an infinite number of values. These variables constitute the digital Tai chi images. Therefore, quantization of Taichiquan pattern refers to the process of using finite number of discrete values to show values which has an unlimited number. Computer system, that is, practical IT which can give it a different code can make a Taichiquan digital image that has a true meaning.

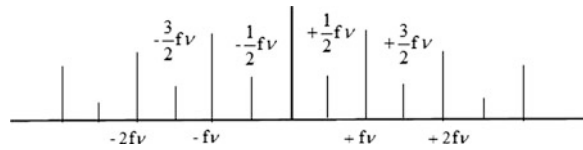
#### 45.3.3.3 The Code of Tai Chi Teaching Image

Line scan is used in Taichiquan during the process of encoding Taichiquan image. In the term of a pixel in the active image, it repeats in cycle of frame. Frame rate  $f_F$  and its harmonics  $f_F$  will be distributed in interval between the presence of frequency and its harmonics. Frame rate of the fundamental component and Margin of harmonic minor is smaller. As is shown in Fig. 45.1 [9].

It can be seen from Fig. 45.2 that quantization noise ratio will increase or decrease 6 dB when 1 bit is increased or decreased. The coded number of sampling values bits  $n$ , directly determines the image quality. General application basically meets the requirement. To obtain high-quality Tai chi still images, it needs 10 bit or higher .



**Fig. 45.1** Rampant scan of still images spectrum

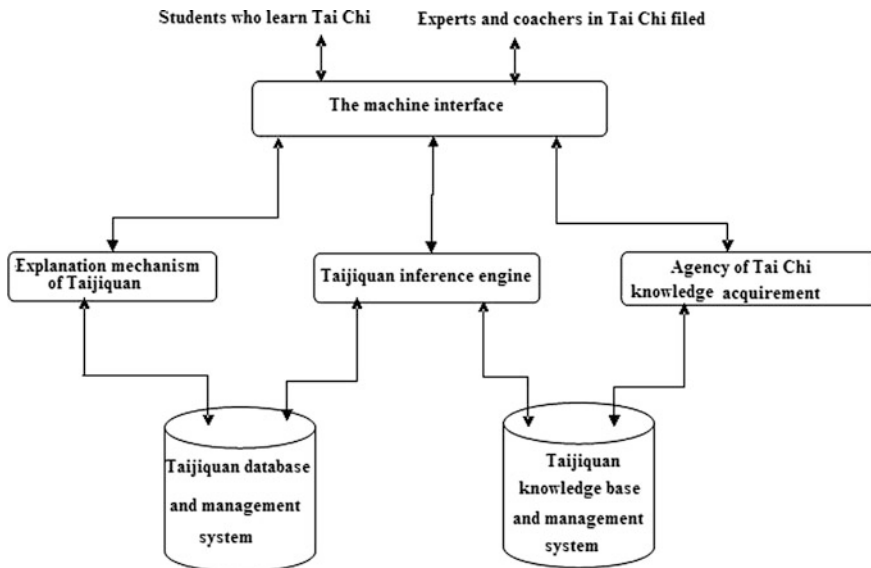


## 45.4 The Teaching and Teaching Quality Evaluation of the Digitalized Tai Chi

### 45.4.1 Teaching Model of Digital Tai Chi

Summary of Tai chi chuan theoretical knowledge and integration of multidisciplinary knowledge is made on the basis of IT. The type of Tai chi or Taiji boxing footwork, position transform, and motion path are formed by expert systems of Tai Chi teaching. According to Martial art features, Tai chi chuan teaching expert system is more prominent on reflecting the special theoretical knowledge of Tai chi chuan and functioning of professional reasoning judgment than the average computer system. It owns more centered ability of decision-making, in comparison to human Tai Chi teachers.

IT Tai Chi teachers have a comprehensive knowledge and high-speed knowledge-processing skills which are not influenced by time and space constraints and human feelings. Tai chi chuan expert system is shown in Fig. 45.2.



**Fig. 45.2** Tai chi chuan expert system

As is shown in Fig. 45.2, Tai chi expert system summarizes theoretical knowledge to make it integrated through its knowledge base and its management system. Comprehensive classification of Taiji boxing spectrum by Tai chi chuan database and management system makes it own a strong comparability and replicability. Mechanism of Tai chi chuan explanation uses multimedia to interpret the theoretical knowledge and to show right Tai chi chuan. New knowledge of Tai chi teaching is acquired by agency of knowledge and results of research makes it inherited. Through Tai chi chuan inference engine, the effective interpretation of the Tai chi chuan and teaching methods makes it more intelligent. The use of man-machine interface forms intelligent man-machine interaction among Tai chi practitioners, coach, teacher scholars, and Tai chi expert system. It plays better role of the expert system. In a word, Tai chi expert system has the features of intelligence, inheritance, integration, replication, and convenience.

### 45.4.2 Assessment Model of Teaching Quality in Digital Tai Chi

Most of the traditional Information technologies that are applied to Tai chi teaching use audio and video synchronization. It does not have an assessment of teaching quality. Score bases are on personal understanding of teachers. Its final judgment also depends on personal understanding. The strong coherence of Tai chi chuan exercises needs digitalization to make scientific judgment. Taking advantage of Tai chi chuan expert system, combining the principle of electro-optics with electro-optic conversion, quality assessment was made by the comparison of Tai chi experts system inner database and the light image that was converted from the optical image of Tai chi (student of Tai chi exercise routine) to electrical signals by digital processing. Digital Tai chi chuan teaching quality assessment model is shown in Fig. 45.3.

As is shown in Fig. 4, a practice image of Tai chi practitioners was decomposed by camera equipment on the sending port first; that is, the image of Tai chi practitioners was transformed into electric images in camera by the camera tube. It

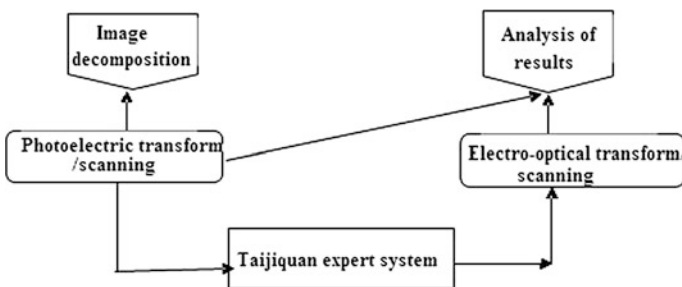


Fig. 45.3 Assessment model of digital Tai chi chuan teaching quality

is smoothly connected to each point which converts optical signals into electrical information to complete photoelectric transformation on space and time under scan of the electron beam. Then the transmission of digital image information was conducted. Comparison judgment of Taichiquan digital boxing and boxing spectrum can be obtained through internal data of expert system. Through composition of image scanned by electro-optical conversion, Tai chi practitioners image can be restored. The final quality analysis report of the Tai chi practitioners can be received according to the analysis of digital image received by imaging equipment at receiving end. As a result, scientific figure judgment of the quality of the refining was made.

## 45.5 Conclusion

The use of IT in martial arts teaching is a modern teaching method. It can effectively contribute to the modernization of the martial arts teaching mode. It makes up the deficiencies of traditional Tai chi, strengthens and attracts Tai chi teaching, and improves the quality of teaching. The way that IT is applied for Tai Chi teaching will quickly become a new teaching mode of numerous educators. It is a new martial arts-assisted teaching model a new mode of Tai Chi teaching for its good intelligence, inheritance, reliability, and interactivity. It is an important tool to improve the teaching quality and a trend for future Tai Chi teaching.

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# Chapter 46

## Study on Origin and Variation of Taekwondo and the Chinese Traditional Martial Arts Based on Function Increment Variation Method

Xiaoju Han

**Abstract** In this chapter, the deep origin of the traditional martial arts and the Taekwondo were digged out through the scientific analysis of the territory relationship and culture exchanges between ancient China and North Korea. Through the scientific analysis of current development and the present situation as well as the mutation process of Taekwondo with mathematical model, we found that martial arts had a very big effect on the country's political, cultural, national defence, and other various aspects.

**Keywords** Function increment variation method · Taekwondo · Chinese traditional martial arts · Variation analysis · Science analogy

### 46.1 Introduction

First, martial arts sport developed during the process of human's struggling against nature along with the development of society [1]. But as the society was progressing, martial arts, culture, and other various aspects as well as science were linked with each other through mutual penetration and interaction. The distinction between various martial arts and the country's territory and culture were also closely linked, especially between Taekwondo and Chinese traditional martial arts. In the course of the Chinese tradition martial arts, they continuously tend to be systematic and structured. Each branch permeated with each other, and continues to cross and grow. In the ancient times, the Korean peninsula had become ancient China's dependency

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for several times. Cultures of China and North Korean peninsula were always closely linked [2]. Each other’s territory limits had been gradually fuzzy.

### 46.2 The Close Relationship Between the Ancient Korean Peninsula and the Ancient China’s Martial Arts Culture

In China’s history, the Korean peninsula had become a part of China’s vast territory for several times. Table 46.1 introduces ancient Korean peninsula and ancient Chinese territory relationship [3].

Through Table 46.1, we could find that in the shang period of ancient China, the North Korea of the ancient Korea’s which was also the vessel of North Korea existed as the identity of the state on behalf of the ancient Chinese; After the Qin Shihuang unified and the farmer insurgents were defeated, the vessel’s North Korea was eliminated and they built their own kingdom and made Pyongyang as the capital; The emperor period, the emperor sent his troops to put out immunoglobulin in North Korea, and established four counties in jurisdiction and rule in the north of the Korean peninsula; Don LiZhi unified the Korean peninsula after he ascended, and made Gyeongju as the capital; In the ninth century, ancient Chinese farmer insurgents in Korean peninsula established their own dynasty which later became the Koryo dynasty [4].

Chinese martial arts culture was a overall system, and it included many aspects as shown in the following Fig. 46.1 [5].

**Table 46.1** Territory relationships between North Korea peninsula and ancient Chinese

Period	Events
Late Shang dynasty	Vessel’s North Korea has been Zhou’s vassal state
Late Qin early Han	Destroy Vessel’s North Korea, establish a new country and its capital in Pyongyang
Time of Han Wu the great	Destroy Vessel’s Immunoglobulin North Korea, set up four counties in North Korean peninsula
Time of Tang Gao-Zong	Destroy Paekche were and Goguryeo, unite Korean peninsula its capital in Gyeongju
In the ninth century	The ancient Chinese farmer’s insurgents establish a dynasty in Korean peninsula
In the year of 926	After Korean unite Korean peninsula, it was beaten by Qidan and Jurchen. Became a vassal state of Liao and Jin
In the year of 1280	Korea was beaten by Yuan and became a province
In the year of 1636	Qing destroy Korea, and Korea became a vassal state of Qing



Fig. 46.1 The main components of Chinese traditional martial arts sport culture

### 46.3 The Scientific Analogy Between The Chinese Tradition Martial Arts and Taekwondo

#### 46.3.1 The Comparison of the History Between Chinese Martial Arts and Taekwondo

The development of Taekwondo in different periods was divided into four stages, while Chinese martial arts were divided into two stages after the new China was built.

From Table 46.2, it could be found that the development of Chinese martial arts was later than the development of the Taekwondo, but Chinese traditional martial arts was not later than Taekwondo. In 1940s, new China had not been set up, and Martial arts sport branches were distracting. At that time, North Korean peninsula Taekwondo started to create Taekwondo hall. Those all laid a solid foundation for Chinese martial arts fight to the world; since the 1980s, the economy developed rapidly with the reform and opening up policy, and Chinese martial arts also had a great development. The Chinese tradition martial arts moved toward the world, and made many high scores in the international competition. The Chinese traditional martial arts would make more progress in the future on the world stage.

Table 46.2 The comparison of the history of Chinese martial arts sport and Taekwondo

Category of martial arts	Period	Stage of development
Taekwondo	1940s	Initial stage
	1950s	The stage of determine name
	1960s	The stage of Rodeo
	1970s up to now	The stage of internationalization
Chinese martial arts	Early 1950s to the mid 1980s	The stage of mining, finishing, and domestic promotion
	1980s up to now	The stage of internationalization

### 46.3.2 Taekwondo Traits

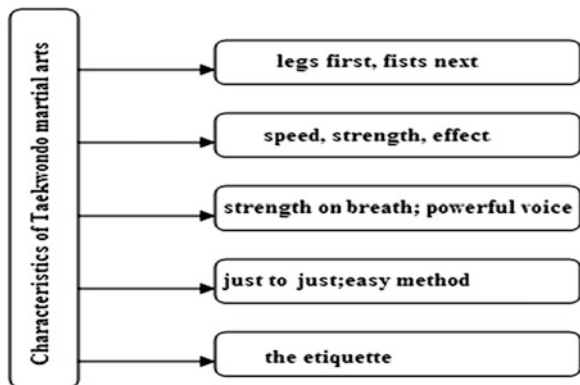
Leg was the most important in Taekwondo while hand is complementary, and kicking skills station to more than 70 % of the total techniques. Its movement pursued speed, strength, and effect. To combat as the core, paid attention to attack, speed, malicious, accurate, fast to break through the force without testing, good damage effect, and judging capability with the extent of the damage template (the thickness of the board, smashed degree). The Majesty was required in the event while in the practice process, loud voice of the deterrence was required to reveal oneself power. In the martial arts strike, just use in making just, direct strike, few defensive, and use continuous struck were to attack. At the same time in any place, a Taekwondo practitioner should be polite and use the spirit of Taekwondo [6] (Fig. 46.2).

### 46.3.3 The Characteristic of the Chinese Tradition Martial Arts

The Chinese traditional martial arts were the soul of Chinese martial arts, and were also the product of the agricultural society. From the process of the original human using stone and clubs to get food, the adventurous skills were produced, and this was also the sprout stage of martial arts. Later in Stone Age, the stone was widely used, and people got the chop skills. In Bronze Age, the producer of sword made martial arts a leap. Under the feudal ideology of feudal society, the martial arts developed with the thoughts of that time unconsciously, and brought up the traditional Chinese martial art with a philosophical entertainment, fighting, and body building (Fig. 46.2).

The broad and profound Chinese traditional culture boosted Chinese tradition martial arts to continually grow stronger. Meanwhile, it promoted many subjects to

Fig. 46.2 Characteristics of Taekwondo martial arts



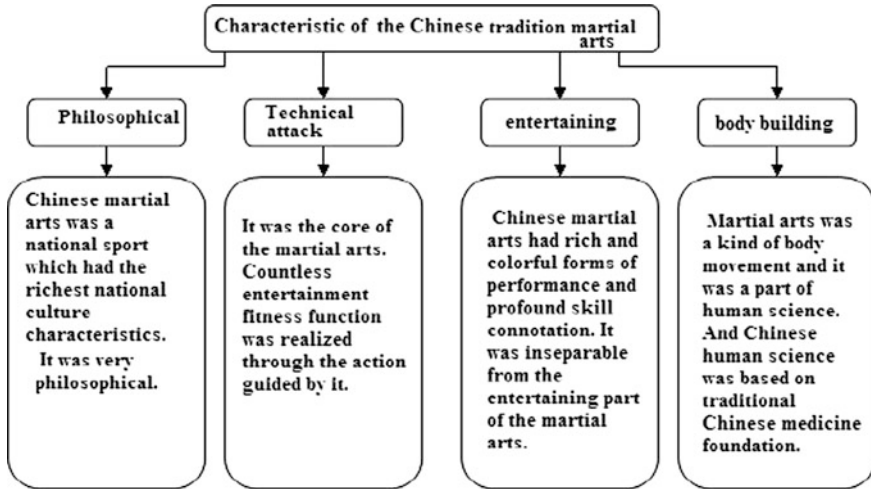


Fig. 46.3 Characteristic of the Chinese tradition martial arts

cross, permeate, inherit, and develop to the final flourish. Just as Fig. 46.3 showed that national culture and thinking produced the philosophy of traditional martial arts. The rise of core of the JiJiXing made the Chinese traditional philosophy be applied to reality; On the basis of JiJiXing we could see the esthetics of traditional martial arts and the broad and profound skills, thus making the Chinese tradition martial arts entertaining; With the participation of the human subject and traditional Chinese medicine, the research methods and the thinking mode of the traditional martial arts had been greatly improved, making the Chinese tradition martial arts adaptable to mental and physical body building.

## 46.4 Variation Analysis of Taekwondo Based on Function Increment Variation Method

### 46.4.1 Variation of the Objective World

The objective world’s many phenomena and things were not static. They were not only in movement but also in change. That is the variation of objective world. The process of sports changed in addition to special factor, is continuous. Just like in our daily life, time went by, variable species of animals and plants grew. The continuous development of the changing things constitutes the continuity of functions in the quantitative [7].

Galileo had studied the free fall sports which was the amount of continuous change. It just directly began with a continuous movement of the object. This was in the sixteen to seventeen centuries; In fact before the ninetieth century, these



continuously variable studies only stayed in geometrical intuitive level; In the middle of the Ninetieth century, a mathematician called Cauchy set up a series of strictly limit theories that made a strict mathematical expression for this kind of variation of the objective world; After 1920s, people found that the intuition light is a continuous movement, and then they found that they were discrete particle of light composition. After being heated, light atom radiated with the discrete frequency. That was the light wave-particle duality [8]. Since the twentieth century, these categories of discoveries were widely applied in our daily life, such as computer science, mathematical modeling, statistics, and so on. Continuous variation (the objective world variations) issue would be a very important significance research topic on theory and practice.

#### 46.4.2 Variation of Taekwondo

In the various phenomenons of nature and society, more than one changing variation often existed in many aspects which were the so-called variables. Variables were not mutually isolated with each other [9, 10]. They were closely linked. The contact of these variables often followed certain rules. We knew that function was a mathematical model which was to describe the relationship between variables. In orders to illustrate the variation of Taekwondo better; we would introduce the concept of Taekwondo time increment.

Set the development time of Taekwondo as  $t$ . From its initial time became a developing time, the changed part which was also called the change volume. It was recorded as  $\Delta t$ , and  $\Delta t = t_2 - t_1 (\Delta t > 0)$ . The change volume of Taekwondo development time variable  $t$  was always greater than zero. So, during the developing process, Taekwondo development time variable  $t$  abided by  $t_2 = t_1 + \Delta t$ .

In the development history of Taekwondo, the ancient Korean peninsula had taken great changes. In the changing period, we might as well set Taekwondo variation as function  $y = f(t)$ . A certain time in the historical transformation had a definition. So while Taekwondo development time  $t$  obtained an incremental  $\Delta t$  at  $t_0$ , during this period of time  $t$  changed into  $t_0 + \Delta t$  from  $t_0$ . Corresponding, the function  $y = f(t)$  changed from  $f(t_0)$  variation to  $f(t_0 + \Delta t)$ , and it was called:  $\Delta y = f(t_0 + \Delta t) - f(t_0)$  was the corresponding increment of Taekwondo time variation function  $y = f(t)$ .

Supposing the Taekwondo variation time function  $y = f(t)$  had a definition in the historical transformation of the time  $t_0$ , if Taekwondo development time variable  $t$  valued very small in a certain time period  $t_0$ , the variable response increment  $\Delta y$  of function  $y$  changed also very small. When  $\Delta t$  closed to zero, the variation delta  $\Delta y$  was close to zero too. During this time, the variation of the Taekwondo was continuous and it continued to change along with the political, cultural, economic, and social evolution.

If, on the other hand,  $\Delta t$  closed to Zero, and incremental variation  $\Delta y$  did not close to Zero, then the variation increment  $\Delta y$  of Taekwondo variation function

$y = f(t)$  in the historical transformation of a period time  $t_0$  was discontinuous. And the response of the incremental suddenly became fierce. As in the history of North Korea in 1909, Japan occupied Korea, and established the Japanese colonial government, with Taekwondo as JinLv list. In the process, Taekwondo did not die out, but fiercely developed, and became the achievement of modern karate. During this time, the development of Taekwondo was quite special. It made the Taekwondo research and communication be limited. Meanwhile, Taekwondo sucked up more essence of martial arts which laid a solid foundation for today's modern Taekwondo [11].

## 46.5 Conclusion

Martial arts played a massive boost for the modernization of the human society. Martial arts permeated in different fields of different subjects. It accurately described the communication between the human and the nature. It was the product that the human dominated and reformed the nature with their own fortitude. It made the human constantly reflect and summarize which was very meaning and profound; it was a kind of spirit which let the human continuously improve; and it was also a kind of culture which had a certain effect on all aspects of human material civilization and spirit civilization. Through the scientific match, we found that the Chinese tradition martial arts and Taekwondo had different charming features; through the establishment of Taekwondo variation time functions, we could clearly found the variation of the Taekwondo in the practical application of the mutation and determined the change amount of Taekwondo (different changes in different stages). Those would be helpful for our future research and study on Taekwondo. In this variation analysis, we first made the Taekwondo variation problem quantified, and then analyzed the variable and constants of the variation time and used function to analyze of the relationship between the variation of Taekwondo. The way to establish a mathematical model would gain more and more attention from all walks of people.

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# Chapter 47

## Statistical Analysis and Influence Research of Shanghai Cheerleading on College Students' Physical and Psychological Development Based on $T$ -Test Law

Yuexian Pan

**Abstract** With the development of science and technology and the progress of society, in sports, cheerleading has gradually come into the university students' life. Cheerleading is a unique charming and new-type sports, which is loved by the majority of university students for its strong appeal and charm. It has great influence on the construction of university campus culture, improvement of university students' physique, and the sense of unity and cooperation. By understanding the basis of some University's Cheerleading Campaign, this paper analyzed the value of physical and mental development in cheerleading university students, which added new content of theory certification process to university sports. After the application of mathematical statistics data analysis and processing in the  $T$ -test methods, the author used the linear regression method to test the significance of the data, and then obtained influence relationship of College Students' physical and mental development in cheerleading, adding new content to the thesis certification process of university physical education.

**Keywords** Cheerleading · Physical development ·  $T$ -test · Significant regression

### 47.1 Introduction

The twenty-first century is a historical period in which our society has undergone great changes. School sports is facing new opportunities and challenges, that are adapted to the need for “national fitness”, “health first”, and “lifelong physical culture” [1]. This opportunity and challenge put forward an issue which the school

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physical education cannot avoid. A review of the issue of domestic and international sports development in schools has revealed that the form of development of school physical education is in constant change [2, 3]. Along with education changing from “exam-oriented education” to “quality education”, sports has also transformed from “should match education” to “health education”. The development of university sports, with fitness as a starting point, more new fashioned and life breath movement projects should be developed to broaden students’ physical knowledge, cultivate physical ability, and establish the consciousness of life-long physical education. Hence, physical education in the school should be based on the present, look to the future, further continue the reform of the Physical Education Curriculum, and diversify the curriculum.

## **47.2 Research Objects and Methods**

### ***47.2.1 Research Objects***

Some related professional university teachers and students in Shanghai.

### ***47.2.2 Research Methods***

This paper uses the literature material law, expert interview law, questionnaire survey, mathematical statistics, and other research methods to study the present situation of Shanghai University cheerleading development, and has collected information about cheerleading, understand of university cheerleading’s present situation and development trend, seek the thought and method on study. Intensive reading on sports teaching, sports training, physiology, pedagogy, and psychology books has provided important theoretical bases for this research [4].

In order to understand the biological value of cheerleading introduced into physical teaching, this paper conducted a teaching experiment. Sixty elective course students of the second grade in university were selected as experiment subjects and the series of campus youth aerobics cheerleading routines “based in high spirit” was taken as the teaching content. Students were taught the basic routines of cheerleading, to analyze the measurement index and demonstrate the physical health effects of Cheerleading Sports on University Students. The experimental test of index classification is shown in Table 47.1.

### ***47.2.3 Data Processing and Results Analysis***

The questionnaire and experimental data were statistically processed. Using the statistical software EXCEL2000 average value, frequency, sorting and testing, and

**Table 47.1** Measuring content classification

Body shape test index	Physical function test index	Physical fitness test index
Length measurement	Breathing skills measurement	Flexible measuring Endurance measurements
Measure measurement	Cycle skills measurement	Force measurement balance function measurements
Dimension measurement		Coordination of measurement

mathematical statistics in data processing, we use *T*-test methods for data regression analysis.

$$t = \frac{\bar{X} - \mu}{\frac{\sigma_x}{\sqrt{n-1}}} \tag{47.1}$$

If the samples are large samples ( $n > 30$ ) can also be written as Eq. (47.2):

$$t = \frac{\bar{X} - \mu}{\frac{\sigma_x}{\sqrt{n}}} \tag{47.2}$$

When the overall distribution is positive, the overall standard deviation is unknown, and the sample size  $n < 30$ , then all possible sample average and overall average deviation statistics are in *t* distribution.

Test uses distribution theory to infer the probability of occurrence and difference, then compare the two averages to see whether the difference is significant or not. Test is divided into single and double overall test. Single master is to test a sample average and a known overall average to see whether difference is significant or not. When the population distribution is normal, such as the overall standard deviation unknown and the sample capacity of  $<30$ , then the sample average and the overall average deviation statistics are distributed in *t* distribution test statistics [5].

Here, *t* is deviation statistic of the sample average and the overall average;  $\bar{X}$  is the sample average;  $\mu$  is overall average;  $\sigma_x$  is sample standard deviation; *n* is sample capacity.

Analysis of the experimental group before and after physical function indicators are as shown in Table 47.2.

- (1) *Respiratory function*. The original lung capacity of the experimental group increased by an average of 230.39 ml compared to the *T*-test,  $P < 0.05$ , showing a significant difference.
- (2) *Circulation function*. Cheerleading is like other aerobic exercises. When it reaches a certain intensity and duration, the continuous movement of the body leads to improved heart and lung function. The step test index changes significantly before and after, by *T*-test,  $P < 0.05$ , with a significant difference.

**Table 47.2** Two indexes of physical function test results comparison

Index	Classification	( $\bar{X} \pm S$ )	<i>T</i> value	<i>P</i> value
Vital capacity	Before the experiment	2701.16 $\pm$ 717.09	2.254	<i>P</i> < 0.05
	After the experiment	2938.4 $\pm$ 538.13		
Step experiment	Before the experiment	45.12 $\pm$ 4.56	2.078	<i>P</i> < 0.05
	Before the experiment	48.44 $\pm$ 3.97		

- (3) *Flexibility*. The left and right leg vertical forks of the experimental group were reduced by 4.36 cm and 4.71 cm, *T*-test, *P* < 0.01. Cheerleading makes significant changes in the flexibility of university students. Kicking in cheerleading helps to improve the flexibility of the leg muscles; hence these exercises often help to improve leg flexibility.
- (4) *Balance*. The experimental group had to balance on one leg with eyes closed. The balance ability of the left leg increased by 13.7s, and for the right leg it increased by 13.9s; *T*-test showed a significant change of *P* < 0.01. As in aerobics, in cheerleading the body needs to maintain an upright posture, so that the centre of gravity stability can be well controlled, and the action can be perfectly finished. Thus, cheerleading can help in improving the balance of the body.
- (5) *Endurance*. The number of push-ups of students increased by an average of four, through *T*-test, *P* < 0.01, which showed that cheerleading has a significant impact on the quality of endurance in university students. In practice, this is a strong movement; the continued contraction of the muscles improved the level of muscular endurance.
- (6) *Strength*. The standing long jump performance increased by 6.44 cm in *T*-test *P* < 0.05 was significant different. In the practice process, cheerleading requires the body to be flexible, elastic ankle, clearing of the foot of the pace, and within a certain time span to perform intense exercise which increases leg strength. This shows that Cheerleading Sports influence the strength quality of university students.
- (7) *Coordination*. The number of rope skipping in one minute increased by an average of 19 per minute as tested by *T* and *P* < 0.05 showed significant difference. The rope skipping process is actually a hand and foot coordination process, in a certain period of time, where the upper and lower limbs have to be well coordinated. Error was found reduced.

Table 47.4 shows the value of cultivating the sense of teamwork among the 169 people who had already opened cheerleading courses in the survey; 91.72 % of people chose to completely agree while 8.28 % of people chose to generally agree. It can be seen from the data that the cheerleading team cooperation consciousness with culture value gets a high degree of identity. Cheerleading is an effective way for development and cultivation of social members' cooperation consciousness. Cheerleading training is done in teams, where the training intends to enhance communication, strengthen cooperation, enhances unity and resolves problems, and fosters mutual trust and team confidence. It also establishes mutual trust,

**Table 47.3** Five physical fitness test scores table

Index		Experimental group ( $X \pm S$ )	$T$ value	Value
Vertical fork left (cm)	Before the text	17.64 $\pm$ 9.58	3.04	$P < 0.01$
	After the text	13.24 $\pm$ 8.23		
Vertical fork right (cm)	Before the text	16.48 $\pm$ 9.12	3.35	$P < 0.01$
	After the text	11.78 $\pm$ 8.59		
Push-ups	Before the text	6 $\pm$ 6	4.73	$P < 0.01$
	After the text	10 $\pm$ 6		
One leg with eyes closed balance left (s)	Before the text	18.98 $\pm$ 9.32	7.532	$P < 0.01$
	After the text	32.45 $\pm$ 14.01		
One leg with eyes closed balance right (s)	Before the text	22.97 $\pm$ 9.32	9.173	$P < 0.01$
	After the text	36.78 $\pm$ 10.45		
Standing long jump (cm)	Before the text	172.45 $\pm$ 15.56	2.345	$P < 0.05$
	After the text	178/34 $\pm$ 17.98		
One minute of jumping rope (min)	Before the text	123 $\pm$ 45	2.114	$P < 0.05$
	After the text	135 $\pm$ 48		

understanding and caring, establishes subordinate to the collective, self-discipline, and wide collectivist ideas to others in the training process. After the experience of Cheerleading with a training team, university students have high recognition of cooperation consciousness values.

Based on Table 47.4, it can be seen that as regards cultivating a sense of responsibility, 51.48 % chose to totally agree, 40.24 % basically agreed, and 8.28 % chose the general. 91.72 % of people agree that cheerleading increases the value of a sense of responsibility. It is a sport using great cohesion, in pursuit of multi-group modeling and throwing and catching that requires each team member to have a high sense of responsibility. In this context it is necessary to consider the security of the throwing members, and also the overall team effort; the players must remain connected to their peers and maintain their trust to make a perfect show in the air. It can be said that cheerleading is a great project to develop the collective sense of honour. University students who have experienced cheerleading have a very high recognition of the development of the sense of responsibility value (Table 47.3).

## 47.3 Analysis on Cheerleading's Present Development Situation

### 47.3.1 The Basic Analysis of Referees, Coaches, Athletes

At present, in most matches of Shanghai University cheerleading, the referee's life is short. The referee fails to reach the upper level mainly because the cheerleading campaign has developed in a relatively short time, competition is relatively small, and specialized cheerleading organization and management system has not been established. Large parts of coaching in cheerleading training and teaching were



begun after working as a coach; although they had a certain knowledge of cheerleading, they had no system training project about cheerleading, which is a major disadvantage.

### 47.3.2 *The Cheerleading Training Situation*

Most university cheerleading training system are not perfect. Most of them take aerobics as the main training in peacetime training. There is no systematic cheerleading training content and just making short-term targeted training before the game does not guarantee consistency in training. These, to some extent have affected the development of university cheerleading.

### 47.3.3 *The Present Situation Analysis of Cheerleading Competition*

The matches over the years show that (Table 47.4) various universities have full enthusiasm to participate in cheerleading competition, but due to the lack of a systematic competition plan and perfect promotion mode, cheerleading has not fully exert its influence. Therefore, doing the job of cheerleading and the promotion of universal wellness can not only enrich students' extracurricular life, but also provide rich soil for Shanghai's cheerleading development in promoting the development of Shanghai cheerleading (Table 47.5).

### 47.3.4 *The Present Situation Analysis of Cheerleading Training*

At present, the training times of University Cheerleading Coaches are significantly less and popularity is not wide enough. The coaches' understanding of cheerleading

**Table 47.4** Universities students' understanding of the cheerleading social adaptability training

Problem	Fully agree with %	Generally agree with %	General %	Somewhat disagree %	Disagree %
Develop sense of teamwork	91.72	8.28	0.00	0.00	0.00
Cultivate a sense of responsibility	51.48	40.24	8.28	0.00	0.00
Promote interpersonal Cultivate self	47.93	49.11	2.96	0.00	0.00
Promote interpersonal Cultivate self	52.07	28.4	19.53	0.00	0.00

**Table 47.5** The annual university cheerleading competition in Shanghai

Years	Name of competition	The number of participating schools
2005	The first session of the “Kentucky Cup” Shanghai students cheerleaders dance competition	12
2007	“Pepsi-Cola Cup” Shanghai cheerleaders dance competition	54
2008	“Disney’s” high school musical east China game of the 2008 national cheerleaders dance challenge	16
2009	“Qingdao Beer” cup of NBA cheerleaders TV competition	14

is not clear, especially for competitive cheerleading and dance cheerleading’s difficulty action learning. if not combined with systematic training, coaches cannot to better implement the cheerleading safety training principles, cheerleading movement techniques, team spirit, and other elements in training.

Based on the survey in ten universities, we can find that only one of the universities has a cheerleading program, but no professional teaching materials. The rest have cheerleading activities in the form sports teams or student organizations. Although the majority of university’s and universities involved the content of cheerleading in the teaching process, teaching is not as a specialized course and such courses are arbitrary and do not have coherence. Thus the present development and cheerleading courses’ of Shanghai University cheerleading are not optimistic.

## 47.4 Conclusion

The practice of cheerleading teaching indicated that cheerleading has an impact on students’ Physique Health. In terms of body shape index, it has a significant effect to improve weight, waist, hip, thigh circumference, no significant changes in height, works with the thigh but the change was not significant; It can improve university students heart and lung function, and respiratory and circulatory functions; It works in vertical fork, one leg with eyes closed, the comprehensive development of physical fitness such as balance, push-ups, standing long jump, one minute rope skipping, the indicators all had a significant change. Besides, cheerleading can effectively develop students’ awareness of teamwork; develop students’ sense of responsibility, promote the ability of students to communicate with people, improve the interpersonal level; cultivate people’s self-confidence, and form good sportsmanship. Cheerleading can enhance students’ aesthetic ability and appreciation of music; can adjust students’ emotions to ease the pressure of learning for a rich cultural life. In addition, the embodiment of cheerleading in the pedagogy is not only to teach people to master a way of exercise but also to play a role in promoting people’s intellectual development.

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# Chapter 48

## Research on Sports Training Based on Information Technology

Yanping Tang, Guanghui Li and Hongyan Yu

**Abstract** In the era of rapid development of modern information technology, the integration of information technology and sports teaching has been sectors of community's concern and attention, through sports to better display a country's comprehensive national power. Aiming at college sports training to carry out empirical analysis, first of all to analyze the understanding requirements degree of information technology physical, followed by the evaluation the level of computer information of physical education teachers in order to enable teachers to recognize the importance of information technology and guide its better use that is effective integration of sports training and information technology, better services for the teaching service.

**Keywords** Information technology · Sports training · Empirical analysis · Proficiency

### 48.1 Introduction

The information era and network technology not only speed up the process of economic globalization, but also continually promote the rapid development and application of information technology, it has experienced drastic changes in the sectors of the economy or in social work and all areas of life. However, national comprehensive national power has been associated and linked in the modern

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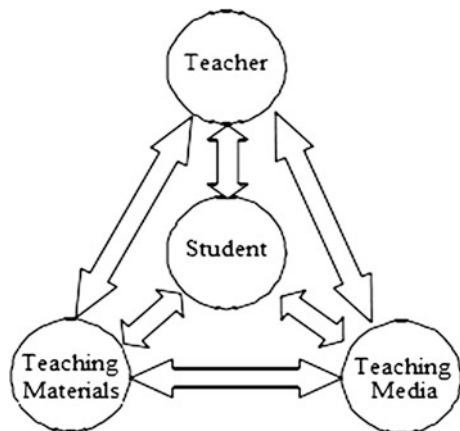
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information education and information utilization situation and level, which have a direct impact and demonstrate a country’s comprehensive strength. At present, education and information technology are closely related, and is combined with the level of information technology application that will contribute to improve education that everyone knows [1, 2]. Therefore, the community has also accelerated the integration of information technology and education teaching, to teach integration in the present situation. For physical training, it is concerned with all society sectors, also caused the widespread attention of the society. From the angle of information technology, how to achieve information technology in sports training to enhance the role will be further exploration. Getting the conclusion will help guidance in the physical training with some reference value and practical significance [3].

### 48.2 The Factor Analysis of Information Technology for Sport Training Application

In the process of education, it not only relates in the two aspects of students and teachers , but also relates to teaching material. Under the background of the information technology, the physical training will also be incorporated into the teaching media as important teaching factors. The teaching mode is from the original teachers “cramming” paradigm to shift the teaching and learning proportion way by students-centered. In Fig. 48.1, the various teaching elements’ relationship of information technology shows that teaching elements is an inter-related whole, it is no longer a simple and an independent combination, is to influence each other mutual promotion of effective unified system, there are three-three combination method [4].

Fig. 48.1 The relationship diagram between the various elements of the information technology teaching



### 48.3 The Result Analysis on Information Technology for Sport Training Application

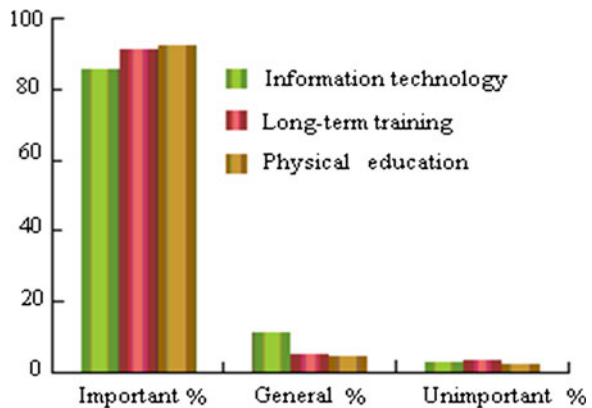
Aiming at college students to conduct a survey, a total of 140 students were involved in the investigation, the research general situation shows that students have high sports information knowledge demand, this also reflects the students' awareness of information technology and the important degree in sports training that is shown in Table 48.1.

Table 48.1 and Fig. 48.2 can be drawn that students for information understanding demand survey show obtain information is the most important for students, accounted for 100 %; followed by the important degree proportion of physical education is 92.5 %; the physical education awareness is general accounted for 4.6 %; thinking not important is accounted for 2.3 %. The third row is that the long-term training knowledge demand importance accounted for 91.3 %, thinking generally students is accounted for 5.3 %, not considered important is reached 3.4 %; only the important degree of information technology knowledge requirement is accounted for 90 %, and the average student ratio is reached for 11.3 %, thinking not important is also accounted for 3.1 % [5, 6].

**Table 48.1** The survey results of student's information recognize need

Content	Important	Scale	%	General	Scale	%	Unimportant	Scale	%
Acquisition information	140	100							
Information technology	120	85.6	18	11.3	2	3.1			
Long-term training	126	91.3	11	5.3	3	3.4			
Physical education	127	92.5	12	4.6	1	2.3			

**Fig. 48.2** The scale drawing of students information recognize need



## 48.4 The Problems and Countermeasures of Information Technology for Sport Training Application

For the impact of sports training, the modern information technology is from the shallower to the deeper process. It not only brings a more flexible and diverse teaching methods for physical training to enhance the teaching entertainment and interest and teaching activity, but also the hightech technology has brought greater opportunities and challenges for sports teaching.

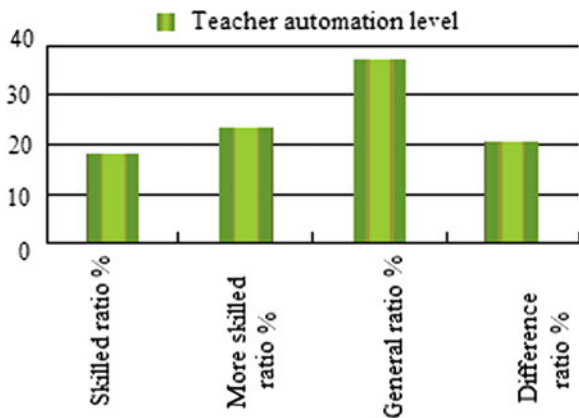
### 48.4.1 Teacher Information Technology Application Attitude

Teachers information technology recognition is shown in Fig. 48.3, the teachers of 3,66.3 % think that information technology is essential, however think that not essential proportion has reached more than 20 %, think that not necessary teacher ratio is more than 10 %, for unclear teacher ratio has reached more than 10 %. Those indicate that the teacher for high-tech information technology awareness is not enough, and can not fully aware of the effectiveness of information technology (Fig. 48.3).

### 48.4.2 Teacher Automation Level

From Table 48.2 and Fig. 48.4, it can be shown that the teacher is good performance in the office documents, fonts inputting, text processing, operation system, network applications, and other aspects, which is also the teachers essential core factors in the teaching process. The teacher automation level is general that it accounted the largest for 37.43 %, the following is more skilled degree that is

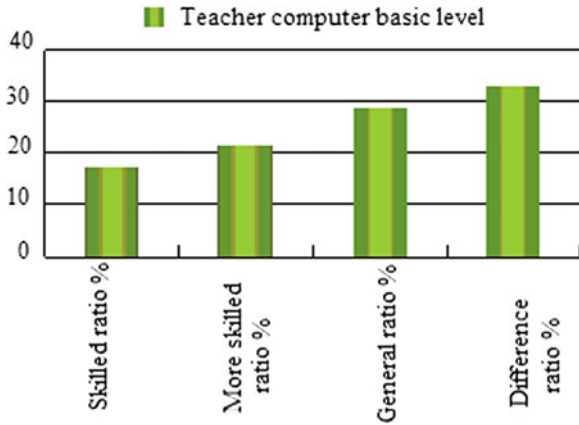
Fig. 48.3 The trend chart of teacher automation level



**Table 48.2** Teacher automation level questionnaires

Situation	Skilled	More skilled	General	Difference
Statistic	Proportion 18.25	Proportion 23.42	Proportion 37.43	Proportion 20.73

**Fig. 48.4** The trend chart of teacher computer basic level



accounted for 23.42 %, the third is the difference automation level that is accounted for 20.73 %, and the automation level for a proportion of skilled as the minimum that is 18.25 % [7, 8].

### 48.4.3 The Teacher Computer Basic Level Questionnaire

The teachers computer foundation level contains the physical education teachers in the knowledge of the Internet applications, such as email, webpage search, information retrieval and searching, download, and other information technology services that is relatively lacking [9–11].

Table 48.3 and Fig. 48.4 can show that the largest proportion of sports teacher computer basic level is a general degree that is 37.43 %; the second is more skilled degree that is 21.35 %, skilled degree ratio is 17.22 % that also reflects the physical education teachers to continue to strengthen its computer basic level, in order to keep pace with the times [12].



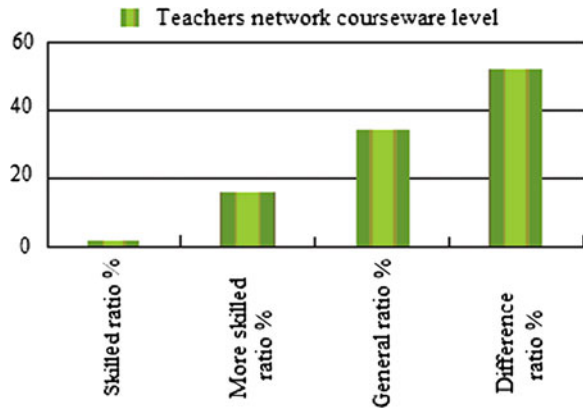
**Table 48.3** The teacher computer basic level questionnaire

Situation	Skilled	More skilled	General	Difference
	Proportion	Proportion	Proportion	Proportion
Statistic	17.22	21.35	37.43	20.73

**Table 48.4** Teachers network courseware level questionnaire

Situation	Skilled	More skilled	General	Difference
	Proportion	Proportion	Proportion	Proportion
Statistic	2.24	16.32	34.27	52.42

**Fig. 48.5** The trend chart of teachers network courseware level



#### 48.4.4 Teachers Network Courseware Level Questionnaire

Table 48.4 and Fig. 48.5 shows that the largest proportion teachers of the network courseware level is general level that is the proportion of 34.27 %, following is the degree of the difference that is the proportion of 52.42 %, and skilled degree is accounted for only 2.24 %, this shows that physical education teachers in network courseware production level should be strengthened, and further upgrade and improvement.

### 48.5 Conclusions

From the perspective of empirical analysis, the information technology for physical training has a very good role in promoting, and information technology for physical training that will have a more broad development space. This should cause everybody and the education circle of the extensive concern, however on the current college sports teachers in computer information technology level

condition, it should strengthen the teachers' information technology application and the ability to upgrade, which can be better applied to teaching and effectively guide students' physical training. The future of sports competition is not only the skills competition and but more is the embodiment of a display of national comprehensive economic strength and the characteristics of high tech information age, so the information technology will achieve sports promotion and realize sports take-off.

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# Chapter 49

## Study on International Development of Chinese Martial Arts Based on SWOT Analysis Method

Xinmei Chen

**Abstract** Taichiquan is the essence of the sports culture in China, it combines the theory of ancient simplicity dialectical materialism Qigong and the five elements theory of Yin-Yang to form developing. With the development of society, Taichiquan is also more and more deeply into people's life, and is generally accepted way of keeping good health. From the Taichiquan promotion pattern starting, studying this model can be applied to the entire field of martial arts, and taking the interview and literature survey method to study the effect of the ideas of Taichiquan promotion, thereby corresponding countermeasures and reasonable proposal are proposed for the international development of Chinese martial arts.

**Keywords** Taichiquan · Chinese martial arts · Internationalization · SWOT · Promotion model

### 49.1 Introduction

Chinese martial art is Chinese nation's wealth after the development of several thousand years, and now Chinese martial art not only represent the Chinese sports, but also represents the spirit of the Chinese nation. Facing the impact of Western martial arts for Chinese martial arts, it inherits several thousand years of Chinese martial arts [1]. In the international field, Chinese martial arts has some important phenomenon, how to inherit and carry forward the Chinese martial arts, how to

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make the Chinese martial arts that remains invincible in the international competition remain invincible, which is the focus of this paper [2]. And on behalf of the Chinese martial arts Taichiquan is Chinese origins relatively long movement, which began in the late Ming and early Qing Dynasty, Chinese martial art combines with breathing qigong and meridian doctrine and has absorbed some boxes as well as the theory of Yin Yang five elements, which are China's national essence [3, 4]. With the development of society, because it is a way of keeping good health of yin and Yang, Taichiquan is favored by more and more people. Through the study of Taichiquan promotion thought to put forward Chinese martial arts promotion, using the interview method and questionnaire survey method to study the effect of Taichiquan exercise's some factors, and combining some commonly methods of mathematical statistics and logical analysis to research Taichiquan's coupling mechanism to solve the problem. Thereby, corresponding countermeasures and reasonable proposal are also proposed for the international development of Chinese martial arts [5, 6].

## 49.2 Research on High-Performance Human Resource Management System

### (1) Research object and content

The four questionnaire survey conducted by the community residents are, whether or not to join the Taichiquan forging, forging time, forging purpose, forging place, and affecting the causes. The questionnaires statistic is shown in Table 49.1.

(2) Distribution of the survey respondents' age and the number of gender are shown in Table 49.2.

Statistical data can be seen in four communities, the number of participating in Taichiquan exercise' highest age is 61–65 years, accounted for 36 %; followed by 56–60 years that is accounted for 33.3 %; and then for 65 years or more, they are accounted for 23.4 %. However, the statistical results are expressed that participating in Taichiquan exercise only accounts for 7.2 % in the older people of 50–55 years old.

In addition, statistical data can also be seen that the male age of participating in Taichiquan exercise is mostly concentrated in the 61–65 years old, and female is

**Table 49.1** Questionnaires statistics

Communities	Sent out questionnaires	Returned questionnaires	Valid questionnaires
A. Community	35	35	35
B. Community	30	30	28
C. Community	25	25	25
D. Community	25	25	23
Total	115	115	115

**Table 49.2** The number of statistical tables of age and sex

Age distribution				
Sex	50–55	56–60	61–65	More than 65 years old
Male	3	17	32	23
Female	5	20	8	3
Total	8	37	40	26
Percentage	7.2	33.3	36.0	23.4

mostly concentrated in the 56–60 years old, this age group is recently retired, living alone, and thus, participating in Taichiquan exercise to enrich their lives, feel less lonely.

(3) Using mathematical statistics for processing of statistical data

To inspect  $\chi^2$  for statistical data

Statistical data may carry on  $\chi^2$  inspecting; significant level is  $p < 0.1$ . The basic idea of the  $\chi^2$  tested is

Set the overall  $X \sim N(0, 1)$ ,  $X_1, X_2, X_3, \dots, X_n$  is  $X$  sample statistics.  $\chi^2$  is defined as

$$\chi^2 = X_1^2 + X_2^2 + X_3^2 + \dots + X_n^2, \quad X_i \sim N(0, 1),$$

Probability density function is

$$f(x) = \begin{cases} \frac{1}{2^{\frac{n}{2}}\Gamma(\frac{n}{2})} x^{\frac{n}{2}-1} e^{-\frac{x}{2}}, & x \geq 0 \\ 0, & x < 0 \end{cases}$$

After mathematical calculations, it can draw a linear regression that is significant [7, 8].

(4) Analysis influence factors

**Table 49.3** Factors of affecting Taichiquan exercise

Labels	Influence factors
X1	Site selection
X2	Environment and weather factors
X3	Degree of action difficulty
X4	Taichiquan exercise atmosphere
X5	Effect of Taichiquan cognitive
X6	Whether or not Taichiquan instructor
X7	Level of Taichiquan instructor
X8	Personal physical condition
X9	Taichiquan promotion efforts
X10	Impact of friends and relatives
X11	Interests and hobbies of Taichiquan
X12	Personal emotional and psychological factors

The survey of four community effects Tai chi exercise factors, according to the result of the questionnaire to make data analysis influence factors, then through the collected questionnaire can obtain 12 factors of tai chi exercise [9]. The statistical results are shown in Table 49.3.

### 49.3 Characteristic of Enterprise Efficient Human Resource Management System

Using SWOT analysis techniques to combine with the promotion model of Taichiquan, and research the domestic martial arts promotion and international development technology. The so called SWOT analysis and the object of study is closely related to a variety of major internal and external's advantage factors, disadvantage factors, opportunities factors, and threat factors, through the investigation and set out, and according to a certain arrangement, and then using the system analysis thinking, matching the various factors to be analyzed that can be drawn from a range of appropriate strategy [10, 11].

#### (1) Analysis methods

Adopting the questionnaire survey form for the domestic martial arts promotion to undertake an analysis, the first is the questionnaire survey, including the design of questionnaire, expert evaluation, constructs validity, content validity, results analysis, and main steps; the questionnaire flow diagram is shown in Fig. 49.1.

#### (2) Analysis techniques (Table 49.4).

Analysis SWOT matrix diagram drawn can be obtained by domestic martial arts promotion's diagram that is shown in Fig. 49.2.

S (Superiority) analysis (Table 49.5)

W (Weakness) analysis (Table 49.6)

O (Opportunity) analysis (Table 49.7)

T (Threat) analysis (Table 49.8).

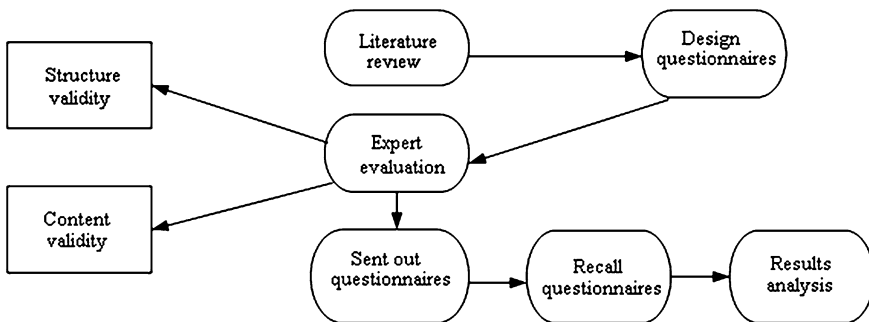
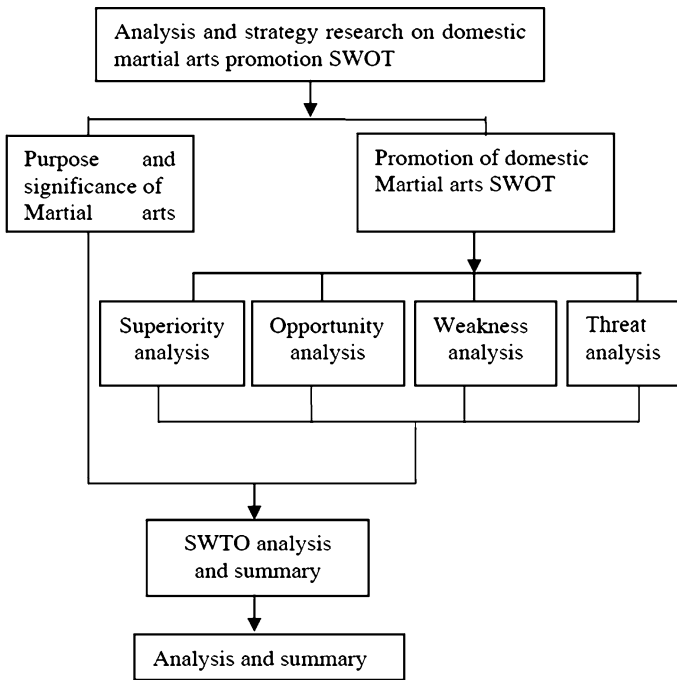


Fig. 49.1 Questionnaire flow chart

**Table 49.4** Analysis techniques

Internal analysis	Internal strengths S	Internal disadvantage W
External opportunities O	SO strategies relies the internal superiority to use external	WO strategy utilizes the external opportunities to overcome internal
External threats T	ST strategies relies the internal superiority to avoid external	WT strategy overcomes the internal disadvantage to avoid external



**Fig. 49.2** SWOT analysis diagram

Above SWOT matrix can show that at present domestic martial arts promotion still exists many internal disadvantages, facing the challenges from the outside environment. At the same time, Martial arts has many remarkable advantages, external also provides many good development opportunities. In general, Chinese martial arts promotion has advantage and disadvantage, opportunities and challenges; however these advantages, disadvantages, opportunities, and challenges are not immutable. Under certain environmental conditions, those can also be transformed into each other at different times. Therefore, we can use the superiority and opportunity of martial arts promotion, at the same time should grasp the changes in the external environment and change unfavorable factors into favorable conditions, and challenges into opportunities.

**Table 49.5** Superiority analysis table

	N	Mean value	Standard deviation	Sequence
Multiple functions of martial arts to meet the public need	38	6.53	0.893	1
The attention of the national government and leadership	38	5.61	1.242	2
The martial arts have a special regulatory agencies	38	4.58	1.518	3
Broad applicability of the martial arts	38	3.66	0.994	4
Gradual increase of the martial arts race	38	3.45	1.622	5
Gradual improvement of martial arts competition rules	38	3.26	0.921	6
Effective <i>N</i>	38			

**Table 49.6** Weakness analysis table

	<i>N</i>	Mean value	Standard deviation	Sequence
Martial arts to promote goal inconsistent	38	6.03	1.127	1
Martial arts' boxing and genre	38	5.53	1.390	2
Martial arts' structure complex and exercise difficulty	38	4.84	1.103	3
The scientific research of martial arts is relatively backward	38	4.66	1.599	4
Realize martial arts meaning and charm	38	4.03	0.972	5
Effective <i>N</i>	38			

**Table 49.7** Opportunity analysis table

	N	Mean value	Standard deviation	Sequence
Good sports background of the Olympic before and after	38	5.84	1.443	1
Diversified publicity of the mass media	38	5.42	1.117	2
Sports consumption growth	38	4.95	1.576	3
Industrial economy involvement	38	4.34	1.192	4
Effective <i>N</i>	38			

**Table 49.8** Threat analysis table

	<i>N</i>	Mean value	Standard deviation	Sequence
The impact of the conflict for Chinese martial arts between heritage and development	38	5.91	1.089	1
Foreign martial art competition	38	5.45	1.115	2
School martial arts education is not completed the task of heritage	38	4.74	1.223	3
The impact of Olympic sports culture	38	4.71	1.374	4
People is affected by the foreign sports cultural to concern about the martial arts	38	4.18	1.522	5
Effective <i>N</i>	38			



## 49.4 Conclusion

The martial arts would improve the culture strategy position, the Survey shows that Chinese traditional martial arts exists the signs of decline, at present our country has mainly not enough awareness for martial arts. If Chinese traditional martial arts can improve the culture development strategy, it can correct the misunderstanding of traditional martial arts and increase the international visibility of martial arts. And through the traditional martial arts SWOT analysis, people can understand the current sports technology that has advantages and disadvantages, opportunities and threats, development advantage, overcome inferior, and may try to translate Chinese martial arts to promote the international track.

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# Chapter 50

## Network Propagation Model of Chinese Traditional Sports in Globalization Based on Differential Equation

Dongsheng Lv

**Abstract** The globalization development is the trend in the development of the world. Under the globalization background, to analyze the characteristics of Chinese traditional sports and to study the propagation model, then to establish Internet information dissemination model formula. Through its dissemination and using the modern media technology, Chinese traditional sports can promote development. Finally, a country urban is investigated and analyzed that Chinese traditional sports are very popular and are extended. So the communication mode and method are helpful to promote the development of Chinese traditional sports, and provide related suggestion, at the same time expect that Chinese traditional sports and traditional sports culture can jointly spread and development.

**Keywords** Globalization · Chinese traditional sports · Spread model · Internet · Differential equation

### 50.1 Introduction

At present, the significant characteristic of world economic system is economic globalization. As a result of the western economic impact, its culture has been developed in every corner of the world and has been a serious threat to Asia, especially nonmainstream culture of east. As an integral part of the Chinese traditional culture, Chinese traditional sports under the globalization background is maintaining its rustic characteristics that is Chinese traditional sports and while

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maintaining its rustic characteristics are widespread concerned by domestic public attention [1, 2]. After analysis, the Chinese traditional sports have no good development promotion and dissemination. In the view of overall development communication of Chinese traditional sports, it is mainly based on the development of national regional traditional sports and a route of transmission. Under the globalization background, Chinese traditional sports culture has been increasingly concerned, which also gives western countries' sports to bring certain supplement. At the same time, the revival of Chinese traditional sports is also significant for the national cultures to meet the requirements of the era [3, 4].

## 50.2 Characteristics of Chinese Traditional Sports

Chinese traditional sports is the Chinese nation's inherited and physical characteristics and the sports mode of the significant historical background, at the same time has the most active, influential, direct, widespread, and the part of profound historical in the entire Chinese nation culture. After Traditional Chinese sports has the historical development of a thousand years, it has formed the culture of a unique system, a core component of the formation of the national culture, and it has fun, entertainment, viewing, and cultural identity. Chinese traditional sports features are mainly ceremony and harmony, self-cultivation, physical and mental, approachable and combining dynamic and static, forming a kind of entertaining, watching, and other features. Chinese traditional sports mainly pursue health and longevity, to carry on the development model of good physical and mental health; Chinese traditional sports pay attention to the motion feature that are mainly body exercise, the spirit of temper, body care, the pursuit of combining static and dynamic, a unity of body and mind; Chinese traditional sports pursues balance and comes naturally, which reflect harmonious development of a kind of person and natural, the formation of an overall effect and values, to form an overall effect and values. And then the competitive characteristics of the western sports and traditional sports entertainment, ornamental and other features have mutual conflict [5].

Due to rising competition of the pressure in modern society, people have to bear the psychological and physiological pressures that are more and more heavy. Especially in the era of economic globalization, the unique humanistic value of Chinese traditional sports is embodied fully, it can effectively alleviate psychological pressure, mental and physical exhaustion, and other state, such as outdoor climbing, horseback riding, and so on. The Chinese traditional sports make man and nature to combine a whole that is the people's physical health development and the nature harmonious promotion and development [6].

### **50.3 Communication Strategies of the Chinese Traditional Sports Under the Globalization Background**

In order to make the Chinese traditional sports to meet the needs of the rapid development of globalization, to research the communication strategy under the globalization background, those are mainly shown in the following respects.

#### ***50.3.1 Construction of the Chinese National Traditional Sports Communication Platform***

With the vigorous development of globalization electronic media industry, it is advantageous to the Chinese traditional sports dissemination platform's establishment. Through the role of visual communication of the mass media, the Chinese traditional sports is propagated by TV, radio, newspapers, and other media to let people know about the minimal dynamic and development trend of the traditional sports, which can carry on the overall media of Chinese traditional sports information and the all-around development, such as using Internet interaction characteristics, connecting dissemination function that carries on a full range of publicity, building national brand of Chinese's traditional sports. The public purpose is to build China's traditional sports globalization knowledge dissemination environment [7, 8].

#### ***50.3.2 Culture Promotion of the Chinese National Traditional Sports***

According to the rapid development of traditional sports, such as badminton, dance, and so on its development needs the government and the national relevant departments to foster and encourage. Learning Japanese judo and Taekwondo, the country set up a special department to research the physical culture and cultural connotation, attacking and defending technique, innovation technology. Therefore, Chinese sport general administration should further strengthen ties with athletes, to enter the deep investigation research on the current situation of Chinese traditional sports, at the same time establish the public construction, recreation demand, and so on. To analyze the system effective administrative law that is beneficial to the development and innovation of traditional Chinese culture, according to the different age, sex, occupation, level, etc.

### 50.3.3 Strengthen the Infrastructure Construction of Chinese's Traditional Sports Ground

As a result of ground and foundation design's limitation, the development of many traditional sports is restrained. Therefore, the development of Chinese traditional sports stadiums and infrastructure construction carry out the spread of primary conditions. Under the market economy system, the development of Chinese national traditional sports is according to market economy rule that vigorously develop the self-development ability. However, under the globalization background, the traditional sports enter the transnational dissemination through publicity building measures.

In the background of globalization, the traditional sports into the transnational dissemination through publicity and construction measures, the domestic and international people into traditional sports is in order to set up related traditional sports club, development of global economic market mode, promote the sustainable development of traditional Chinese sports. The people at home and abroad entered the traditional sports movement that can establish the traditional sports clubs, the development of a global economic market model and to promote the sustainable development of Chinese traditional sport (Fig. 50.1).

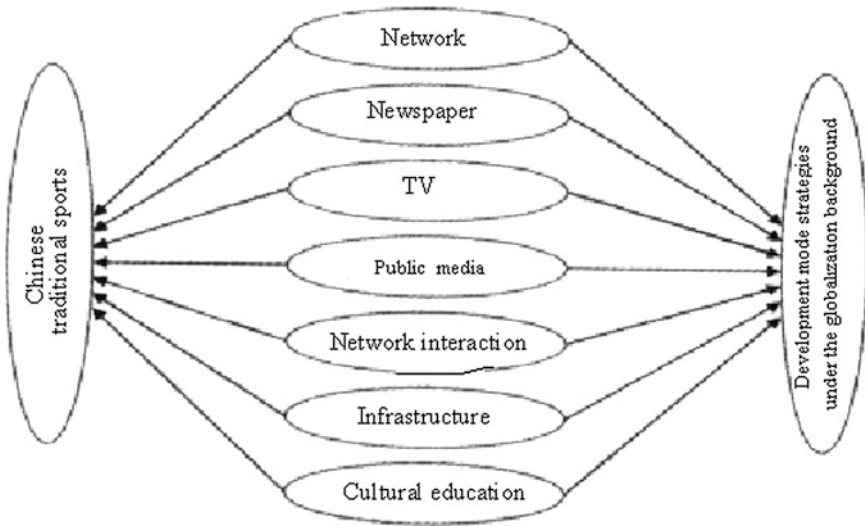


Fig. 50.1 Development strategies of the Chinese traditional sports' communication under the globalization background

### 50.4 Communication Model of the Chinese Traditional Sports Internet Under the Globalization Background

Typically, the Chinese traditional sport is usually easy to learn, participation relatively high, and restriction relatively few. Among them, the development and dissemination of Chinese martial cultural is through one-on-one face mode and hall type teaching mode. Due to the differences of geographical and cultural, Chinese martial arts have different characteristic. Therefore, the communication development of Chinese traditional sports needs a national culture center to spread. At the same time, the development of the globalization information age, information communication technology, the mass media technology laid the foundation as the Chinese traditional sports’ globalization development. At present, the information electronic science technology has been the fastest propagation velocity, the size of public communication range size, newspapers, magazines, advertising, internet, television, and other means, those carries on information dissemination for the masses [9].

Therefore, in view of Chinese traditional sports dissemination, the communication model is analyzed using Internet. By establishing the Internet differential equations modeling, Chinese traditional sports information get the differential equation model of Internet as

$$\begin{cases} \frac{di(x)}{dx} = \alpha b + \beta i_2(x)t(x) \\ i(x) = b + i_2(x)t(x) + i_2(x) = M \\ t(0) = t_0, i_2(x) = i_{20} \end{cases} \tag{50.1}$$

While  $t(x)$  is represented as the number of Internet propagation nodes;  $i_2(x)$  is represented as the number of Internet centralized propagation;  $M$  is represented as the total number of Internet nodes.

Supposed that the Internet communication information model coefficient is  $\theta$ ;  $g(x)$  is represented as the number of information communication nodes to get the differential equation that is

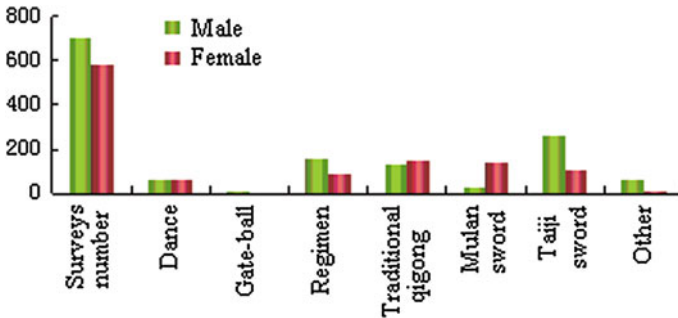
$$\begin{cases} \frac{di(x)}{dx} = \beta i(x)t(x) - \theta i(x) \\ \frac{dt(x)}{dx} = \theta t(x) - \beta i(x) \\ \frac{dg(x)}{dx} = \theta i(x) \\ M = t(x) + i(x) + g(x) \end{cases} \tag{50.2}$$

While  $t(0) = t_0, i(0) = i_0, g(0) = M - t_0 - i_0$

According to above Internet information dissemination model, to investigate a foreign city after the Chinese traditional sports carry on a period of propagation.

**Table 50.1** Participating Chinese traditional sports questionnaire

Gender	Surveys number	Dance	Gate-ball	Regimen	Mulan sword	Taiji sword	Other
Male	700	57	12	158	24	257	64
Female	580	62	4	89	142	105	12
Scale		9.3	11.5	1.7	32.2	30.1	5.2
Total	1280	119	16	247	166	362	76



**Fig. 50.2** Participating in the ratio of male to female comparison chart of Chinese traditional physical exercise

The type and situation status of public participation in traditional sports is shown in Table 50.1 (Fig. 50.2).

The survey shows that participating in the Chinese traditional sports item exercise is mainly in boxing, qigong, Tai Chi, and other items are only small part. This also shows Chinese traditional sports is very popular in the world, so that Chinese traditional sports communication mode is effective and sport characteristics is under the market economy system.

### 50.5 Conclusions

With the development of the economic globalization, the development of Chinese traditional sports will be challenging and threatening. Under the globalization background, the Chinese traditional sports development opportunity is very important and should be hold, and restricted by other countries. In the entertainment, health and other aspects, the value of Chinese national traditional sports need to be excavated, and show Chinese sport culture. In particular, the cultural development of Chinese traditional sports is stressed and increased globalized development, such as dragon dance, lion dance, and so on. Through the cultural

exchanges of system, learning from the transmission mode of western sports development strengthen the development of Chinese traditional sports culture and open up new space development.

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# Chapter 51

## Study on Attacking Foul of Basketball Players in Competition Based on SPSS and U-Theory

Peng Pu, Sufei Yang and Fenglin Dong

**Abstract** This paper focuses on the analysis on attacking foul of basketball players in competition, also investigates and analyzes on attacking foul of basketball players. The findings conclude the relationship between behaviors and motivations of basketball players, and indicate the attacking fouls and functions of basketball players, psychological factors of basketball players, the revenge degree, sex, and the referee scale tend to exist relationship on attacking tendency of basketball players. At last, the author puts forward some measures and methods to improve attacking foul of basketball players.

**Keywords** Attacking foul · Behavioral factor · SPSS · U-theory

### 51.1 Introduction

At present with the rapid development of modern sports, the major world basketball league is often hold, these competitions affect the eyes of basketball fans. At the same time, the political and social view of basketball game became more prominent; the interesting factors it represents is increasing [1]. Therefore, the intensity and the degree of hostility of basketball players in basketball games both are very high, coupled with the utilitarian mind of basketball players that is also

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enhanced, which to some extent have increased violence in a basketball game. In today's basketball game, frequent disagreement and friction exist between basketball players from both teams and the basketball referees, even attacking fouls or acts of violence, which not only caused the body injury of basketball players, but also, contrary to the spirit of basketball sport, is not conducive to the healthy development of world basketball and basketball player [2].

## **51.2 Investigation Methods of Attacking Fouls**

### ***51.2.1 Research Tool***

Questionnaires been carried out on basketball teams to investigate the basketball players of a certain province using SPSS data processing software tools for structural statistics and related data processing of survey data [3].

### ***51.2.2 Survey Sampling***

Conducted questionnaire survey on athletes in all regions in a certain province, a total of 229 basketball movements participated in the investigation, resumed 220 effective questionnaires. A total of 213 student basketball players from another college have participated in this survey, including 213 effective questionnaires [4]. They will take into account all factors in their investigation, such as gender, age, psychology, temperament, the degree of penalties, and so on as much as possible to ensure substantive representation of the survey sample [5].

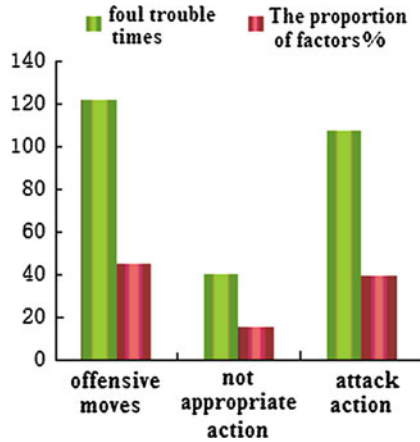
## **51.3 The Results and Reasons Analysis on Emerging Attacking Foul Behavior of Basketball Players**

### ***51.3.1 The Relationship Between Behaviors and Motivations of Basketball Players***

Through the investigation and analysis of basketball players in a certain province, Results showed that there are various attacking foul actions, the investigation is shown in Table 51.1 (Fig. 51.1).

**Table 51.1** Fouls of basketball team

	Offensive movement	Not appropriate action	Attack action	Foul trouble
Foul trouble	122	40	107	
The proportion of factors (%)	45.1	15.3	39.6	269



**Fig. 51.1** The comparison chart of foul action for basketball team

### 51.3.2 Attacking Foul is Associated with the Functional Differences of Basketball Players

In general, basketball competitions are to win. The basketball athletes of different functions lead to different positions and behaviors on the basketball court. That is, the position difference between forwards, center half-back, back, and the behavior of functional athletes behavior are not same, namely the offensive tendency they show is also different [6, 7].

From Table 51.2, we can see that none of the three functional basketball players scored high. Averages between 12–51 are normal players, and the *t* test showed that  $T > 0.05$ , which indicated that forwards, center half-back, and back had no significant difference [8] (Fig. 51.2).

**Table 51.2** Offensive tendency characteristic comparison of forward center half back

Item type	Sample size	Averages	Standard deviation	<i>T</i> value
Forward	94	28.6	6.2	0.53
Center half back	213	27.5	8.8	0.53
Back	127	28.0	7.1	0.35

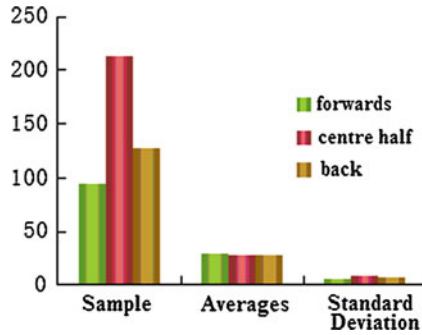


Fig. 51.2 The offensive tendency comparison chart of forwards center half back

### 51.3.3 The Psychological Factors of Basketball Players

Inverted U-theory in sports psychology is familiar to many basketball coaches. It changes with basketball players’ mental energy. The increase of mental energy affects the athletes race level. If the level of basketball player’s psychological gentleness is different or lower mental energy is highly vulnerable to external factors that cause being out of control psychologically and thus make a bad behavior of offensive foul (Fig. 51.3).

From Table 51.3, we can see the modest disposition of basketball athletes as its offensive actions tend to score lower value, that is, less offensive tendencies. But the *t* test value of  $T > 0.05$  indicates that there are no differences between temperate and violent; the offensive tendencies *t* test value of athletes between more violent and quite angry is  $T < 0.05$ , indicating that their discrete degree is high, occurring easy mutual friction and attack action.

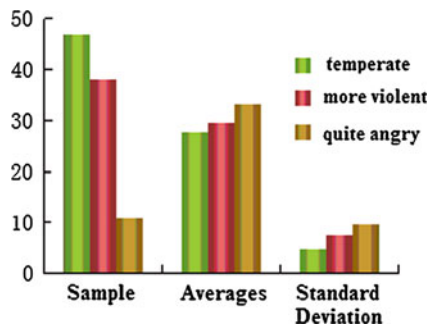
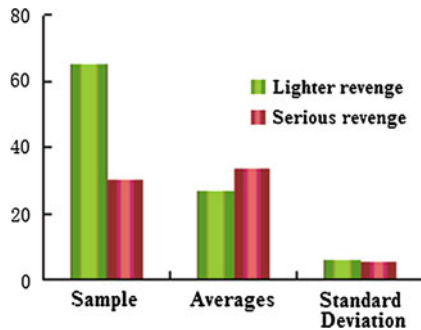


Fig. 51.3 The attacking tendencies’ characteristic comparison chart of temperament moderate degree for basketball players

**Table 51.3** The attacking tendencies characteristic data table of temperament moderate degree for basketball players

Item type	Sample size	Averages	Standard deviation	T value
Temperate	47	27.8	4.8	0.54
More violent	38	29.4	7.6	0.54
Quite angry	11	33.1	9.7	0.048



**Fig. 51.4** The degree of revenge taken and the referee scale of the basketball players attacking tendencies comparison chart

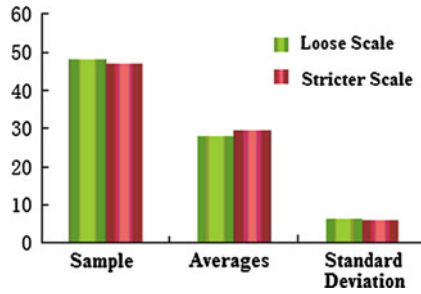
### 51.3.4 The Relationship Between Revenge Mental Degree and Basketball Players Attacking Tendencies

In the basketball competition, as the body collision contact is inevitable and the game is very competitive, foul behavior of basketball player in the game is also very normal. Once a basketball player’s psychology is imbalanced, other’s foul actions generate discontent, or not if treated properly, it will create a thought of revenge on the enemy’s intentional foul actions, thus attacking foul occurs [8, 9] (Fig. 51.4).

Table 51.4 indicates that serious revenge attacks of varying degrees show different characteristics. Basketball players with lighter revenge tendency scored lower, but a combination of *t* test results showed  $T < 0.05$ , which states that basketball players with serious revenge tendency are more offensive and their personal psychological states have impact on their attacking behaviors.

**Table 51.4** Questionnaire on Mental degree of revenge of the basketball players’ attacking tendencies

Item type	Sample size	Averages	Standard deviation	T value
Lighter revenge	65	26.8	5.8	0.015
Serious revenge	30	33.4	5.6	0.015



**Fig. 51.5** The offensive tendencies comparison chart of referee scale of the basketball players

**Table 51.5** Questionnaire on the referee scale of the basketball players attack tendencies

Time	Sample size	Averages	Standard deviation	<i>T</i> value
Loose scale	48	28.1	6.3	0.115
Stricter scale	47	29.4	6.1	0.115

### 51.3.5 The Relationship Between Referee Scale and Basketball Players’ Attacking Tendencies

In basketball competition, basketball referee scale has a significant impact on technical level as well as psychological control on emotions of basketball players of both sides [10] (Fig. 51.5).

Table 51.5 shows that loose refereeing leads to lower score averages, but *t* test result is  $T > 0.05$ , which indicates that judge’s fine has no obvious difference in scale, indicating that attacking tendency of basketball player and referee scale have no close relationship.

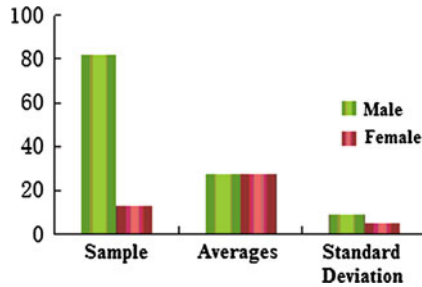
### 51.3.6 The Relationship between Gender and the Attacking Tendencies of Basketball Players

Due to the gender differences between men and women, the force, action, language, and behavior present in individual basketball are different. In order to analyze the impact of gender on attacking fouls of basketball athletes, we investigate and analyze on gender differences for basketball players; the findings are shown in Table 51.6.

Table 51.6 indicates that average scores of men and women basketball are similar; just the standard deviation of female basketball players is smaller, indicating that there is no clear distinction on individual gender differences between men and women, but *t* test result  $T > 0.05$  shows that basketball player attacks of

**Table 51.6** The relationship questionnaire between gender and the attacking tendencies of basketball players

Gender	Sample size	Averages	Standard deviation	T value
Male	82	27.4	9.3	0.709
Female	13	27.5	5.1	0.709



**Fig. 51.6** The relationship questionnaire between gender and the attacking tendencies of basketball players

sexual orientation have no difference between men and women, namely, an offensive foul and basketball athletes’ gender have no close relationship (Fig. 51.6).

### 51.4 Methods of Reducing and Controlling the Behavior of Attacking Fouls for Basketball Players

Conduct of research on attacking foul of basketball players in basketball game, taking corresponding system or measures to reduce and control attacking foul behaviors.

(1) Raise the cognition degree of basketball players

To enhance basketball player’s self-cultivation of moral qualities, the sports technology and professional quality, enhance the cultural theory of basketball player’s own learning. Holding activities to help basketball players reduce the tendency of unruly behavior attacks, educating basketball players must assume the consequences of bad behavior.

(2) Strengthening the basketball coach’s guidance work

Basketball coaches should raise business level and improve their comprehensive professional qualities. Basketball coach’s statements, actions, thoughts, and movements have a significant role on basketball player’s growth of physical and mental health. No matter in the basketball training process or basketball sports

field, basketball players' rough and aggressive behaviors should be banned, and make criticism and ideological education for basketball players. Especially in the fierce basketball games during the confrontation, basketball coach should be calm, control the basketball player as well as their own emotions to prevent irrational words and deeds have an offensive foul actions, avoiding causing harm.

## 51.5 Conclusion

In conclusion, in order to avoid basketball players' attacking fouls during the competition, we should create a good basketball communication environment, report properly before the basketball game, create a favorable atmosphere of basketball games main stadium [11]. In addition, strengthening basketball players' management level such as radically modifying basketball malicious punishment regulations and increasing punishment for attacking foul behaviors. It ensures the field training of basketball players to cultivate just and fair consciousness, avoid attacking foul actions [12].

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**Part VI**  
**Sustainable Education Management**

# Chapter 52

## Research on Cultivation of Higher Engineering Education

Haijuan An, Xue Zhang and Xue Yao

**Abstract** In recent years, higher engineering education has developed rapidly, and contributed to set the new modern engineering education system gradually. However, cultivation of higher engineering education meets new problems, which has the big influence on further development. Therefore, it is essential to deal with the problems in order to improve the quality of cultivation of higher engineering education and good advice should help engineering graduates to be more suitable to society. This article mainly analyzes the problems and its reason as well as proposes solution.

**Keywords** Higher engineering education · Problem and solution · Exploring process on cultivation

### 52.1 Introduction

Nowadays, science and technology updates rapidly and plays a more and more important role in promoting economic and social development. The cultivation of excellent students with engineering is vital to the level and speed of development of engineering technology, leading to the abilities of industrial competitiveness. The higher engineering education is the important parts in higher education system

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and becomes the main way for cultivating engineers, thus supporting the development of engineering science and technology. Therefore, many countries are reforming the engineering education to cultivate the high-quality engineers, and maintain the advantage in competition.

## **52.2 Definition, Characteristics, and Status Quo**

The definition, characteristics, and status quo of higher engineering education is the first platform on which we develop this research and indispensable to deeply understand the influencing factors and solutions.

### ***52.2.1 Definition***

The higher engineering education is a specific education based on technological science, with the aim of cultivating engineer who can transfer science and technology into productivity [1]. It emphasizes on application in practice from theory, points at the capability of solving on-site engineering problems, and focuses on team training.

### ***52.2.2 Characteristics***

Based on the rapid and great changes of twenty-first century, American Engineering and Technology Certification Board made 11 assess standards for new engineering education talents, including: the capability of the application of mathematics, science, and engineering knowledge; the capability of design, laboratory analysis, and data processing; the capability of designing a single component, system or process as needed; the comprehensive capacity of various training; the capability to validate, guide, and solve engineering problems; the knowledge of profession and social responsibility; the ability to express and communicate effectively; the understanding of the impact of engineering problems on the global environment; the ability of life-long learning; the knowledge of today's problems; the capacity of application of various techniques and modern engineering tools to solve practical problems. Thus, the twenty-first century requires engineering graduates to have composite knowledge structure, comprehensive ability, and higher engineering quality [2].

### 52.2.3 Status Quo

At present, the higher engineering education in China developed rapidly, winning big success. First, the scale of engineering education expands rapidly, holding the largest share at university. In 2010, the portion of engineering students was about one-third of the total number of college students, the largest share of higher education.

Second, education structure gets optimized. Professional master's degree based on application and practice has been affirmed and developed rapidly. Master of Engineering accounted for the largest share in 2010, a total enrollment of 3.86 million people. Now we are being started the pilot of Doctor of Engineering Graduate Education [3].

Third, the graduates grasp some of the innovative system technology which has been used in those major construction projects, such as Daqing Oilfield, the Gezhouba project, the Three Gorges project, large bridge projects marked by major construction projects and has made significant achievement in the field of coal, metallurgy, petrochemical, manufacturing, electricity, and transportation (Tables 52.1, 52.2).

## 52.3 Main Problems of Cultivation

Although higher engineering education in China has made great achievements, as evidence of largening scale, improving education quality, and increasing efficiency, there are still large gaps and many problems compared with developed countries as following:

### 52.3.1 Unclear Cultivating Objective

China had mimicked pattern of Soviet system to set professional major, which targets to on the professional tales. After the reform, we found that there are many limitations and began to explore the general education, which is the way of the United States [4]. However, the research and development of China's corporate is weak, and the engineer cannot be easily cultivated in the enterprise. In China's

**Table 52.1** Number of students in college and university in China in 2008–2010

Years	Graduates	Enrolments
2008	51,19,498	2,02,10,249
2009	53,11,023	2,14,46,570
2010	57,54,245	2,23,17,929

**Table 52.2** Number of engineering students in college and university in China in 2008–2010

Years	Graduates	Enrolments
2008	18,41,946	72,72,009
2009	19,18,428	77,41,552
2010	21,20,361	80,31,197

higher engineering education system, it keeps controversy how to train scientists or engineers. And it is also a question to train generalist or specialized students.

There is not enough coordination between degree, system and multi-level training requirements in engineering education. The training objective and division of the multi-level education are not very clear, and there is lack of characteristics. In addition, there is still blind pursuit of high-level tendency. For example, some universities of technology in China are blind to mimic the integrated direction of United States, resulting in a single level of training, not adapting to the diverse needs of the community.

### **52.3.2 Old Teaching Content**

The problem exists in both traditional and emerging majors. The course content updates behind the times, and the theory is divorced from reality. Many so-called new or revised materials have the same original system with the content and lacks of knowledge that reflects the disciplinary development of cutting-edge new science, new technologies, and new thinking.

### **52.3.3 Lack of Practical Process**

In higher engineering education curriculum system, the theory class proportion shares too large parts while the hours of practice including design, experiment, practice, trainee, and graduate design is small, leading to lack of cultivation of practical ability. To emphasize too much on the integrity of the theory of knowledge and ignore practice of knowledge results in integration of theory without practice. Practical lessons are just to test, review, and consolidate the theory. Therefore, the graduates of Higher Engineering Education mostly lack practical ability, creative spirit, and practical problem-solving capability in integrated and complex project. Meanwhile, the drawback of communication and teamwork is more prominent.

### ***52.3.4 Single Teaching Method***

Teaching method and model pay too much attention on teaching knowledge on schedule and acceptance. Therefore, it is a model of “injection of knowledge education”. Lack of interaction between teachers and students is the main problem, and it is difficult for students to actively participate in teaching activities. Traditional teaching methods and models are hard to help students to develop divergent, critical, and creative thinking which is conducive to innovation ability. Furthermore, this approach ignores the differences between different students, and is not conducive to the personality development of students.

### ***52.3.5 Far Away from Social Requirement***

It has been revealed as a serious problem in the job-hunting market that engineering education is not closely linked to the enterprises, and lack of forward-looking perspective on the market. For example, although enterprises need a lot of engineering and technical personnel, the graduates of Higher Engineering Education, cannot find the job which matches with their highly educated degree, due to the obsolete knowledge and little innovation.

## **52.4 Training Path to Explore**

Under the present circumstances, Higher Engineering Education in China must establish a reasonable education system and training mode in line with the requirements of the times, in order to meet the requirements of engineering and technical personnel in the context of globalization.

### ***52.4.1 Clear Training Objectives***

Higher engineering is a system, which includes professional education, undergraduate education, graduate education, and postgraduate education. Engineering education at all levels should accurately obey with their own training objectives. Higher professional education focuses on the cultivation of skilled personnel with the initial training of engineers. Undergraduate training completes the basic training. Graduate education cultivates senior specialists of the highest level. To be specific, there are higher requirements on the depth and breadth than the undergraduates and the goal of doctoral students is emphasized on science and technology researchers and teaching staff.

Graduate education should not limit to a single scholar model, and it should adapt to society. The interdisciplinary Master of Engineering, Doctor of Engineering will gradually become an important form of graduate training. Higher Engineering Education mainly aims to cultivate the students who will work at first line of production and has the ability to solve technical problems in the production process, so it is important to build good foundation of knowledge and expertise, as well as to strengthen practical ability. Graduate as a complex talent with an interdisciplinary cross-professional degree will be welcomed by enterprises.

### ***52.4.2 Optimize Teaching System***

Higher Education of Engineering has its own training objectives, academic settings, teaching content, teaching methods, and management system. It is essential to adjust professional setting, expand professional caliber, broaden the basis of discipline, and change to adapt to the needs of the community project. All of these fully reflect the requirements of knowledge, ability, and quality.

It should revise teaching plan according to the modern engineer training objectives, and determine the proportion of various types of courses. It also should increase in the experimental design, trainee, internship, and other practice hours and update teaching content by using the cutting-edge, advanced, and practical new textbooks. It is important to focus on interdisciplinary integration, broaden their knowledge, and enhance adaptability.

The re-application, re-practice, and re-solve the problem should be highlighted. Teaching method such as on-site teaching, case teaching, and participatory teaching should be used. To strengthen the application of modern teaching technologies and means, such as computer-aided teaching, online teaching, as well as to encourage students to identify and solve the problem in practice should also be emphasized.

### ***52.4.3 Enhance Project Training***

Higher Engineering Education requires engineers to grasp the basic scientific knowledge, with the ability to solve the engineering and technical problems. In order to train qualified engineers in universities, it is urgent in China to strengthen the teaching of engineering practice and modern engineering training.

Engineering training is really a factory production process to train students to have engineering practice competencies, skills, and develop the awareness of engineering process. China's universities should cooperate with industrial enterprises in the field of project, curriculum design, case studies, production practice, and graduated design, closely combining with engineering practice.

Modern engineering training is able students to have a fully experience of innovation process, and develop students' awareness of creative thinking and innovation capability. Students operate by themselves and design, process, produce, learning not only innovative design in production, but also a comprehensive system throughout the training process.

#### ***52.4.4 Promote International Communication***

Internationalization is the trend of higher education development, and the main process to improve talent cultivation. Therefore, we must follow this trend in cultivating engineers. It is indispensable for college and university to have international academic communication and cooperation through inviting professors from famous foreign universities to lecture on cutting-edge knowledge and research development. Nowadays, it is welcome to promote students to participate in exchange activities, at which they show academic advantages and play a spirit of innovation. To sum up, international academic communication is helpful for fusion of views and communication of innovation.

If condition permits, we can also send students to pursue a degree in the world famous university in form of exchange students or foreign students study, making full use of teaching and research advantages and radiation effects in foreign-leading subjects.

#### ***52.4.5 Update Education Thoughts***

With the development of science and technology, it is urgent to update technique education thoughts to the great engineering thoughts. On one hand, it should establish optimized, generalized comprehensive teaching system. On the other hand, attaching importance to practical and applied focus of engineering education is advisable. At last, cultivating engineering awareness, interests and capacities, and exploring unique training model for engineering education should be focused.

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# Chapter 53

## Research on Traditional Confucian Culture on University Students' Mental Health Education Based on the Value Analysis Method

Jianxin Ma

**Abstract** This paper aims at the prevalence of students' psychological problems in universities, and uses the traditional Chinese Confucian culture to take value analysis of the mental health education on university students. Through the study on one university, students' mental quality using questionnaire and symptom self-assessment analysis to study the students' mental health showed that university students' mental health has increased year by year. However, drawing on the ideas of traditional Chinese Confucian culture, it can effectively improve the good thinking quintessence and the ways of education, which can improve university students' mental condition and guide universities for good mental health education.

**Keywords** Confucian culture · Mental health education · Value analysis · Symptom analysis

### 53.1 Introduction

At present, mental health problems of light or heavy nature exist in university students universally. Mental health includes their own psychological normal activities, the coordination of relationship, and their own personality in certain state of relative stability while the reality and the content is consistent [1, 2]. University students are still in the immature stage in body, emotion, morality, intelligence, and personality. When they face something independently and make

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decisions while they encounter major problems in their life growth process, the juvenility will result in psychological conflict, and they will have mental health problems and if the contradictions are not handled well it will result in mental disease. Students' mental illness has become a serious national social issue which hinders their healthy growth of their body and mind [3–5].

It can provide us some enlightenment to solve this problem according to the great essence of Chinese traditional Confucian culture. Confucius, the founder of Confucian culture advocates self-cultivation, which mainly advocate us to be magnanimous, open-minded, not proud or discouraged when we meet any difficulty or elation, and live up to have a clear conscience; do not worry about personal gains and losses and do not grieve. This kind of culture teaches us to keep a happy mood, strengthen moral character constantly, and maintain physical and mental health. Therefore, this could guide physical and mental education on university students according to the traditional Chinese Confucian culture, and thus prevent psychological diseases in university students.

## **53.2 Problems in Mental Health Education of University Students**

Currently, mental health education has many problems in universities students, which mainly lies in the following aspects [6]:

### (1) A lack of initiative

College students' mental education in Chinese universities is very late, and has not received the social attention which cannot adapt to the developmental needs of the modern university students' education. Besides, there are no independent institutions of mental and educational management in the internal university, and it here are no related courses on the mental health education system. Meanwhile, it exists that universities think little of it, they have no specific remedial measures and the responsibility is not clear. University students do not have high positivity to participate in their own mental health training education, adding the wrong idea's confusion, which leads them not treat their mental illness normally, and their understanding also is insufficient, so that they are not willing to accept educational counseling actively. Furthermore, it influences on the degree of university's attention.

### (2) A lack of overall importance

Because of not paying attention to the work of university students' mental education, and taking this work as the students' ideological politics and counseling by error. And some universities ignore students' mental development, do not take the mental training of group, which increases the burden of individual student's mental consultation, and there is lack of the cultivation of moral healthy personality to the whole students as well as the development of mental quality.

### (3) A lack of professionalism

At present, it is incomplete that the mechanism of healthy teachers' constructive system in university mental consultation. The teachers who can do professional mental health counseling are very few, also, a large part of the teachers have no professional basic educational knowledge and the experience of practice mental health education. At the same time, there also is not protective policy to the teachers engaging in mental health in our country, which restricted the development of mental educational industry.

## 53.3 Analysis of Test and Investigation on University Students' Mental Health

After 2009, one college has tested on the enrolled students' mental health each year, and the test data show that the total number of students having symptoms of abnormal psychology is on the rise. This university did the test through the issuance of questionnaires and symptom self-assessment scale. There were 6,000 issued in total and 5,637 questionnaires were taken back, while the effective rate was 94 %, and the statistical results are shown in Table 53.1 (Fig. 53.1).

The results show that, according to the newborn mental health test in recent years, in almost 39.7 % of university students, there exist all kinds of mental diseases. The major mental diseases display in: paranoia, force, fear, split, communication, hostile, nerve, and other symptoms. Some of the most serious performances are hostility, anxiety, depression, and so on. The data surveyed from 2009 to 2011 about the total number of students' mental diseases are shown in Table 53.2.

From Table 53.2 and Fig. 53.2, it is known that the problem of university students' mental health has increasingly become prominent. Various mental diseases present rapid growth trend, and one of the fastest growth is the problem of diet sleep followed by hostile symptom, depressive symptom, anxious symptom, paranoid symptom, etc. It has a close relationship with the living environment of university students. After investigation and analysis, these university students who have different degrees of mental disease are influenced more or less by family, bad learning atmosphere, and so on. For example, students with hostile symptoms are mainly from single-parent families, and due to the absence of siblings, they show the psychology of taking themselves as the center of attraction and cause contradictions of inability to communicate with people, which results in a hostile attitude to the outside world ultimately.

**Table 53.1** Statistics of the test results on university students' mental health condition

Symptom	Hostile symptom	Paranoid symptom	Partite symptom	Diet sleep	Anxious symptom	Forced symptom	Communicative symptom	Depressive symptom	Fearful symptom	Neural symptom	Total
Slight	146	234	165	146	121	183	152	135	173	135	1,590
Medium	142	63	57	48	42	26	72	46	37	51	584
Serious	14	15	3	7	8	5	2	9	1	5	69
Total	302	312	225	201	171	214	226	190	211	191	2243

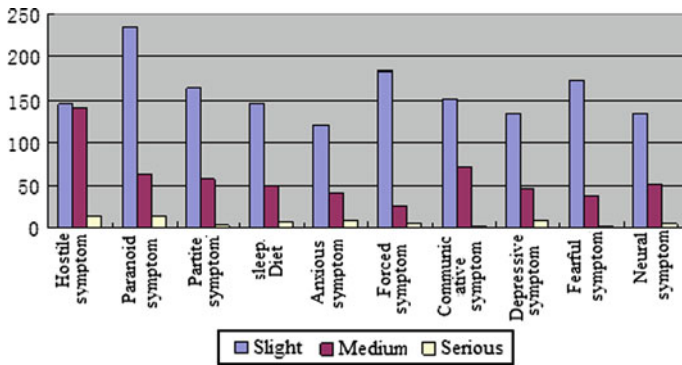


Fig. 53.1 Analysis of university students' mental health situation

### 53.4 Value Analysis on the Thought of Confucian Culture to Mental Health Education

Value analysis is an analytical method that the industry of social management generally accepts, and its basic expression is [7]:  $V$  (value) =  $F$  (function)/ $C$  (cost).

As the cost reduces and the function increases, the value becomes higher. For the value analysis of Confucian culture to university students' mental health education, the range of the Confucian culture will be widespread when the cost of education reduces, then the influence and the orientation on students' mental health is enhanced, and the value of the Confucian culture is higher. When  $V$  (value) is more than 1, the influenced degree of the Confucian culture for university students' mental health is greater than the relative cost of mental health education, and it is equipotent between the Confucian culture' function and the relative cost when the  $V$  (value) is equal to 1. And when  $V$  is in the scope of 0–1, it expresses the cost of education is relatively large, and should strengthen diversity and effectiveness of methods, so that the Confucian culture could play its deserved function and value [8].

In view of the various kinds of mental health problems in university students, our psychological education system should insist on the educational method combining the traditional Confucian essence with the scientific method of modern psychology for the education to university students' mental health. 2000 years have gone by after the spread of Confucian thought and the great spirit of active development, which has obtained all kinds of cultural essences and establishes the nuclear status of Chinese traditional culture. At the same time, Confucian culture has also shaped the fine social behavior, temperament, thought, and mental shape of Chinese people's nation [9]. Therefore, universities should develop the essence of Confucianism vigorously, and explore the university students' mental educational training mode actively, which could improve their mental quality and moral

**Table 53.2** Statistical data of the quantity of university students' mental diseases during 2009–2011

Years	Hostile symptom	Paranoid symptom	Partite symptom	Diet sleep	Anxious symptom	Forced symptom	Communicative symptom	Depressive symptom	Fearful symptom	Neural symptom
2009	130	140	90	67	88	50	23	97	17	43
2010	241	563	467	568	255	354	435	463	279	165
2011	567	685	796	1056	785	759	953	954	785	685

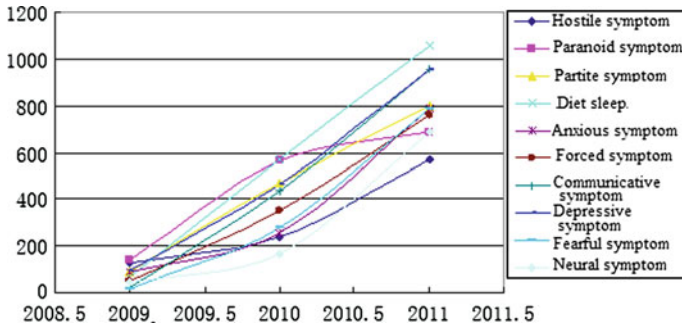


Fig. 53.2 Trend of mental disease patients' number in university students in 2009–2011

personality and transmit all-round harmonious development of culture, knowledge, practice, affection, and morality in the whole nation.

(1) Value of Confucianism lies in it being a kind of effective promotion and supplement on mental health education

The Chinese traditional Confucian thought cultivates the morality and personality to perfect through education to mold the good ideal life of value, moral personality. Being chaste, personality, philanthropic, which is the pursuit of kindheartedness by Confucius. Goodness, namely that a person has healthy morality and the basic moral character of personality. The pursuit of the good by Confucius, namely that a pursuit of the ultimate goal of mental health. Confucianism emphasizes that the individual should do internal training of kindheartedness and cultivation of external behavior in the process of practice.

The value of Confucianism is that it not only teaches knowledge, but pays more attention to educate students the philosophy truth of conducting themselves in society. It teaches them the way of getting along with people, self-control, self-discipline, self-cultivation, and improving their own psychology constantly. So using the traditional Confucian culture helps cultivating good moral personality on the mental health education to the university students. And it is not only the value of carrying forward the traditional cultural, but the urgent need of contemporary social development and the education and cultivation of talents.

(2) Value of Confucianism lies in its moral codes promoting the proper training of the university students' mental behavior

Confucianism mainly advocates the standard being human from the personality moral quality, and its pursuit is kindheartedness and harmony. On the mental education of university students, the value of Confucian culture is that it can teach students to use the ways of tolerance, respect and harmony to establish harmonious relationship among human, society and environment. At the same time, Confucianism pursues their own cultivation and self-denial to beyond ourselves. This can encourage students to achieve perfection gradually through the personalistic morality, and to beyond themselves step by step. Besides, it can cultivate noble

character, willing, cheerful and positive mental health, which ensures physical and mental health of university students [10].

- (3) Value of Confucian cultural lies in its educational method and educational content increasing the effect of mental health education

Mental diseases are caused by various aspects, which lead to the difference of mental quality. Therefore, it needs to be analyzed and cultivated from different angles. Meanwhile, it is given attention to the development factors of modern social economic culture, political culture and other aspects to establish pluralistic methods and content of university students' mental health education.

### 53.5 Conclusion

Through the above analysis of surveyed results on university students' mental problems, and the value analysis of the traditional Confucian culture for university students' mental health education, it is shown that Confucian culture has significant value for university students' mental health education. Its abundant educational connotation and essence of thought can help to improve the seriousness of ordinary university students' mental problems. It enlightens university to learn from its thoughts on educational methods to develop a new system and mode of university students' mental health education. At the same time, the students should take part in mental health education and consultation actively, learn Confucian culture's essence constantly and improve their physical and mental health constantly for the all-round development of morality.

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# Chapter 54

## Research on Epistemology of Students' Beliefs and Attitudes and in Learning and Teaching Based on *T*-Test Method

Li Kang

**Abstract** In order to be adaptive for the methods of learning and teaching, by conducting a questionnaire survey of epistemological beliefs and concepts of teaching and learning, the author identified the relationships between the beliefs of teachers' teaching students and their learning of teaching. According to 341 students and teachers' survey, the structure factors survey showed that it was the same model. Further analysis of the results showed that students and teachers held different views on the basis of sex, sector, and class level. At last, we could draw the conclusion that it is important for the knowledge and beliefs (innate/fixed ability, hard working, the learning process/expert knowledge, and certain knowledge) and the beliefs of method teaching study (constructivism idea and tradition idea).

**Keywords** *T*-Test · Epistemology · Student beliefs · Teaching ideas · Learning faith

### 54.1 Introduction

Different cognitive variables have different impact on the teaching and learning process, there are important variables which can be called epistemological beliefs and teaching and learning concepts [1, 2]. Epistemological beliefs expressed that knowledge with belief properties and access to knowledge (learning). Jones Kumord defined epistemology beliefs as a personal epistemological system, it

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includes five independent variable factors which are named knowledge organization, certain knowledge, knowledge source, and the speed of controlling and obtaining knowledge [3]. Personal epistemology belief has important effects on the personal cognitive and met cognitive process [4]. At the same time, these beliefs affect learning, not only as individuals, but also influence the learning and so on as a whole. The results of the investigating literature showed that other related variables in epistemological beliefs also include achievement motivation, learning method, problem-solving approaches, learning motivation, learning strategies, learning styles, and reflective thinking as well as academic record.

Recent studies suggest that epistemological beliefs and epistemology of teaching and learning have an impact on epistemological beliefs. The concept of teaching and learning refers to teachers' teaching and the faith of their preferred way. These measures include implications for teaching and learning, roles of teachers and students [5]. It has two main aspects and construction in concept of teaching and learning. Concept of construction comes from Piaget's theory basis. He emphasized the importance of experience and personal enthusiasm in the process of learning and construction of knowledge. In traditional concepts of teaching, we used a teacher-centered teaching strategy. This idea defines teachers are receivers of passive knowledge and a knowledge source of students. On the other hand, the construction concept used a student-centered teaching strategy. Because this type of research will help students develop critical thinking and collaboration capability, meanwhile allowing students to actively participate in [6].

The main purpose of this research was to adapt to the learning concepts of teaching, to provide students and teachers with the questionnaire. At the same time, to discuss the relationship between concepts of students and teachers and knowledge beliefs in teaching and learning.

## **54.2 Research Method**

### ***54.2.1 Sample Selection***

This research covered a sample of undergraduate students at education College (science education, English education, geography education, history education, computer education, and College of social science (history of Kung fu education and science teacher education) [7]. Samples included 341 students and teachers.

## ***54.2.2 Instrument in the Experiments***

### **54.2.2.1 Epistemological Beliefs' Questionnaire**

In this research, the epistemological beliefs' questionnaire (EBQ) included 30 questions. Testing and confirmatory factor analysis (CFA), 30 problems analysis. Questionnaire survey results: NFI: 0.64, CFI: 0.77, IFI: 0.78, RFI: 0.58, RMSEA: 0.054. According to the results which consist of four factors (innate/fixed ability, hard working, the learning process/expert knowledge, and certain knowledge). The entire result value of testing instrument  $\text{Alpha} = 78$ .

### **54.2.2.2 Teaching and Learning Concept Questionnaire**

This questionnaire had 30 questions. Survey results indicated that GFI: 0.93, AGFI: 0.91, RMR: 0.50, RMSEA: 0.54. The factor structure of this result included the concept of constructivism, two-factor structure of traditional concepts. The entire result value of constructivism and traditional concepts  $\text{Alpha} = 86$  and  $84$ .

## ***54.2.3 Program***

As the second experiment, researchers concluded that there were no meaningful differences in instruments. Therefore, the researchers came to the conclusion that the instrument was effective and reliable. In addition to descriptive statistics, we also ran data analysis of correlation, Final Act, Kehlenschbach alpha, *t*-tests, ANOVA [8].

## **54.3 Research Results**

### ***54.3.1 The Questionnaire Results for the Concept of Teaching and Learning***

Through the analysis of Final Act, we could see if there was a suitable data pointed out. We also investigated the fitting index of Final Act ( $X^2 = 1021$ ,  $3n = 341$ ,  $SD = 404$ ,  $P = 0.00$ ), there were significant differences. The fitting index showed that RMSEA: 0.067. It indicated that the method was a good choice when RMSEA was between 0 and 0.05. If that value was between 0.05 and 0.08, it is also acceptable. Therefore, when RMSEA: 0.067, this represented an acceptable model. Comparative fitting index (CFI): 0.80 and IFI: 0.81, NFI: 0.72, relative fitting index (RFI): 0.67. These results led to one conclusion that the Final Act was a suitable model. The overall reliability of measuring instruments was 71, constructing concepts of reliability were 88 and traditional concepts were 83.

### 54.3.2 Results of the Concept of Teaching Between Students and Teachers

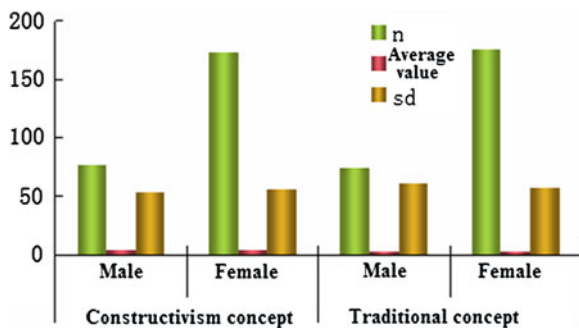
Through an analysis of the survey of students' views on the concept of teaching and learning, the average scores built a configuration concept of teaching and learning. This concept is known as "view of Constructivism", the average score was 4.1 (SD = 61). Results of this research showed that major recipients of teaching and learning process of construction methods were teachers. Second was named as "traditional concepts", it was on average value 2.7 (SD = 58). This surveys howed that compared to traditional methods, teachers preferred construction method. By *t*-test, we will see teaching and learning concept of students and teachers which is mainly about gender. *T*-test results are summarized in Table 54.1 (Fig. 54.1).

The "constructivism concepts" score which is the first factor of the instruments differences: male, female students' teacher [ $t(249) = -2.15, P < 0.05$ ]. Women student teachers have better score than males ( $\bar{X} = 4.08$ ) in "constructivism concepts". Therefore, it can be claimed that women student teachers like construction methods more than male. The second factor based on gender factor is "traditional concepts" [ $t(248) = 2.82, P < 0.05$ ] which is the opinion to students' teacher. However, at this time, the score of male students and teachers in "the traditional concept" ( $\bar{X} = 2.92$ ) is higher than the female student teachers ( $\bar{X} = 2.98$ ). It suggests that, compared to female students and teachers, male students and teachers prefer traditional methods. We had one-way ANOVA test to test whether the views on the concept of teaching and learning based on their

**Table 54.1** The results comparison table of teaching and learning concept based on gender *t*-test

	Sex	<i>n</i>	Average	sd	df	<i>t</i>	<i>p</i>
View of constructivism	Male	77	4.08	54	249	-2.16	0.005
	Female	173	4.24	56			
Traditional concepts	Male	74	2.92	61	248	2.82	
	Female	175	2.68	58			

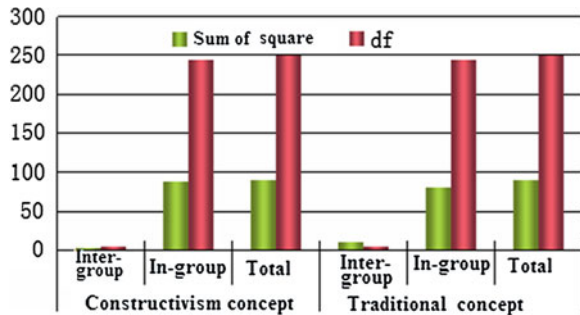
**Fig. 54.1** The results comparison diagram of teaching and learning concept based on gender *t*-test



**Table 54.2** The comparison table of questionnaire variance results on teaching and learning concept

	Sources of variance	Sum of square	df	RMS	F	p
Constructivism concepts	Group	1.883	5	0.472	1.304	0.271
	Within the Group	88.129	245	0.362		
	Total	90.012	250			
Traditional concepts	Group	10.309	5	2.578	7.845	0.000
	Within the Group	80.163	245	0.328		
	Total	90.472	250			

**Fig. 54.2** The comparison diagram of questionnaire variance results on teaching and learning concept



suggestion had reached the top level. ANOVA results are summarized in Table 54.2. We can find that the traditional values  $f(4-244) = 7, 84, P < 0.01$ , which had significant differences (Fig. 54.2).

Tests have shown that there is significant difference between constructivism concepts and traditional concepts. At the same time, we calculated the correlation coefficient between epistemological beliefs questionnaire and beliefs questionnaire (innate/fixed ability, research hard, research/expert knowledge, and certainty of knowledge), and the concepts factors of the questionnaire in learning of teaching concepts (concepts of constructivism, traditional concepts). That is, concept and learning process of positive constructivism/relationship of experts knowledge ( $R = 0.539, P < 0.01$ ); belief in learning effort and low positive correlation ( $R = 0.267, P < 0.01$ ); the negative correlation coefficient between the certainty of knowledge and belief is ( $R = -0.116, P < 0.01$ ). Therefore, it should be questioned in increasing importance in the process of learning and expertise of the faith and it is important to increase concept of learning constructivism and hard working. It is certain that knowledge remains unchanged declining in the constructive ideas in teaching and learning among increase in concepts. The relationship between Innate/fixed ability and certain knowledge is  $R = 0.437, P < 0.01$ ;  $R = 0.441, P < 0.01$ . Results showed that in the concepts of teaching and learning, we should believe traditional/fixed, innate ability, research hard, and increase certainty of knowledge.

## 54.4 Result Discussion

The date of the two factors' structure showed that the concept of teaching and learning concept survey was construction and traditional. The analysis of structure pointed out that the appearance of factors result was the same. Research results showed that teachers in the teaching and students in learning strongly tended to constructivism concepts. One of the possible reasons might be the recent reform of curriculum and teaching and learning activities in the construction of the education system.

This research found that gender-based teaching was different from learning. Women's average scores of trainee teachers' construction concept were significantly higher than that of men, and scores of men students' traditional concepts of teachers were higher than that of women. This means that women more strongly believe learning and research hard. With these results showed that women students teachers agree to build students' knowledge [9, 10].

## 54.5 Conclusion

The survey results of epistemological beliefs and ideas on the relationship between teaching and learning pointed out that, as an important part of the learning process, students' teachers' beliefs should be challenged, and increased importance during research meanwhile constructive ideas also increased. For other aspects, with the increasing certainty of teachers' beliefs, their construction concept was lower. But fixed/inherent ability, hard working, and belief in the certainty of knowledge increased, average score in research showed that traditional concepts increased either. When a person maintaining the traditional practice is to remember teacher centered, knowledge transferring is one way from teacher to student. But in the relationship between two similar concepts of traditional and construction, it is very important for us to work hard and be full of faith.

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# Chapter 55

## Study on Influencing Factors of Effectiveness in Performance Management

Shaohuan Li

**Abstract** The performance management is a very important element of management for the modern enterprise management. Academic circles often study enterprise performance management based on the specific enterprise performance management, analyzing concretely based on concrete problems. This paper constructs the influencing factors of performance management effectiveness mainly based on the performance management of the relevant documents and materials, and does empirical analysis aimed at the high and new technology enterprises. So, it determines influencing factors according to above actions. They should not only improve enterprise performance evaluation index of the work, quantificating index, making clear duty, analyzing job, but also have to strengthen the enterprise leader's attention and supervision, providing a reference on enterprise performance management, and guide the enterprises to improve and strengthen performance management effectiveness index factors in the performance management, realizing good effectiveness of enterprise performance management.

**Keywords** Performance management · Effectiveness · Influencing factors · Empirical analysis

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## 55.1 Introduction

With the improvement of economy and the level of management, more and more attention is paid to the enterprise human resources management, especially to the performance management [1, 2]. For an enterprise, performance management is a key index to measuring effectiveness of the work, competitiveness of an organization and work efficiency. Without Performance management, the work progress cannot be measured, and work efficiency and work performance cannot be determined, either. Only when the effective performance management has been done, every person's work responsibilities and tasks can be determined, and the value created by every person to the enterprise for the sector can be cleared. So the performance management occupies an important position in the enterprise management [3, 4]. It needs to cause the attention of industry leader. At the same time, only seriously implemented performance management, effectively provided information y for the leader's decision-making, and the work mode and method can be constantly improved, so as to achieve high efficiency, high work performance. The community has many studies about the performance management, but many do practical analysis based on the enterprise performance management work itself. This paper mainly analyzes the influencing factors aimed at the effective performance management in order to guide enterprises to improve and implement these influencing factors. And it has practical significance on enterprise performance management.

## 55.2 The Definition of Performance Management and Application Process

The researchers in every country have done an extensive research on the development of performance thought, and the understandings of its definition are not the same. They are mainly the following three points [5, 6]:

- (1) It does performance to the business management organization system. It includes a description of system organization of the basic expectations and development strategy as well as the definition of performance goals; and to improve the performance must go through a process, including the business process reorganization, sustainable development by improving the process, total quality management and standardization and so on; performance test includes measuring and assessment of performance results.
- (2) It does performance to the management of staff. The whole process of performance management includes: work plan, target estimation, process correction and so on. Firstly establish work commitments and working targets agreed to it; secondly measure or evaluate the desired objective performance; then do continuous dressing through mutual information feedback, determine target and take action.

(3) It does comprehensive performance to the management of organizations and employees of enterprises. The main goal of performance management is to excavate the potential of employees' working, and combine organization strategy and individual target in order to improve performance results of overall organization.

As the performance management is a complete organization system, so it is necessary to establish a set of allowing businesses to complete its strategic goal of rules and procedures, namely the performance of various elements in the process of realizing the management based on corporate strategy, foundation, and through the establishment of enterprise strategy, goal decomposition, performance, and more achievement of evaluation performance applied to day-to-day management to motivate staff to achieve continual improvement of performance and eventually complete the strategic objectives of enterprises. The whole system of performance management includes all functions of departments: organization, planning, coordination, and control. It is a complete management system. It is not only the final evaluation of enterprise employee performance, but also effective tracking management of the performance target realization of the whole process and all-around. Circulation management program is divided into five aspects: performance, implementation, evaluation, feedback improvement, and application of performance result. As shown in Fig. 55.1.

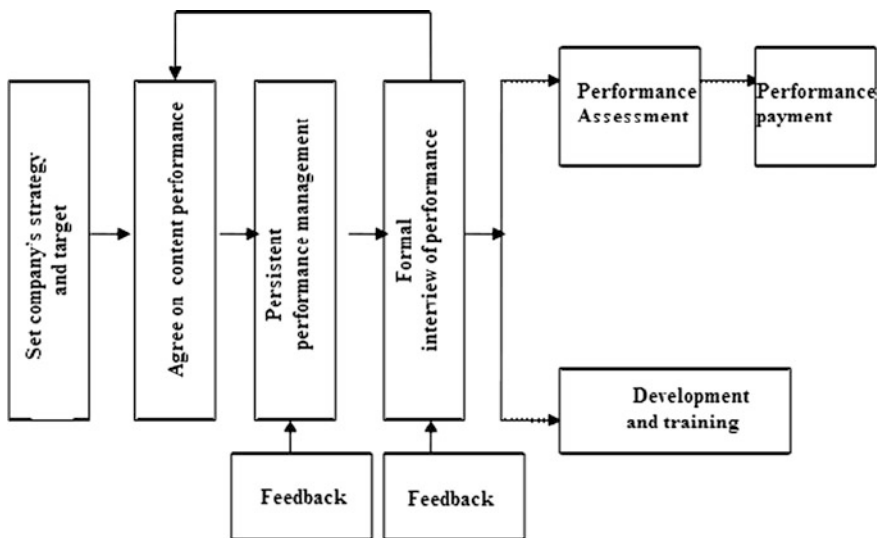


Fig. 55.1 Flow chart of performance management

### 55.3 Survey and Analysis

In order to study the effectiveness of performance management better, we analyze survey combined with internal management of performance situation of enterprise. The present investigation issued a total of more than 200 high-tech enterprises, a total of 241 questionnaires, reclaimed 105 effective questionnaires, and effective questionnaires have accounted for 43.2 % of the whole [7, 8].

(1) Investigation of employee’s information

Do individual statistics on effective questionnaires. Statistical results are shown in Table 55.1 (Fig. 55.2).

Table 55.1 shows that female employees are main persons for management, at the age of 26–40 years old. Many of these managers’ level of education are undergraduate course. Furthermore, the grass-roots management accounts for the major proportion in enterprises of investigation.

(2) Data analysis of the survey

In order to increase effective and scientific analysis of questionnaire data, we use the reliability analysis for evaluation of investigation. We use cronbach alpha reliability coefficient of performance management to do effectiveness analysis. Its formula is [9, 10]:

$$\alpha = \frac{i \left[ 1 - \sum \frac{S_i^2}{S^2} \right]}{i - 1} \tag{55.1}$$

*i* represents the total questionnaire problems; *Si* represents fractional difference quantity of survey item; *S* represents score differences of each survey’s content. We can know that  $\alpha$  is score coherence representation in the Table, namely internal consistency coefficient [11, 12]. The effectiveness reliability investigation data of enterprise employee’s performance management is as Table 55.2.

Table 55.2 shows that the dimensions of the *C* values are more than 0.7, indicating that this questionnaire credibility is relatively high. It also shows that

**Table 55.1** Statistical table of investigation

Personal category		Total questionnaires	Proportion
Gender	Male	35	34.3
	Female	67	65.7
Age	Under 24	1	1
	Between 26 and 40	74	72.5
	Over 40	27	26.5
Education level	Under undergraduate course	74	72.4
	Over undergraduate course	28	27.6
Position	The grass-roots management	86	84.4
	Middle-level and above leadership	16	15.6

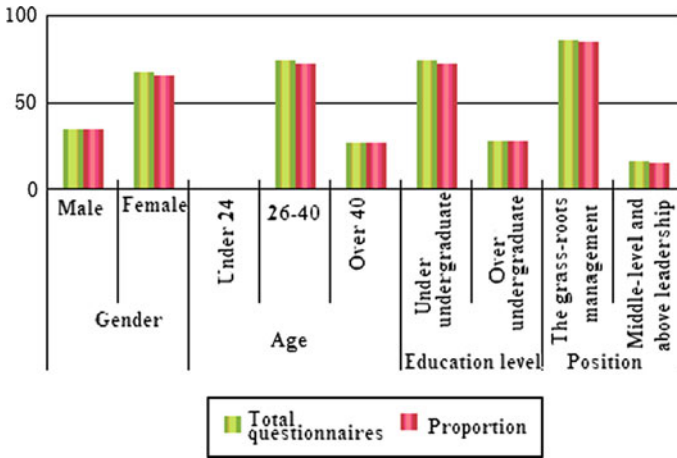


Fig. 55.2 Comparison diagram of investigation statistics

**Table 55.2** Analysis of the effect of enterprise employee performance management in reliability

Survey project	Mean value	Standard deviation	Alpha value
The current performance management policies can assist the leadership and subordinates to complete the target	3.55	0.80	0.93
Can stimulate potential of subordinate staff	3.51	0.75	
Can assist staff of enterprises to improve working efficiency and effectiveness	3.72	0.82	
Can motivate staff to work hard	3.64	0.79	
Can help employees understand leadership’s expectations to them	3.81	0.73	
Can help employees improve their shortcomings	3.57	0.76	
Help employees develop themselves	3.48	0.83	
Justice of the performance system	3.63	0.88	
Can play correct guiding function	3.45	0.82	
Degree of satisfaction of performance management system	3.20	0.87	
Mean value of enterprise employee performance management effectiveness	3.66	0.62	

this questionnaire can better reflect the majority of enterprise performance management and direct correlation.

### 55.4 Analysis on Reasons Affecting Performance

Through analysis of the questionnaire and reliability, we can know that there are many effective factors affecting internal performance management of enterprises.

**Table 55.3** Regression analysis data sheet of the performance management of all factors and effectiveness of enterprise employee performance management

Name	<i>B</i> coefficient	Standardized regression coefficient (Beta)	<i>T</i> value
Constant variable	-0.24		-0.73
Ownership (foreign/domestic)	0.13	0.06	0.88
The age of establishment	0.07	0.08	1.34
The total number of employees	0.02	0.05	0.7
Set working goals	0.14	0.15	1.5
Evaluating method and standard	0.33	0.34	3.23
Feedback of performance	0.11	0.12	1.12
Organize salary and career development	0.32	0.34	3.65
<i>F</i>	20.95		

They mainly display in: goal setting, performance feedback, organization of compensation and development, the effect of performance management and evaluation methods and evaluation standard [13, 14]. Therefore, through regression analyses of these four factors and staff performance management effectiveness, data have been got which are in Table 55.3.

It shows from the data in Table 55.3: the value of *F* is 20.95, indicating the result of enterprise staff performance management is very good, various factors can reach the significant level, showing that performance results and salary promotion have close link, management effectiveness is higher.

## 55.5 Conclusion

In order to increase the competitiveness of enterprises, a good performance management method plays an important role in the development of staff and enterprises. This also requires: (1) Attach top management importance to it. The implementation of performance management can be achieved by joint efforts of all levels of managers and staff. At the same time, performance management includes many aspects of enterprise management, such as planning, assessment, information feedback, encouraging, these management need to be valued and supported by senior managers. (2) Manage responsibility appropriately; (3) Design scientific and reasonable scheme; (4) Scheme propaganda goes thoroughly to basic level; (5) Communicate all the way. From the view of whole management, only through effective communication with employees can help understand their work and advance information, and can provide effective guidance pertinently, to ensure that the employees can complete goal smoothly, to promote whole performance level implementation capacity of enterprises, then further increases the competitiveness of enterprises.

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# Chapter 56

## Analysis on Characteristic and Realization of High Performance Enterprise Human Resource Management

Jing Sun

**Abstract** Since the development of enterprise management science, enterprises and managers have researched for higher human resource performance management. In recent years, the enterprise high-performance human resource management system is high-profile. In order to better management, development and utilization, and configuration for human resources, many companies are not clear in the high-performance management applications and do not have a deep enough understanding of high performance work systems structure. Through interviews and questionnaires, characteristic factors of high performance human resource management, and their impact on enterprise management are analyzed. After the content technical analysis, a way to develop the realization of high performance human resource management will be shown, and further provide a guiding role in the management of human resources for enterprises.

**Keywords** High performance · Human resource management · Management characteristics · Realization

### 56.1 Introduction

Due to the development of economic globalization and the constant change in technology updates of enterprise management mode, it causes ongoing management activities within the adjustment. Especially, the impact of network technology's the rapid development, enterprise-wide quality and standardized production, personnel of many enterprises is reconfigured, the process is

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redesigned etc. [1, 2]. As the enterprise core sector's human resources management departments must also follow the development of the times to improve it. Namely, the combined management affairs of their own and the entire enterprise management, increasing staff the working initiative and improving work efficiency, to compose the high performance management model.

## 56.2 Research on High Performance Human Resource Management System

In the process of enterprise strategic target realization, human resource has become the enterprises competitiveness core means. Human resource management practice, strategy and working system for enterprise's performance will have a great effect. For human resource management practices, the initial study focuses on organizational performance results and impact [3]. However, with time continuous development and social competitiveness has continued to increase, and enterprises continue to highlight the human resource management's strategic intention and its coordination. Especially now constantly presented study of high performance human resource management work system, further shows the importance of the human resource management work. The study presented a high performance work system will be combine with human resources structure and realize and the information technology. At present, the high performance human resource work system is shown in Table 56.1 (Fig. 56.1).

At the same time, high performance human resource management system includes five contents: structure, design, information system, salary system, and staff training and system, etc. [4]. In the organizational structure, it needs clear

**Table 56.1** Content analysis of high-performance human resource management system

High performance human resource management content categories	High-performance system work items	Applied frequency
Performance incentive	Pay Incentives	42
	Establish salary grade regime	19
	Enterprise internal promotion mechanism	15
	Performance evaluation system	7
Staff training	Learning training	30
Information exchange and sharing	Resource sharing	8
	Information exchange	6
Staff participation	Work team	9
	Staff participation	17
	Flexible regime	7
Other	Employee career planning	11
	Occupational safety education	6

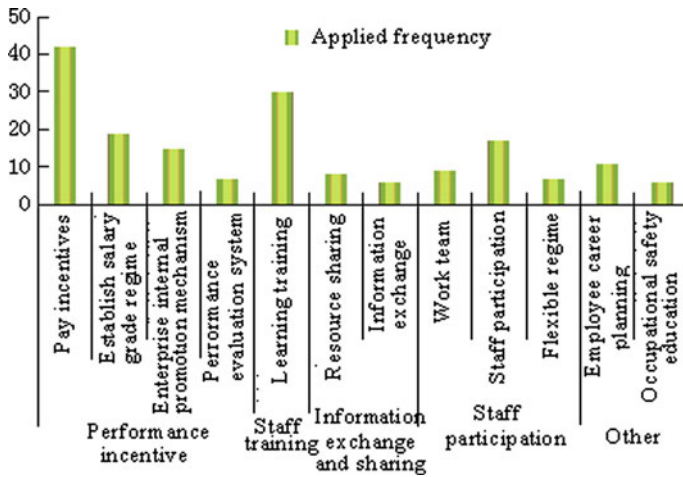


Fig. 56.1 High performance human resource management system content proportion map

division, cooperation, and communication between staff. High performance management system requirements within the organization need to encourage each other, collaborative learning, and continuous improvement. Design task description is on employee job clarity, requires designing effective tasks, which can efficiently reach a higher level. Among these five elements, staff is the most important, and it is the entire performance system of core key and needs to strengthen the personnel training and staff for organization’s mandate to match. The information system includes information sharing and communication mode. The five elements form a performance overall for the enterprise organizational structure high performance human resource management to provide a favorable support. The system is shown in Fig. 56.2.

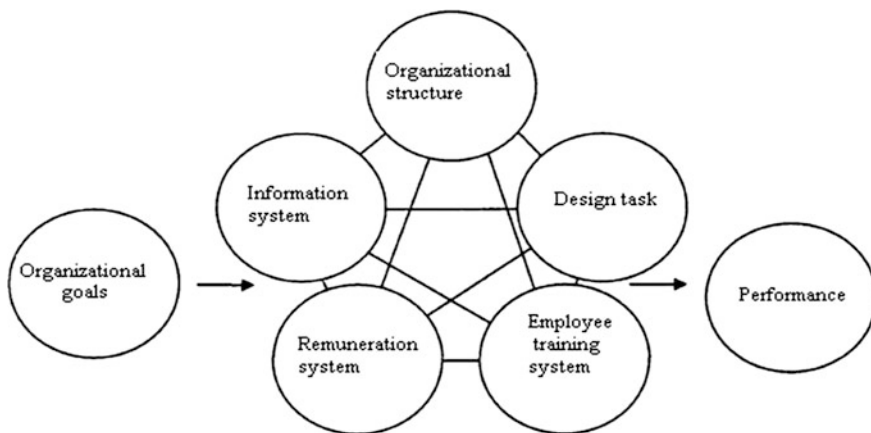


Fig. 56.2 High performance human resource management system composition

### 56.3 Characteristic of Enterprise Efficient Human Resource Management System

In order to clear the efficient human resource management system-specific features, further analysis of the core content, including training development in the management process, performance incentives, etc is done [5]. To this end, through interviews, questionnaires, and other forms to access high-performance human resources management system and the role of management information, and analysis of the high performance human resource management system' feature.

According to the above analysis, high performance human resource management elements includes five categories: personnel factors, salary reward, etc. Therefore, putting forward the enterprise high performance human resources work system feature structure hypothesis [6, 7]:

Assuming A: high performance management practice composition system: identification system, staff training development, performance incentives, authorized to participate in, the information exchange, etc.

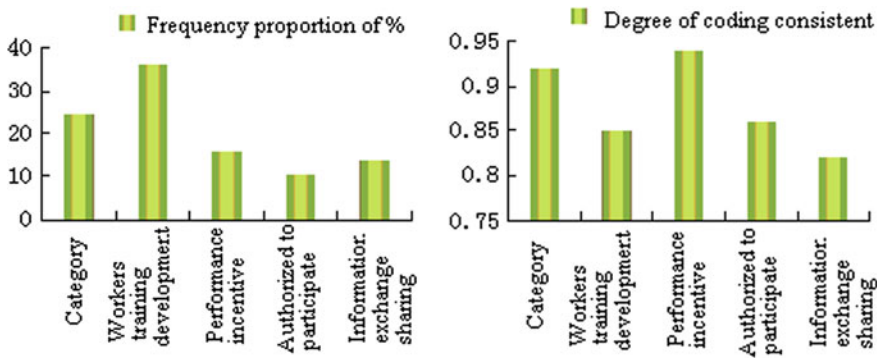
Assuming B: according to the high performance work demand express "ability - participation - complete target" model can be divided into strengthen staff work reward, providing employee involvement, strengthen the technical ability training.

Through the 14 enterprises to carry about human resource management activities of detailed interviews and survey, and interview results to build the coding table, and calculate encoding the degree of consistency. The same time, through the encoded content to carry content analysis, it can be seen that the managing content application level's frequency. Obtained coding results are shown in Table 56.2 (Fig. 56.3).

It can be seen that the interview basically contains the various practice content in the enterprises human resource management. Basically, assume A, the five have been verified, including staff training development as well as performance incentives and discrimination, which are a higher degree of importance [8]. In addition, the enterprises standardization and standardized management is also an important feature of high performance human resources management system, which helps improve the overall management of the enterprise's own technical level. Analysis derived from the specific content of the practice management

**Table 56.2** High performance human resource management system encoded data table

High Performance Human Resource Management Work Category	Degree of Coding Consistent	Frequency Proportion of %
Distinguish	0.92	24.4
Workers Training & Development	0.85	36.1
Performance Incentives	0.94	15.5
Authorized to Participate	0.86	10.2
Information Exchange and Sharing	0.82	13.8



**Fig. 56.3** The encoding consistency degree and frequency comparison chart of high performance human resource management system

angle, information systems play an important role in the high performance human resource management, and develop quickly.

Many enterprises introduce the enterprise internal information network system to carry staff information exchange and sharing of resources, to promote the employees learning initiative, and to enhance staff work capacity [9]. Therefore, obtained through interview research, high performance enterprise human resources management’s prominent features can reflect its high performance human resource management system role.

## 56.4 Particular Pathway Analysis on the Effective Management of High Performance Human Resources

### 56.4.1 Building Enterprise Interior of the Correct Guiding Thought

In China past of enterprise culture, human resource management is people-oriented as the core of enterprise management, and carries forward the traditional Confucianism culture, attaches great importance to people importance. Today, people-oriented still can be used as the corporate of culture core and value orientation. Enterprises should realize the values as a guide, to humanized management standardize employee behavior thinking. At the same time, to mobilize the staff’s working enthusiasm, initiative, and creativity.

Along with a new era of scientific development, also need to seek truth from facts, to follow the scientific outlook on development to guide the humanized management. During this period, establishing an effective enterprises incentive mechanism, playing the motivation of enthusiasm staff role for high performance

human resource management work is very important. Therefore it is necessary to do the following [10]:

- (1) Establishing a reasonable enterprise interior various levels of staff salary and reward standard, and corresponding formulation the suitable for enterprises to the long-term development of salary bonus plan, on this basis, and constantly improving incentive system, and on the basis of long-term plans to offer employees salary and bonus, but also has a certain binding;
- (2) The employees are in the company's growth process, according to the different types of employees as well as the direction of enterprise development to establish the staff adapting corresponding occupation skill training. At the same time, in favor of the enterprise's long-term development under the background, giving full play to enterprise employees' advantages, mining their work ability as well as potential.

#### ***56.4.2 Strengthening the Function Training for the Internal Staff***

Function training of the internal staffs is conducive to the dissemination and application of corporate values and spirit, but also helps to improve the internal management leadership management ability and skill level, and can help achieve enterprises strategic development goals. There are two main steps in the training of employees:

- (1) Training enterprise management. For an enterprise, personal qualities of the management have a direct role in high performance human resource management process. Managers must have advanced political thought, as well as a sense of responsibility for the enterprise work, and the spirit of innovation and professionalism. At the same time, enhance the work ethic of the leadership team.
- (2) Strengthening staff training education, namely the targeted training trainers for occupation development planning, skilling, innovation, and other aspects; at the same time, in order to perfect the training mechanism, doing the training mission and enterprise long-term development to adapt, to ensure that training work rational institutionalization and standardization; combining various training, depending on different working conditions to conduct short-term, semi-full-time, and full-time training; strengthening the culture of innovation, according to their own characteristics to conduct the management innovation, mechanism innovation, learning innovation, and so on.

### ***56.4.3 Building a High Performance Human Resource Management Information***

Information technology refers to the enterprise human resources management using information technology to solve management, mainly through enterprise information, employee self-service system, automatic information processing, and information sharing to improve work efficiency. Construction of high-tech information system can standardize the management and improve work efficiency of an enterprise.

## **56.5 Conclusion**

Through the analysis, the enterprise high-performance human resources management system can improve the role of the competitive organization. In order to ensure the quick realization of enterprise high-performance management system, through the study of its feature structures as well as other enterprise performance management content and method, it shows that the high performance human resource management system is in the five contents to achieve consistency, including organizational structure, design tasks, information systems, compensation systems and employee training and system, to ensure that employees' job performance, work enthusiasm and initiative. For the enterprise development process, because the market competition intensifies unceasingly, enterprise want to maintain a strong competitive situation, it is necessary to make human resources management highly effective operation, at the same time to innovate mechanism and thinking mode for the entire human resources management in the enterprise, to promote the rapid growth of enterprises and employees.

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# Chapter 57

## Study on Social Constructivism Teaching Concept and Enlightenments in Curriculum Reform

Xiaoyun Lou

**Abstract** Generally, constructivism can be classified into a great number of small genres, and social constructivism is one of its very important genres. The knowledge-based concept, teaching concept, and learning concept, which are proposed in the social constructivism, can exert great enlightenments for people to make an improvement to classroom teaching. In this paper, the author carries out an introduction on the intension of the social constructivism teaching concept first, and discusses its great enlightenments on the new curriculum reform of China. Therefore, this paper is of practical and guiding significance to some extent.

**Keywords** Social constructivism · Teaching concept · New curriculum reform · Enlightenments

### 57.1 Introduction

Constructivism attained great prosperity in the United States of America in the 1990s. It has attached high importance and provided interpretations to a great number of aspects of teaching activities. In the mean time, completely new learning theory and teaching concept were proposed in the social constructivism, and also its distinctive claims and ideas are with validity and rationality to some extent. Therefore, the social constructivism has produced important reference and enlightenment significance for the new curriculum reform of China [1]. In this paper, the author carries out an introduction on the intension of the social

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constructivism teaching concept first, and discusses its great enlightenments on the new curriculum reform of China. Therefore, this paper is of practical and guiding significance to some extent.

## **57.2 Intension of the Social Constructivism Teaching Concept**

People who believe in the social constructivism stress that knowledge is obtained by the learners through the construction of meaning by relying on the help from others and necessary teaching materials under a certain context (i.e., a social and cultural background), but not completed through the one-way knowledge transfer from teachers to students and the knowledge impartation from teachers.

The core idea of the social constructivism is student-centered [2], which attaches the highest importance to the initiative exploration of students on knowledge, the initiative findings, as well as the initiative construction of the meaning of what they have learnt.

With the purpose of revealing the nature of the teaching concept of the social constructivism better four basic elements, which are necessary for the teaching process, have been proposed by people who believe in the social constructivism.

### ***57.2.1 Teaching Situation***

From the social constructivism, it can be seen that it is necessary for the context in the teaching environment to be conducive to the construction of the meanings of what the students have learnt. Therefore, in teaching design, it is necessary not only to give full consideration to the analysis of teaching objectives and the arrangement of teaching contents [3], but also attach the highest importance to the creation of the context and the design of problems for students to construct what the students have learnt. In the mean time, it is necessary to regard the creation of context as one of the most important elements of teaching design. For these reasons, the knowledge and experience in application can be migrated by construction with great flexibility.

### ***57.2.2 Cooperative Sharing***

Cooperation always run through the process of teaching from the beginning to the end, and this is also one of the core concepts of the social constructivism. It is thought by people, who believe in the social constructivism, that social interaction can play a highly important role in the process of teaching.

Such a social interaction, which is centered at cooperation, has the ability to create a very extensive teaching and learning group for the construction of knowledge, and then students can carry out the discussions and exchanges under the guidance of their teachers, and therefore a great teaching and learning group can be commonly constructed by both teachers and students.

In this group, the mutual cooperation between different individuals can play a very important role in the collection and analysis of the teaching materials, the proposal and demonstration of hypothesis, and the evaluation of the teaching results, and the ultimate construction of the meanings.

Through such a cooperative teaching and learning environment, the thinking way and wisdom of each member in teaching and learning group can be shared by all members, and therefore the construction of the meanings of what students have learn can be completed jointly by teachers and students.

### ***57.2.3 Dialogue and Exchange***

Dialogue and exchange is not only one of the indispensable parts of the cooperative process, but also one of the most important means to achieve the construction of meanings [4].

In the social constructivism, high importance is attached to the idea that teacher should provide the teaching and learning group with freedom. In the mean time, it is necessary for such a teaching and learning group to be small enough, so that all people can take part in a very explicit collective mission.

Besides, it is necessary for all members of the teaching and learning group to discuss how to complete the specified teaching tasks or make a plan on the complex specified tasks through dialogues.

In addition, the process of carrying out operation is also a process of making dialogues in essence.

In such a process, the idea of each member of the teaching and learning group as well as the way of thinking to solve problems becomes more definite and explicit, and simultaneously the thinking achievements of each member can be shared by all other members of the whole teaching and learning group.

### ***57.2.4 Meaning Construction***

The construction of meaning is that the learners can effectively know well the nature and laws of things as well as the intrinsic relationship among things after the learning of above several stages and hence complete the effective migration of new knowledge, and simultaneously can get an in-depth understanding of new knowledge and establish a cognitive structure related to what they have learnt currently, and ultimately produce their own unique perspective to understand the objective things.

From above analysis, it is believed by the social constructivism that the quality of teaching is one of the manifestations of the ability of learners to construct the meaning of what they have learnt, but not the ability of the learners to reproduce the way of thinking of their teachers.

For this reason, it is also thought by it that the amount of knowledge acquired by the learners mainly depends on the ability of the learners to construct the meanings of relevant knowledge in accordance with their actual experience, but not on the ability of the learners to memorize and recite the contents that are taught by teachers.

### **57.3 Enlightenments of the Social Constructivism on the New Curriculum Reform of China**

From the end of the last century, the social life in China has undergone a great number of earth-shaking changes.

At the same time, science and technology have attained a changing-over development with each passing day; knowledge-based economy has emerged over the horizon; information-based society has arrived in the world quietly. In the modern times, persons with ability have changed into the important factor for the competition between different countries.

Therefore, knowledge becomes the most important resource for the competition between different countries. Under this situation, the new curriculum reform was proposed in China, for the ultimate purpose of cultivating increasingly more talented personnel possessing an innovation ability and making an enhancement to the comprehensive national strength of China.

In the new curriculum reform of China, a certain number of requirements are proposed on the course objectives and teaching methods of Chinese school education, etc.

However, the teaching concept of the social constructivism also has produced a series of influences on the new curriculum reform of China, which can be specifically reflected from the aspects in the following.

#### ***57.3.1 Course Objective***

Course objective refers to the expected results that should be achieved in the teaching of a course within the specific educational phase. It is placed in the core position in a course structure.

For a very long time, the course objective in China was primarily oriented at the value of social standards, but did not put forward relevant requirements on the character development and personal growth of students. This made high

importance attached to the unity and integrity but ignorance given to the development of the educational objects in curriculum formation, and there the cultivation on the subjective initiative of students was seriously suppressed.

However, it is thought by the social constructivism that carrying on national history and culture is one of the major purposes of education, but not the only purpose. Therefore, in education, it is necessary to cultivate the creativity of the students, but not to tame students.

The rapid developments of the knowledge-based economy and the information-based age require that education should focus on the cultivation of the innovation ability of students, but not be firmly entrenched in the knowledge that has been old-fashioned and deadlocked.

For these reasons, under the support of the teaching concept of the social constructivism, it is necessary for the goal of the new curriculum reform of China to focus on the cultivation of the abilities and individual characters of students, especially the ability in innovation.

### ***57.3.2 Courses Structure***

The structure of courses refers to the organizational, coordinative, and proportional relationship among all parts of a curriculum system.

In the previous time, a single subject structure was mainly applied in the basic education courses of Chinese school education, in which Chinese language, mathematics, politics, history, chemistry, physics, and biology were only deemed at courses, but other kinds of educational activities were considered to be the “extracurricular activities”. This situation directly played a negative effect on the development of students in an all-round way.

However, in the social constructivism, it is thought that the educational activities should be dynamically in combination with the actual environments, get rid of the idea of attaching importance only to the courses with subject standards, and allow more students to actually take part in the context of the practical applications.

Under the guidance of such a teaching concept, it is necessary for the new curriculum reform of China to develop the structure of courses from diversity to comprehensiveness, and also add more comprehensive courses. Only in such a way, a structural system of courses, which is beneficial for the lifelong development of students, can be produced ultimately.

### ***57.3.3 Teaching Process***

For a long time, it is thought in the traditional concept that the process of teaching referred to only a one-way process of knowledge impartation from educators to educational objects. Such a teaching concept attached high impotence to the

leading role of teachers, but gave a cold shoulder to the principal part of students. Therefore, it could be seen that such a kind of teaching concept was far away from being comprehensive.

However, it is believed in the social constructivism that the process of teaching refers to a process of students to actively take initiative to construct themselves under the promotion of their teachers.

In such a process, students are allowed to construct their recognition on learning and world on the basis of their own attitude, interest and knowledge structure. Therefore, according to the teaching concept of the social constructivism, the process of teaching should be started from the existing knowledge, interest and attitude of students, create a certain context for them, and promote them to construct their own knowledge under the help of teachers. In this way, students can be helped to get an in-depth understanding of knowledge ultimately.

## 57.4 Conclusion

In the educational reform which is oriented at teaching students “how to learn” and “how to survive”, it is necessary to make great efforts to promote the reform of the new curriculum reform in China, and simultaneously carry out reforms in the aspects such as course objectives, curriculum structure, and teaching process. The teaching concept of the social constructivism provides the modern people with a powerful theoretical reference to promote the new curriculum reform smoothly in China, and also bring about a great number of useful enlightenments.

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# Chapter 58

## Ways to Improve the Students Communicative Competence

Xianmei Wei and Yiquan Liu

**Abstract** This essay analyzes the problems that the students are facing in speaking English. Suggestion giving the students assignments to write articles and check them, assigning some students to make a speech every class and check them, requesting the students to write down several questions about the topic and then talk, which are good strategies to improve the students oral English speaking. Then instructs the methods to enhance the students the motivation to speak English, such as guiding the students to find the reason correctly; praising the students when they do it well and criticize less; urging all the students to support each other emotionally and learn from each other. Finally emphasize that the teacher should try to use multi-media to help the students to learn English speaking.

**Keywords** Ways · Improve · Communicative competence

### 58.1 Introduction

As we all know, English speaking is very important for all of the students. We study a language in order to use it in our life and work, and communicate with foreigners. At present, there are more and more foreign funded companies, and the students have more chance to go aboard. So that, they must be able to speak English in order to live more comfortably [1]. What's more, English speaking is kind of language technology, if the students master this kind of technology, it will become hard for them to forget, they will remember it all their life [2]. If the students want to speak English fluently, they have to practice a lot, and have more opportunity to be trained to speak English.

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## **58.2 The Problems that the Students are Facing in Speaking English**

At present, though all of the teachers and the students realize that it is important to improve the English speaking language, it is still hard for the teachers to use effective strategies to enhance the students English speaking, so that the students still find it is difficult for them to open their mouth to speak English. In English teaching, though we have listening and speaking class, most of the teachers believe that the students' major is not English, and the English speaking is not important for them [3]. What is more, there are only four English classes for the non-English major students to study, the time is limited, we have no time to practice speaking, because we have to train the students listening ability, so that the students can pass the CET 4 examination, As we all know, listening accounts for 35 % in the CET 4 examination. As a result, a lot of the teachers neglect the training to the students in the English speaking, the students still dare not open their mouth to speak English; of course, they can not use English freely. Though they have studied the English for several years, they still can not communicate with foreigners in English, because they seldom practice speaking before they come to the university, and when they are in the university, they still can not get the chance to be trained in English speaking, they do not have the initiative to improve it without the teachers guiding. In fact, if the teacher tried to train the students the speaking ability, they will improve it quickly, because most of the students have studied English for years, their reading English is good, and the sentences which the students speak are simple, not complicated. As we often use simple language to express ourselves. So it is necessary for the teacher to use all kinds of methods to improve their English speaking.

## **58.3 The Strategies to Improve the Students Oral English Speaking**

### ***58.3.1 Give the Students the Assignments to Write Articles and Check Them***

The teacher can ask the students to write articles, and the students must be familiar to these subjects. What is more, they must be interested to the subjects, so that the students can have a lot of things to write, and when they write, they will think it is not boring and difficult for them to express themselves; for example: My College Life, My Childhood, My best friends, How to Study English Well, and so on. Every week, the teacher can ask the students in the whole class to write the article on the same topic, each time, the topic should be different. The teacher can also ask the students to choose the topics that they are willing to write. Each time, the

teacher should use all kinds of methods to check if the students have finished. As most of the students do not have autonomous studying in English studying, if the teacher does not check the assignments, some of the students will not finish it. Sometimes, the teacher can check several students assignments; sometimes the teacher can ask all of the students to exchange their articles with their partners and correct them for each other, so that they will find it interesting to study English, and concentrate on the articles. As a result, their will have deep impression on the points that they have made mistakes, so that the students can help each other and improve together. Sometimes, teacher can correct some of the students' articles, the teacher can ask all of the students to hand over their articles, if the teacher has enough time, and he can correct all of them. Above all, the teacher must deal with the students' article with flexibility.

### ***58.3.2 Assign Some Students to Make a Speech Every Class and Check Them***

It is nature for the students to relax themselves when they think that have nothing to do, only some of the students can study actively without giving them the assignments. In class, if the teacher gives the students some tasks to finish, and the students will try their best to finish them. After the students have written the articles, the teacher should ask the students to make a speech on the subjects written. If the teacher ask all of the students to prepare the articles so as to make a speech, maybe none of the students will prepare it very well, that is to say, perhaps not one of the students can make the speech without looking at the articles which they write. So it is a good idea for the teacher to assign several students (five students or so) to prepare well, and they have to make the speeches in public next class, and the rest of the students have to write and prepare too, because the teacher will also choose one of the students to make the speech in public. As a result, all of the students will prepare for the speech. I have done this kinds of experiments in my class for years, the finding is: Most of the students who are assigned to make the speech can do it without looking at their articles. And all of the students can read their article in public. If every week, the teacher and the students do like that, the students' English speaking will improve, what is more, they will get the habit to study English gradually.

### ***58.3.3 Request the Students to Write Down Several Questions About the Topic and Then Talk***

If the students can write the articles and read them out, this is not to say that they can speak English. Speaking is different from writing and reading. If the students



want to communicate with foreigners in English, they must try to improve their English speaking language, and use all kinds of strategies to improve it. The teacher plays an important part in enhancing the students' oral English. And they should take measures to guide the students to practice speaking in class. It is often very hard for the students to open their mouth to speak. They do not know how to speak. First of all, the teacher can ask the students to write down five or six questions about the topics that they have just written. This is not difficult for them, they will find it easy to finish. Then ask the students to read the questions they have just written loudly until they are familiar with it. Finally, the teacher can ask the students to ask each other questions without looking at those questions, and answer them. So that the students will begin to open their mouth to speak English, which is very important for them to improve their oral language. Next time, the students will know how to speak English, their fearing emotion for speaking English will disappear. When the students know how to talk with their partners, it is not necessary for the teacher to ask them to write down the questions. After some students make the speeches, the teacher should guide them to talk on the subjects that they have prepared well. Then the teacher can ask some of the advanced students to act out in public, so as to set an example for the whole class. It is important for the teacher to take part in their conversation, which will help the students who still can not open their mouth, if the students can speak English frequently with their teachers, he will be encouraged a lot. Talking with the students can also improve the teacher's oral English.

## **58.4 Enhance the Students' Motivation to Speak English**

The motivation to study English is very important, if the students have the motivation, they will become more active and initiative, when they are studying, they will feel very happy, they will always be eager to study English, and they will be interested in studying what's more, they will feel powerful and energetic when they are studying. When the students are full of motivation, it will become easy for the students to improve the English.

### ***58.4.1 Guide the Students to be Confident to Improve Their English Speaking***

A lot of the college students can not speak English frequently, they often think that they do not have such ability, and they are weak in speaking English naturally, and they will not improve it no matter how hard they study. If the students have such opinion, they will not work hard on it. That is to say, they will not use all kinds of strategies, and catch every chance to improve their English oral language. As a result,

they will not improve it. In fact, speaking is not so difficult, if the students use the correct methods to practice, they will improve their oral language; because oral language is often made up with simple sentences, they need not use difficult and complicated sentences to explain themselves. What they need is the encouragement. So it is important for the teacher to tell their students that can speak English very well if they practice speaking it. If the students began to open their mouth to speak English, they have achieved half of the success.

#### ***58.4.2 Praise the Students When They Do It Well***

All of the students need the encouragement, if the students are encouraged, they will have more motivation to study. Because when the teacher often praises them, they will feel that they are respected, which is the most important at present. Being respected is everyone's essential need, which is described a lot in educational psychology. When the teacher praises them, they will feel happy and confident, and they will believe that their English is very good, even if their English is not very good; they will also believe that if they study hard in the future, they will achieve success; so that they will have power to study and work harder than before. In conclusion, the teacher's praise can give the students encouragement and inspiration, and let their behavior be better. So when the students do something well, the teacher should praise them, so as to urge the students to do it well. Of course, the teacher should try to find good reasons to praise the students, if the teacher praises the students for no good reason, which will not be effective. Every student has their advantage, so the teacher must watch and listen carefully while the students are making speeches and talking with each other. So that, the teacher can praise and encourage the students suitably, and the teacher should also say it with a smile and passion, so that the students will think they really do it well; so that, they will be encouraged and study hard. Of course, the teacher can not use the same words to praise them, he should use different kinds of language to tell out the students' advantages, and he should also judge them from different angles. For example: some of the students' pronunciation is very good, some of them speak loudly, some of them speak fluently, and some of them can write good articles, and so on. The teacher should judge the students shortly, just use one or two sentences; so as to save the time, and give more time to the students to practice, or the students will feel bored and disgusted.

As we all know, everyone has shortcomings, and everyone will not do something perfectly, so the teacher must be tolerant, and be sure not to pay more attention to the students' mistakes, try not to criticize them less. As a result, they will build good relationships with the teacher, be eager to follow the teacher's instruction, and have more initiative in English study.

### ***58.4.3 Urge all the Students to Support Each Other Emotionally and Learn from Each Other***

The students' support will also give the students power and encouragement to behavior well, so in the class, the teacher should ask all of the other students give applause to the one who is going to make the speech, when the students are going to act out, the teacher should also urge the other students to clap for them, so as to offer them their support. When the students are making a short conversation in public, the teacher should ask all of the students to keep silent and listen carefully, which is to show the respect for each other, and give each other good environment to act out. If the students can do like that, it will become easy for them to learn from each other. Because students' knowledge are close to each other, so it is easy for them to imitate from each other and improve their English speaking quickly. What's more, good students can also set all the other students good examples. That is to say, guiding the students to support each other will help all the students to enhance the oral language well.

## **58.5 Use Multi-Media to Help Them**

Multi-media are important for all of the students, they can help the students to pronounce well, offer them examples to imitate. The teacher can ask the students listen and follow, so as to imitate the pronunciation. And the teacher can also play the English song for the students to follow, and instructs the students to open their mouth to sing after it; teach the students sing English songs, then ask them sing the English songs together. The teacher can also play some parts of the interesting movies for the students to see the dialogue of the actors and the actresses. Let the students watch the real conversations. If the students feel hard to understand, the teacher should try to help them understand. The teacher can also ask the students to prepare well and act out some parts of the play in public of the class, so as to enhance the students' English oral language.

## **58.6 Conclusion**

Thought decides our behavior, though the students' oral English is not very good, and they find it very hard to enhance their speaking. If we trust us and our students, make determination to try our best to help the students, make up our minds to improve our teaching methods, then use our heads, think about all kinds of ways to train the students, use different kinds of strategies to improve the students oral language, instruct them to organize all types of English activities; guide them to take part in the English corner in the campus, they will speak English fluently sooner or later.

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# Chapter 59

## Improved Teaching Scheme Based on Communicative Approach

Wen Zhou

**Abstract** The Communicative Approach was produced in the early 1970s and was accepted by the majority of English teachers, which also played a leading role in English teaching. After introducing into China, the Communicative Approach was widely accepted. In particular, it played a very important role in the teaching of English vocabulary, oral, and reading teaching.

**Keywords** Communicative approach · English teaching · Teaching theory

### 59.1 The Theoretical Basis in a Communicative Approach

Communicative Approach is a language featured project, with emphasis on cultivating interpersonal skills. Its purpose is to improve the communicative competence of language learners, so that the four skills in language learning: listening, speaking, reading, and writing are to be further developed. Undeniably [1], the Communicative Approach is an effective way that trains students' language ability, so in the early 1980s, China's famous scholars such as Hu Wenzhong, spreaded communicative teaching approach to China, and occupied an important field of foreign language teaching in China status [2]. According to the new College English Curriculum Requirements, the purpose of college English teaching is to develop students' ability to use English, especially listening and speaking, so that students can use English effectively in oral and written information exchange.

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Communicative Approach is to adapt the new course requirements of college English teaching requirements, in particular, has played a positive role in promoting the college oral English teaching level, to improve students' oral proficiency.

Linguistic theoretical basis of the Communicative Approach:

Hymes theory of communicative competence of Communicative Approach. In 1972, Hymes published an article entitled "On communicative competence"; he proposed that communicative competence consists of the following four parts: the form of the possibility; to implement to fulfill the possibility; depending on the context whether it is appropriate; and whether in fact completed. Four parts, including language skills and grammar, included the feasibility and appropriateness. His communicative competence theory provides a theoretical basis for the later Communicative Approach in English teaching.

Canale and Swain theory of communicative competence, the early 1980s, the theory of communicative competence in Canale and Swain enriched Hymes's communicative competence doctrine [3, 4]. They believe that the communicative competence comprises: grammatical competence, social language skills, discourse competence, and strategic competence. Practice has proved that the doctrine of their interpersonal skills is the guidance of language teaching and testing of programmatic and instructional standards.

In early twentieth century, Buckman on the basis of previous doctrine put forward the doctrine of communicative language ability. He believes that communicative language ability is composed of three parts; namely language skills, strategic ability, and psychological mechanisms. He made it systematically. Finally, he believes that psychological mechanism included the communicative language ability. In addition to enriching the elaboration of communicative competence in language skills, he produced strategic competence as an independent part of the language ability to deal with, and the relative importance of implementation factors.

## 59.2 Communicative Approach in English Teaching

Vocabulary is the key to language learning, neither words nor language. Therefore, vocabulary learning is a prerequisite for students to learn English. Issued by the State University English teaching requirements, the students after 2 years of study at the University should be asked to master the 4,500 words and 700 phrases. In the actual study, students were generally reflected the large amount of vocabulary, usage, lack of regularity, although they spend a lot of time to memorize the words, but had little effect. Therefore, study about how to learn vocabulary and how to improve the learners' vocabulary has great significance, that is also the problem what teachers and scholars urgently need to address.

Vocabulary learning is a long-term process of accumulation; only through classroom learning is not enough. Mastery of the vocabulary and the vocabulary of

the students inevitably have individual differences; a unified vocabulary teaching is difficult to meet the students' own needs. Thus, training the students' independent learning ability, culturing vocabulary learning strategies are the key to solve the problem. The arrangements for this kind of teaching students learn independently, and in accordance with individual differences to select the articles of moderate difficulty, monitoring and evaluation through classroom report, the independent learning ability to help students to achieve the transition to independent learning to rely on teachers. Its uniqueness lies in that the students can choose a certain range of vocabulary learning, more appropriate to their existing level of learning. This also conforms to the current knowledge economy on the talents of the demand—the cultivation of independent innovation capability. Due to scientific and technological progress has brought the rapid update of the knowledge, the challenges faced by the students are no longer just how much knowledge is important but also to have independent access to the ability to update their knowledge, independent thinking, and innovation skills.

The vocabulary teaching is a complex process of teaching, it includes the specific problems of vocabulary teaching ideas, methods, and skills. Teaching purposes, students of different ages, with teaching materials vary. The theory of communicative teaching with the new outline and the emergence of new teaching materials have been available to an increasing number of foreign language teachers to understand and accept. Communicative Approach is the majority of foreign language teachers consciously applied to teaching practice, but also withstood the test of practice of teaching. As teaching vocabulary and language use of teachers teaching in vocabulary combination of classroom arrangements are flexible, learners experience and gradually master the vocabulary, we must not only ensure the basics of learning and consolidation in the plot or scene locale, but also to ensure the needs of the students' language skills training and communication activities.

## **59.3 Communicative Approaches in Oral English Teaching**

### ***59.3.1 Pair Work***

Two activities are to train students to flawless state, and the appropriate exchange of a teaching and learning activities r, there are three main forms: one is the open pair with another student, a student in the arrangement of teachers in the classroom engage in a dialog that the other is close pair, that is, at the same table activities, both dialog the third called flexible pair (free combination), this pair work will make the activities more interesting, because the students are free to choose partners of these three forms, the pair can work the use of oral teaching activities at different stages in the oral classroom, teachers should be flexible and appropriately

use of these three forms, for teaching Communicative Admittedly, in the process of the two activities, the teacher first, to play a supervisory role, pay attention to the dialog of different sent teams, to pay attention to the mistakes of students, generally do not interrupt the two men talk, serious errors should be pointed out in the session after the event or before the start of the next class and to attract attention, repeatedly practicing two is to play the role of troubleshooting who provide help and feedback.

### ***59.3.2 Group Work***

Group activities, language communication activities to promote language acquisition, and effective means of group activities can reduce the anxiety students may have to participate in language communication activities, so that they show greater enthusiasm for learning and creativity. In addition, the group of students is aware of the aspects that the interaction between the students coordinate flexible combination with the participation of teachers is no longer indicative intervention, but arbitrary and irregular access; it will be limited to conversation rather than to teach the resulting language and can be for the acquisition of useful materials that are necessary but active in group activities, does not mean the teacher's role can be reduced, do a good job in the group activities, the key lies in the leading role of the teacher teaching experience informed.

### ***59.3.3 Role Play***

To Use the Communicative Approach to spoken language classroom, role-playing activity is of use. Role-playing activities are often composed of several short plots; the plots can be realistic, the most basic requirement of virtual role-playing is to use virtual character interpretation, improvisation of role-playing can be very simple, their improvisation by the high degree of control is usually a role-playing drama scenario role and vocabulary of students performing scenario consists of three parts in specific operations where teachers should explain in detail the scenario because the students always in a certain sociolinguistic scenario, the language form will vary depending on the context changes its meaning and the discourse unit that contains a form of language that must be consistent with the social situations they use only for the people to accept any oral or written information expression of the form of tone and be acceptable to a large extent depending on linguistic factors outside so the teacher must try to provide students and to create true realistic verbal communication scenarios for the role of student regulations and introduced some of the background of the role, students left the room for free play in order to arise students' curiosity and increase their interest in learning, and promote the aspirations of English Communication.



### ***59.3.4 Topic Discussion***

Any student interested in things that can become the topic of speaking practice, for example, the matter of public concern is a good public topic, interesting topics make it possible to discuss the persistence of this discussion activities at any time, the duration of the coin and the interest given topic of discussion is a better way to train students' coherent skills; the aim is to allow students the different stages of knowledge, logical thinking, or thinking in images. A comprehensive analysis processing, the form of speech or report the idea expressed on the classroom between teachers and students, between students and students of mutual understanding, mutual trust and harmonious relationship, and this is to mobilize students' enthusiasm, initiative and creative is an important factor in the form of discussion of the class can be divided into three categories: verbal notice, or a small report and learned feature-related content and information; the scalability conversation informed of the outline of students by teachers in advance to talk; debate around teacher scalability issues raised by the debate on class as a teaching organization form can be divided into three stages: the first phase of a prepared statement the students according to teachers in selected topics, and fully prepared; The second stage is half intend to speak at this stage, teachers still need to discuss the subject of advance, then the speech is written in outline when students have access to the basic continuity of language ability before use; The third stage is an impromptu speech that teacher before the class discussion without having to plan to inform students only need to grasp the thematic content and information on basic vocabulary and language means of expression, access to information in connection with the topic to expand horizons, to discuss and express their views according to the specific circumstances of the students in these three phases combined; part of the problem in advance by students to prepare to stay one or two questions allow students to carry out semi-ready to speak in the class or in an unscripted, teachers may at any time according to student feedback, timely adjustment of the next class teaching teachers to guide the students in the class discussion do not deviate from the topic, and timely that the students in the language to express terms of error, the final seminar make a summary of new tasks and requirements in order to make class discussion more effectively on those psychological qualities, study hard enough self-confidence of students, teachers were presented to them than the simple question, according to the specific circumstances of the students, to attract participate in the discussion.

If properly organized to discuss the lesson is to train students to the development of language skills. Thinking ability to work independently to carry out the implementation of an effective Communicative Approach to teaching activities. With China's reform and opening up a comprehensive and in-depth, the greater the opportunity to use English to communicate at work requirements to the more skilled use of English to complete communicative tasks students will become the leader in the Communicative Approach in the future work is precisely this objective, the classroom social and real, so that students gradually formed in the

classroom and developed the ability to solve problems and completed tasks, especially in the office of student use of language, the knowledge they have learned has a very strong professional and purposeful communicative teaching method that is a chance to study the knowledge of English, but also to students work to bring a good way to help, and teachers should be based on the status of the students, by flexible use of the Communicative Approach. I believe that with the joint efforts of the teachers and students, we can surely advance Communicative Approach to the top.

## **59.4 Occasion of Teaching in English Reading Class**

Communicative Approach is not a traditional language teaching method, it is carried out around a series of activities to develop students' communicative competence and spoken in the real scene and context, student-centered classroom teaching, group discussion or dialog based, fun activities to mobilize the enthusiasm of the students, and create the opportunities and occasions of the use of a second language to students, increasing the opportunity to practice. In English reading class, the Communicative Approach six use:

### ***59.4.1 Interested in Learning***

Interest is the best incentive to learning is also an important factor in learning, teaching the key to success. Before the beginning of the reading class, the teacher can give students a read articles related to topics for student discussion and reflection, on the one hand, to mobilize students to mention interest in learning, on the one hand, you can review previously learned knowledge, greater interest by students on textbooks. They learn better.

### ***59.4.2 Access to Relevant Background Information***

Every article has a different background knowledge, and to expand your knowledge students should develop the habits of the preview before class as much as possible to consult the relevant background information to understand the relevant background knowledge, of course, it requires students to their own independent completed, so that students can broadly read the article, there is an emotional understanding of a certain awareness of unfamiliar words and phrases, classroom also not be too difficult to accept.

### ***59.4.3 Develop Students' Ability to Guess the Word***

Above said, the words are a stumbling block to hinder students' understanding of the intent of this chapter. There are major problems in vocabulary, reading, and are unlikely to encounter a new word to the dictionary, so to pass the context to guess the meaning of the word, which is a very important reading skill, but also can help students' profound understanding and memorizing vocabulary, after the expansion of reading will certainly help.

### ***59.4.4 Reading***

The reading is in order to obtain information, reading teacher to the students staged a number of tasks to ask some questions to enable students to read with these issues, so students would not be read aimlessly, but according to the teacher. Problem to obtain the information you need to know when reading, the teacher can read after the end of the form of questions to understand the students' understanding and appropriate given the supplement.

### ***59.4.5 The Classroom Discussion of Class***

Communicative teaching to emphasize that the language of communication and practical application, in order to strengthen the students have learned in reading class, you can take students to vote to select one to discuss the title and text from multiple alternative grouping discussions and oral reports, real-time exercise and strengthen students' speaking ability to cope with the end of the discussion, let students discuss the problems raised by the teacher to resolve the issue and summarize the students' logical thinking ability is also a good exercise.

### ***59.4.6 Homework***

Language learning for practical use is to achieve the purpose of the fluent exchange with people. To foster students' awareness of a second language to communicate with people, the layout of the actual reading and communication tasks.

## **59.5 The Inadequacies of Six Interpersonal Teaching English Teaching in China**

In late 1970s, many scholars tried to be the introduction of the Communicative Approach to China, because no comprehensive system to introduce the Communicative Approach, just published their views in some special, so making it on the Communicative Approach was full of confusion and puzzled. Therefore, in the process of understanding and acceptance of the Communicative Approach, there are some problems:

### ***59.5.1 For the Misunderstanding of the True Communicative Approach***

Teachers and scholars that “weak” to say as the whole of the Communicative Approach. They believe that the Communicative Approach to prepare for future communication activities, so they will concentrate on the structure of language teaching for students to see it as important as the communicative function.

### ***59.5.2 It Will Be Teaching as a Method***

The Communicative Approach is only a teaching method, or just a theory, rather than specific real teachings. But in China, many teachers see it as specific teaching methods. So, in the classroom, they just drill the students and said this is the Communicative Approach.

### ***59.5.3 Communicative and Teaching Reality***

The Communicative Approach to the subject is training the students’ communicative ability. Language and communication skills through the communication can be mastered and received. But students’ environment living in China is not formed in their mind about the atmosphere of English communication. This did not reach the ideal of Communicative Approach the object and purpose.

### ***59.5.4 The Teacher Problems***

Communicative Approach came to China only a short period of 10 years and it is still in a learning study period. Many teachers on communicative teaching

approach still do not understand. In fact, the Communicative Approach requires teachers a good organizer and guide, fully readymade at any time by the students cannot predicted. Before the end of the lesson, the teacher must be the language activities for students in the classroom. English teachers in China's own conditions, especially those in the rural English teachers are not enough in the process of applying the target language communicative competence; they cannot handle emergencies on the classroom, and therefore cannot play as well the role of a classroom organizer. Furthermore, subject to the intellectual level of the difference between the trained teachers, they are able to understand the nature of the Communicative Approach and proficient in the target language and language teaching art teachers are few and these are the fatal problems hinder the smooth application of the Communicative Approach.

### ***59.5.5 Test System Problems***

Communicative Approach aimed at training students' communicative ability, so we need to have communicative tests. Unfortunately, there is currently no way to test specifically for the students' communicative competence. The foreign language curriculum is to help students acquire communicative competence, but we only test students for grammar mastery, and the Communicative Approach The purpose of contradiction. Therefore, the current test extremely has large negative impact on our foreign language teaching.

### ***59.5.6 Decision Problem***

They must be systematic and comprehensive understanding of the Communicative Approach. If people can well understand this approach, they do not have this abstract theory as specific teaching methods. Second, we must take a variety of teaching methods to adapt to China's reality. As the saying goes: "there are many teaching methods, but is not fixed." Communicative Approach is only a teaching method in theory, it sometimes cannot really adapt to the reality, as an English teacher, to form our own unique teaching methods, to meet our unique practical, to improve our students' communicative ability is a basic key to solving all the problems. Again, the teachers and students should change their respective roles. As a student, he must shift from a passive listener into an active participant; as a teacher, he must be transformed into knowledge for classroom organizers. For teachers, it is more urgent. What they should do is to be trained to improve the organizational capacity of language skills and language materials and teaching. We should change the teacher-centered, while the shift to student-centered teaching. Finally, we should change the test system. We test for the means test students' communicative competence, to the main objective of our language

courses. Therefore, we should establish a communicative competence Location Test System to replace the traditional test. The new test system should be measured under realistic conditions Abstract: the Communicative Approach in the early 1970s. It introduced into China after the widely popular, and occupied a place in the field of English teaching. the article focuses on the essence of the Communicative Approach in English Teaching problems and proposed solution.

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# Chapter 60

## Exploring Bilingual Uyghur–Chinese Students’ Use of Language Inside and Outside School

Huaying Chen, Anniwar Rozy, Dilnur Abliz and Renaguli Muharemu

**Abstract** This paper examines language use inside and outside school of Uyghur students from the middle schools for both Han and ethnic minorities in Urumqi, Xinjiang, China. A total of 341 Uyghur students between 12 and 15 years of age, attending three middle schools for both Han and ethnic minorities in Urumqi, responded to questionnaires requesting information about their language backgrounds, their use of language at school (inside and out of classroom) and in the wider community, their self-perceptions about their linguistic competence in Uyghur and in Chinese, and their attitudes toward Uyghur, Chinese and toward bilingualism. The results, in general, demonstrate a positive attitude toward bilingualism, and there is a trend toward favoring the use of Chinese both inside and outside school. This pattern is mediated by language experiences and perceived language abilities within the individual. The implications of the findings for language policy and planning in education are discussed.

**Keywords** Language use · Language attitude · Uyghur · Bilingualism

### 60.1 Introduction

There are over 20 ethnic minorities, among which, Uyghur has the largest population, in Xinjiang, China. Both Chinese and Uyghur are the official languages used in the region. In the past 20 or so years, minority language—Chinese bilingual education for ethnic minority students has been greatly enhanced here.

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The new type of school, that is, one school for both Han and ethnic minorities has been established in recent years, whose purpose is to conduct bilingual education, to improve the quality of education in ethnic areas, and to promote the common development of all ethnic people.

Previous studies show that one of the current challenges confronting bilingual education has to do with children's reluctance to transfer their school-based L2 (second language) linguistic knowledge into the wider social domain. Children often revert to the comfort of their L1 (first language) at home and in peer–peer interactions. Such practices may have long-term effects on children's ultimate linguistic achievements and may inadvertently influence the potential success of bilingual education at school. This paper addresses these concerns by examining the extent to which the middle schools for both Han and ethnic minority students in Urumqi are successful at transmitting the second language—Chinese to the ethnic minority students and by exploring the factors that influence bilingual students' language use inside and outside school.

While it is clear that bilingual education, in its multiple forms, can and does lead to successful outcome [1, 2], the definition of 'success' is often limited to the sociopolitical climate of the school/area/language(s) of interest and to the patterns of dominant relations between the two languages [3, 4].

Since education establishments are at the heart of language planning initiatives, they have a clear role to play, in terms of both language development and language maintenance. Yet, preschool education, schools, and colleges cannot achieve these goals by themselves. Success of bilingual education is dependent on three core components: (1) intrapersonal factors; (2) educational experiences; and (3) interpersonal engagements involving the individual, the school, and the wider social community.

Bilinguals are by definition a heterogeneous group [5, 6]. This heterogeneity results from differences in linguistic experience—including differences in patterns, age, and frequency of exposure—that give rise to varying levels of linguistic achievements and different kinds of attitudes and motivation, and leads to different levels of confidence in relation to each language within the individual [7, 8].

Second language education is often 'challenged by contextual factors' [9], including factors involving the quality of the education—teachers, curriculum, materials, and provision—and opportunities to use the language in various contexts and with various individuals.

## **60.2 Methodology**

### **60.2.1 Schools**

Three middle schools (Nos. 67, 58, and 15) situated in the city of Urumqi, Xinjiang, China, are chosen. The three schools are all middle schools merged together in recent years by original schools for Han students and schools for ethnic



minority students. Most of the ethnic minority students in these schools are Uyghur (with Uyghur as their L1). The questionnaires filled in by ethnic minority students who are not Uyghur are sorted out and are not included in the analysis of the study.

The models for bilingual education for ethnic minority students in this kind of school in Urumqi are divided into three types; and the curriculum is different for each type. The first type is set up for Min Kao Han (MKH) students (who will take part in College Entrance Examination using Chinese when they graduate from middle school), whose curriculum is the same as the national common type for Han students, and the dominant instruction language is Chinese. The second type is set up for Min Kao Min (MHM) students (who will take part in College Entrance Examination using their mother tongue), whose curriculum is nearly the same as MKH students' but with the difference in that only three main courses (Chinese, math and English) are taught in Chinese, and the dominant instruction language of other courses is Uyghur. The last type is set up for Shuang Yu Ban (SYB) meaning Bilingual Class students (who will take part in a special version of College Entrance Examination using Chinese); as a particular group receiving bilingual education, SYB students are different from MKH students and MHM students in terms of curriculum and instruction language. Besides the regular curriculum, there are some extra hours for Chinese course for SYB students to improve their Chinese. Although they were educated in their mother tongue in primary school, the dominant instruction language of all courses is Chinese when they come to junior middle school. SYB model is supposed to be the new model of bilingual education for ethnic minority students in Urumqi.

### 60.2.2 Participants

In order to obtain a representative sample, altogether ten classes including the three educational types in the three middle schools were chosen. A total of 341 Uyghur students between the ages of 12 and 15 receiving junior middle school education took part in the study. The number of participants in the three groups of educational types is shown in Table 60.1.

### 60.2.3 Questionnaire

One structured questionnaire, based loosely on Baker [1], is piloted and formed. The questionnaire was divided into various sections including: (1) language use in

**Table 60.1** The number of participants in the three group

	MKH	MKM	SYB
Male	35	93	25
Female	45	117	26
Total	80	210	51

the family; (2) language use in the community; (3) language use at school (with staff and other classmates, in class and outside class); and (4) attitudes toward Uyghur, Chinese and bilingualism. The questions were all worded in people-friendly prose and involved mostly tick-box responses.

### ***60.2.4 Procedure***

The students of different classes were taken to their classrooms in their schools, where the first researcher introduced herself and explained her visit. Uyghur students filled in the Chinese version of the questionnaire. The researcher worked through the first question with the students to ensure they all knew what they were meant to do. Thereafter, the students progressed through the remainder of the questionnaire at their own pace, with support from the researcher as and when required.

## **60.3 Results**

### ***60.3.1 Use of Language at Home***

From Table 60.2 it can be seen that the language used at home is predominantly Uyghur, and when talking with brothers and sisters, the proportion of the use of mixing Uyghur with Chinese is much higher than with elder members of the family.

### ***60.3.2 Use of Language Within School***

Responses to the questionnaire reveal some interesting patterns in terms of language use within the school (Table 60.3). First, the highest proportion of language

**Table 60.2** Degree of language use at home

	Uyghur (%)	Mixing Uyghur and Chinese (%)	Chinese (%)
With parents	83.9	9.7	1
With grand parents	96.4	3.6	0
With brothers and sisters	55.6	39.3	5.1
With other relatives	84.2	14.8	1

use with teachers both in class and outside class is Chinese. Second, the highest proportion of language use with peers in class is Chinese, but outside class with peers the highest proportion of language use is mixing Uyghur and Chinese. Third, the proportion of use of Chinese in peer–peer conversations at school is lower than that with the teachers. Fourth, the use of Chinese is markedly lower outside class than in class among peers. Finally, there is a clear trend among the bilingual Uyghur-Chinese students to turn to the use of Chinese over Uyghur at school.

### 60.3.3 Linguistic Skills and Attitudes

When asked which language they feel speaking most comfortably (Table 60.4), mixing Uyghur and Chinese has the highest proportion, with Uyghur higher than Chinese.

In response to the question asking which language they want to learn (Table 60.5), both Uyghur and Chinese are preferred with the highest proportion among the choices.

When asked whether it is necessary to promote bilingual education in schools in Xinjiang (Table 60.6), the overwhelming majority of the students have positive attitude toward bilingual education.

In summary, the students are supportive of Uyghur–Chinese bilingualism, but some students lack the necessary confidence in using Chinese, which is a cause for concern.

### 60.3.4 Social Use of Language Outside School

Unsurprisingly, it seems more likely that the students use Chinese in dealing with government agencies and banks, and going to cinema. This may be due to the likelihood of having Chinese-speaking staff and the common language of Chinese used in those places (Table 60.7).

**Table 60.3** Degree of language use at school

	Uyghur (%)	Mixing Uyghur and Chinese (%)	Chinese (%)
With teachers in class	1	2	96.9
With teachers outside class	0.5	1.5	98
With peers in class	1.5	6.1	92.3
With peers outside class	15.3	64.5	20.2

**Table 60.4** The most comfortable language

Uyghur (%)	Mixing Uyghur and Chinese (%)	Chinese (%)
38.8	39.8	21.4

**Table 60.5** The language wanted to learn

Uyghur (%)	Chinese (%)	Both Uyghur and Chinese (%)	English (%)	Other (%)
6.1	25.0	32.1	30.6	6.2

**Table 60.6** Attitudes toward bilingual education

Very necessary (%)	Necessary (%)	It does not matter (%)	Unnecessary (%)	Very unnecessary (%)
70.4	17.3	8.7	2.6	1.0

**Table 60.7** Degree of language use outside school

Place (%)	Uyghur (%)	Mixing Uyghur and Chinese (%)	Chinese (%)
Government agencies	5.6	17.9	76.5
Bank	12.8	19.4	67.9
Cinema	14.3	27.6	58.2
Shop	32.1	54.6	13.3
Restaurant	53.1	32.7	14.3
Hospital	22.4	57.1	20.4

The students use more Uyghur than Chinese in social places of shops, restaurants, and hospitals where the situations likely associate within group and informal activities.

## 60.4 Discussion

The purpose of this study is to identify the factors that influence current patterns of language used among middle school students inside and out of school. The results identify different patterns of use in various contexts, highlighting a number of implications, as discussed below.

### ***60.4.1 Chinese Transmission at School***

The typical teacher–students/students–teacher interaction in class is Chinese, providing L2 speakers with at least some opportunity to converse in Chinese for a substantial portion of the day. We can thus say, in so far as classroom-based transmission is concerned, that the bilingual education policy is largely a success at these schools. However, the extent to which the nature of the teacher–students/students–teacher interaction enhances the students’ competence, confidence, and subsequent use of Chinese needs further investigation [2].

### ***60.4.2 Use of Chinese Among Peers***

Although the majority of students tend to use Chinese with their peers in class, peer–peer outside class at school interactions highlight a trend of the use of mixing Uyghur and Chinese. What may account for the pattern? (1) The use of Chinese at school (and outside) is influenced not only by the students’ own mother tongue but also by the availability of a ‘critical mass’ of peers who share the very same background of language experience. (2) It is clear that some students lack confidence in their own abilities to speak Chinese.

In order to encourage the use of L2—Chinese, schools need to increase students’ awareness of the similarities and differences between Uyghur and Chinese, from an early age, so that they learn about Chinese through their existing knowledge of L1—Uyghur. Further research will be able to identify best practice in this regard.

In many ways, the results of this study are consistent with the findings from other situations [3, 4] and highlight the need to monitor students’ use of L2 in their social activities and in the controlled classroom setting.

## **60.5 Conclusion**

Bilingual education in Urumqi is successful so far as the students are involved in classrooms where Chinese is being transmitted, and in so far as the students are generally supportive toward bilingualism. Yet, input of this kind does not necessarily guarantee output. The shift from passive to active engagement with the language in all walks of life can only be achieved through careful curriculum planning, and only if education policy is supported by the wider social contexts.

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**Part VII**  
**Knowledge Management Engineering**

# Chapter 61

## Study of Phosphorus Removal Efficiency in Enhanced Biological Phosphorus Removal Process

Yanhui Ge, Lin Zhao, Ruochun Zhang and Jiayi Chen

**Abstract** An enhanced biological phosphorus removal (EBPR) system was developed in sequencing batch reactor (SBR) using acetate as the carbon source. The SBR was operated for over 2 months. Excellent phosphorus removal performance and stability were maintained in this system, where the phosphorous concentration in the effluent was below 0.6 mg/L. The Nile Blue staining was more specific than the Sudan black staining for the PHB. The DAPI staining and the Neisser staining for the poly-P were proper than other staining methods. SBR operation state after 2 months of start-up was stable.

**Keywords** Enhanced biological phosphorus removal · Phosphorus removal efficiency · Sequencing batch reactor

### 61.1 Introduction

Removal of phosphorus from effluents by biological processes is necessary to control one of the most important problems in receiving waters: eutrophication [1]. Enhanced biological phosphorus removal (EBPR) is the most economical and sustainable process to remove phosphorus from wastewater [2, 3]. In the activated sludge process, a group of bacteria known as polyphosphate accumulating organisms (PAOs) is prime important for EBPR systems through alternating anaerobic and aerobic conditions.

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Under anaerobic conditions, PAOs take up volatile fatty acids (VFAs) and store them as polyhydroxyalkanoates (PHAs). PAOs primarily produce polyhydroxybutyrate (PHB) when acetate is used as the sole carbon source [4, 5]. The energy for this process is obtained partly from the glycogen utilization but mostly from the hydrolysis of the intracellular stored polyphosphate (poly-P), resulting in an orthophosphate release into solution. In the subsequent aerobic phase, PAOs use the stored PHA as the carbon and energy sources for biomass growth and take up excessive amounts of orthophosphate to synthesize the intracellular polyP. Net phosphorus is removed from the system through the wastage of excess sludge [6, 7].

In this work, the study aims to investigate the response of EBPR sludge in a sequencing batch reactor (SBR) operated under anaerobic–aerobic conditions to acetate as carbon sources. The fate of the significant parameters involved in EBPR mechanism was studied to evaluate the process performance [8].

## 61.2 Materials and Methods

### 61.2.1 Reactor Setup and Operation

A SBR used in this study a working volume of 8 L. The cycle time was 8 h consisting of a 2 min filling period, a 120 min anaerobic period, a 240 min aerobic period with 13 min settle/decant period, and a 105 min anaerobic idle period. The amounts of filling and withdrawing were 3L each, resulting in a hydraulic retention time (HRT) of 21 h. At the end of aerobic period, 400 mL of excess sludge was wasted per day, ensuring a sludge retention time (SRT) of 20 days. The dissolved oxygen (DO) concentration was maintained above 4.0 mg/L throughout the aerobic phase. The reactor was operated in a temperature controlled room at 20–25 °C. The reactor was operated for over 2 months.

### 61.2.2 Synthetic Wastewater

The composition of the synthetic wastewater per liter was as follows: 0.683 g  $\text{CH}_3\text{COONa}\cdot 3\text{H}_2\text{O}$ , 0.087 g  $\text{KH}_2\text{PO}_4$ , 0.076 g  $\text{NH}_4\text{Cl}$ , 0.011 g  $\text{CaCl}_2\cdot 2\text{H}_2\text{O}$ , 0.035 g  $\text{MgCl}_2$ , 0.001 g yeast extract, 0.005 g allylthiourea (ATU) to inhibit nitrification and 0.3 mL of a trace metals solution. The trace metals solution consisted of the following compounds each liter of what: 1.5 g of  $\text{FeCl}_3\cdot 6\text{H}_2\text{O}$ , 0.15 g of  $\text{H}_3\text{BO}_3$ , 0.03 g of  $\text{CuSO}_4\cdot 5\text{H}_2\text{O}$ , 0.18 g of KI, 0.12 g of  $\text{MnCl}_2\cdot 4\text{H}_2\text{O}$ , 0.06 g of  $\text{Na}_2\text{MoO}_4\cdot 2\text{H}_2\text{O}$ , 0.12 g of  $\text{ZnSO}_4\cdot 7\text{H}_2\text{O}$ , 0.15 g of  $\text{CoCl}_2\cdot 6\text{H}_2\text{O}$ , and 10 g of ethylenediamine tetra-acetic acid (EDTA). The pH of the synthetic wastewater was about  $7.0 \pm 0.2$ .

### 61.2.3 Sampling

Water samples and mixed liquor activated sludge were collected at the end of aerobic and anaerobic periods.

### 61.2.4 Analytical Procedures

Mixed liquor suspended solids (MLSS), mixed liquor volatile suspended solids (MLVSS), the settled sludge volume (SV), and the sludge volume index (SVI) were analyzed according to standard methods 2540B, 2540E, 2710C and 2710D, respectively [9]. Samples were filtered through 0.45  $\mu\text{m}$  membrane filter for the analyses of phosphate ( $\text{PO}_4\text{-P}$ ) and DOC.  $\text{PO}_4\text{-P}$  and DOC in the samples was measured by ICP-OES (VISTA-MPX CCD Simultaneous, Varian, USA) and a TOC analyzer (vario TOC CUBE, elemental, Germany), respectively. The freeze dried and weighted of biomass samples were analyzed for polyhydroxybutyrate. The PHB was determined by Gas Chromatography (GC, CP3800, Varian, USA) according to a modification of the method of Pijuan et al. [10].

The staining methods used for poly-P polymer are Neisser and DAPI stain. The staining methods used for PHB granule detection are Nile Blue and Sudan Black stain.

## 61.3 Results and Discussion

The batch experiments were performed after 2 months of SBR operation. The MLSS and SVI profiles are shown in Table 61.1. The MLSS in the samples were on average 2280 mg/L with a (MLVSS/MLSS) ratio of 0.75 at the end of the aerobic period. Sludge volume index, determined after 30 min settling in a 100 mL graduated cylinder, averaged 93 mL/g MLSS. The data were ranged in the urban sewage treatment standards [11], implying that the SBR reached steady state after 2 months of operation. SVI formula is shown as follow:

$$\text{SVI}(\text{mL/g}) = \frac{\text{SV}(\text{mL/L}) \times 1000}{\text{MLSS}(\text{mg/L})} \quad (61.1)$$

Quantificational sodium acetate and potassium dihydrogen phosphate were added to the reactor, resulting in an acetate concentration of 120 mg C/L and in a phosphate concentration of 20 mg/L. During anoxic zone of acetate-fed reactor DOC was converted into biomass PHB, averaged at 30.7 % of sludge dry weight. Biomass phosphorus was released into solution, thereby quantity of phosphorous was significantly increased (Table 61.2). In the subsequent oxic zone biomass, PHB was rapidly consumed and aqueous phosphorus was incorporated

**Table 61.1** Performance index of active sludge

Sample	SV (%)	MLSS (mg/L)	MLVSS (mg/L)	MLVSS/MLSS	SVI (mL/g)	PHB (%)
1	20	2,270	1,720	0.76	88	27.5
2	23	2,330	1,750	0.75	98	37.8
3	21	2,310	1,690	0.73	91	26.9
4	21	2,200	1,650	0.75	96	30.5
Average	21	2,280	1,700	0.75	93	30.7

**Table 61.2** The SBR performance

Sample	DOC mg C/L		DOC removal rate (%)	PO43-P mg P/L		Phosphorus removal rate (%)
	Anaerobic end	Aerobic end		Anaerobic end	Aerobic end	
1	42.5	8.6	92.8	50.3	0.56	97.2
2	39.3	7.9	93.4	52.8	0.64	96.8
3	34.9	7.2	94	48.6	0.55	97.2
4	32.2	7.8	93.5	50.7	0.48	97.6
Average	37.2	7.9	93.4	50.6	0.56	97.2

into biomass. Results of Panswad [12] indicated that increasing the P: DOC feeding ratio could significantly stimulate the growth of PAOs and increasing of phosphorus removal rate. The phosphorus removal rate formula is shown as follow:

$$W = 100\% \times (A_1 - A_2)/A_1 \quad (61.2)$$

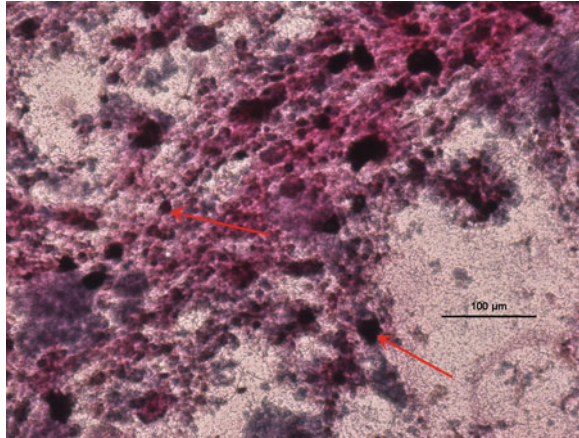
$A_1$  -phosphorus content in influent water (mg/L)

$A_2$  -phosphorus content in effluent water (mg/L)

Generally, the longer the SRT, the higher the biomass concentration in the reactor. Chua et al. [13] showed in their study that the MLSS in the SBR with an SRT of 3 days were around 700 mg/L, whereas it was around 2,500 mg/L in the SBR with an SRT of 10 days. This might have led to the higher PHA production capability of activated sludge in the first mentioned SBR of two. In addition, activated sludge process with longer SRT normally contains higher amount of inert biomass and this might contribute to the lower PHA content in the SBR. Van Aalst-van Leeuwen et al. [14] observed that faster growing organisms accumulated less PHB. Further study should focus on the impact of SRT on phosphorus removal efficiency and the content of inclusions in the PAOs.

Staining methods are important in supporting culture-independent methods for the description of EBPR biomass composition. In an anaerobic EBPR, biomass able to accumulate large amount of PHB and the characteristic positive reaction of the Sudan black method is a black-blue granule in a clear or light pink background (Fig. 61.1). The specific fluorescence of stained PHA granules with Nile Blue is

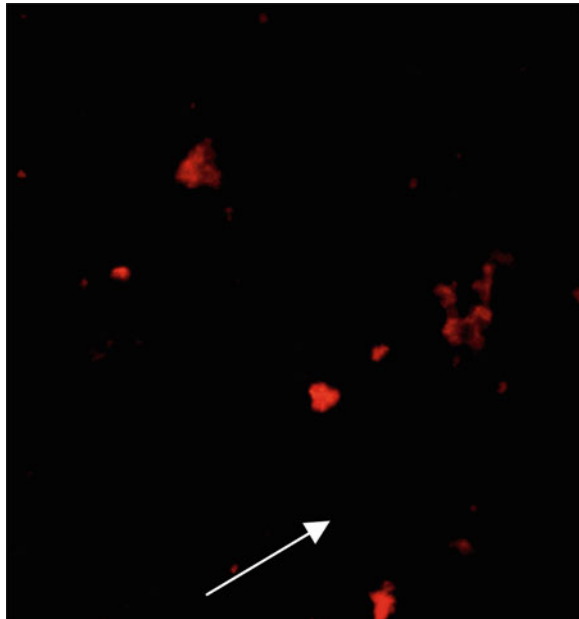
**Fig. 61.1** EBPR sludge, end of anaerobiosis, Sudan black staining



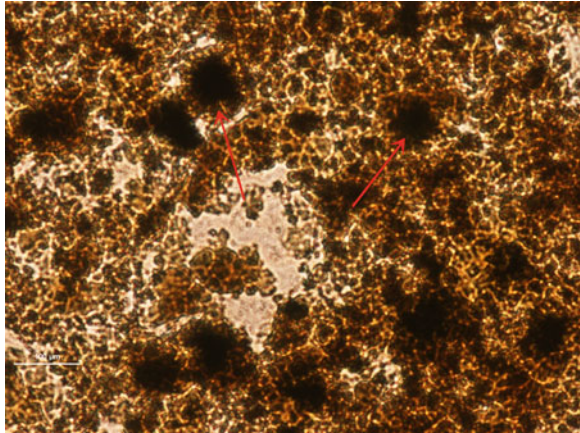
visible with excitation wavelengths of both 460 and 546 nm. Cell membranes and other lipid-containing cell components apparently do not adsorb enough dye to give a detectable fluorescence (Fig. 61.2). Arrow shows a typical cluster of PHB granule.

In an aerobic EBPR, biomass accumulates large amount of poly-P and the characteristic positive reaction of the Neisser staining method is a purple—black granule in yellowish-brown background of counterstained cells (Fig. 61.3),

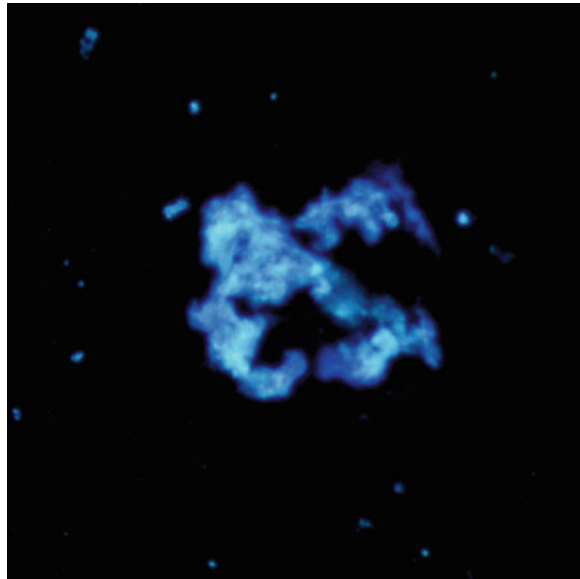
**Fig. 61.2** EBPR sludge, end of anaerobiosis, Nile blue staining



**Fig. 61.3** EBPR sludge, end of aerobiosis, Neisser staining



**Fig. 61.4** EBPR sludge, end of aerobiosis, DAPI staining



6-Diamidino-2-phenylindole dihydrochloride (DAPI) is a fluorescent dye usually used for DNA detection. DAPI-DNA fluorescence is blue white, while both DAPI-poly-P and DAPI-lipid fluorescence are yellow. Discrimination between the two storage compounds is by the intensity of the fluorescent response: the lipid fluorescence is weak and fades in a few seconds while poly-P granules appear bright yellow (Fig. 61.4). Arrow shows a typical cluster of poly-P granule.

## 61.4 Conclusion

The main conclusions of this study show that:

During the EBPR activity period of the SBR, anaerobic phosphate release was around 50.6 mg P/L, aerobic phosphate removal efficiency was round about 97 %. SBR had stable operation state after 2 months of start-up.

The MLSS were 2.3 g/L and the SVI was 93 mL/g MLSS on average in the samples; therefore activated sludge had good performance and was completed domestication.

Staining results of intracellular polymers stored by PAOs indicated that in an anaerobic EBPR biomass and in an aerobic EBPR biomass able to accumulate large amount of PHB and poly-P, respectively.

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# Chapter 62

## Study on RMB Cross-Border Settlement in China's Foreign Trade Enterprises

Hongqin Liu

**Abstract** RMB Cross-border Settlement is an important step in international settlement and has a special influence on Chinese enterprises. This paper summarizes its implementation course and outcome in China, and then analyzes opportunities brought to Chinese foreign trade enterprises, and uses the index of REER and TCI to enhance the argument. Finally, this paper puts forward countermeasures for enterprises to take better advantage of RMB Cross-border Settlement.

**Keywords** RMB Cross-border Settlement · Foreign trade enterprises · REER · TCI · Countermeasures

### 62.1 Introduction

Under the circumstances of financial crisis, the exchange rate of main international settlement currencies is undergoing a wide volatility with a huge margin, which makes Chinese export enterprises withstand many exchange rate risks and competition pressures. The grim situation of Chinese foreign trade and a number of other factors gave birth to the introduction of RMB Cross-border Settlement.

The so-called RMB Cross-border Settlement is that the state allows the designated and qualified enterprises to settle their cross-border accounts with RMB on a voluntary basis, and allows commercial banks to provide relevant cross-border settlement service with RMB to enterprises but within the scope of policies of the People's Bank.

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In 2009, China officially launched the pilot of RMB Cross-border Settlement in Shanghai, Guangzhou, Shenzhen, Dongguan, and Zhuhai, which announced a new step for RMB internationalization. The practice and promotion of RMB Cross-border Settlement is not only good to help enterprises to reduce the burden of exchange costs and reasonably avoid exchange rate risks in the international market trading and competition, but also to bring favorable opportunities to banks in China to takeover more market shares and seek new economic growth points.

## **62.2 Overview on Implementation**

### ***62.2.1 The History***

Since September 2008, the State Council made a series of strategic arrangements to accelerate RMB Cross-border Settlement.

In July 2009, the pilots were officially set up. Shanghai and four cities in Guangdong Province became the first inland pilots, and meanwhile Hong Kong, Macao, and ASEAN were the first ones outside China.

In June 2010, the pilots were expanded to Beijing and other 20 provinces (autonomous regions and municipalities); business scope included cross-border business in goods, services, and other current accounts. RMB Cross-border Settlement could be used in any region outside China. Enterprises could use RMB for settlement according to market principles.

On December 6, 2010, the People's Bank increased the number of pilot enterprises from 365 to 67,359. The expansion of the pilot further promoted the development RMB Cross-border Settlement. The settlement amount made a breakthrough and maintained a good upward trend.

In March 2012, the People's Bank and other relative departments jointly allowed the Chinese enterprises engaged in import and export trade in goods, services, and other current accounts to select RMB for pricing, settling, and payment. The detailed history is shown in the following Table 62.1.

### ***62.2.2 The Outcome***

From July 2009 when the pilot was started to the end of December 2010, banks handled RMB Cross-border Settlement in the amount of 509.3 billion RMB yuan.

In the first quarter of 2011, China totally handled RMB Cross-border Settlement 360.3 billion yuan, accounting for 70 % of the total business volume of 506.3 billion RMB yuan in 2010, and about 7 % of the country's international trade was settled with RMB, much higher than 0.5 % in the same period of 2010.

**Table 62.1** The detailed history

Time	Policy	Authorities
Sep 2008	Strategic arrangements to accelerate RMB Cross-border Settlement.	The State Council
July 2009	The pilots were officially set up.	The State Council
June 2010	The pilots were expanded to Beijing and other 20 provinces	The State Council
December 6, 2010	The number of pilot enterprises from 365 to 67,359	The People's Bank
March 2012	All Chinese enterprises can select RMB for pricing, settling, and payment	The People's Bank

The Monetary Policy Report released by the People's Bank of China on May 11, 2012 showed that in the first quarter, banks handled RMB Cross-border Settlement 580.4 billion RMB yuan, an increase of 61 %. Among them, 416.57 billion trade in goods. For investment, 2.87 billion ODI and 47 billion FDI (Table 62.2).

## 62.3 Opportunities Brought to Chinese Foreign Trade Enterprises

### 62.3.1 To Reduce Exchange Rate Risks

Since 2005 when RMB abandoned the peg to US dollars, it has appreciated nearly 20 % in total [1]. Especially since the financial crisis in 2008, Chinese enterprises made bad to worse because of exchange rate instability. Under the circumstances

**Table 62.2** The ratio of main economies GDP to the global GDP

Years	Global (%)	US (%)	Euro area (%)	Japan (%)	China (%)	Germany (%)	France (%)	UK (%)
1980	100	25.94	–	10.04	1.78	8.62	6.48	5.08
1991	100	25.04	24.47	14.68	1.60	7.62	5.24	4.45
2000	100	30.79	19.50	14.52	3.73	5.91	4.13	4.60
2001	100	32.04	19.85	12.82	4.15	5.92	4.19	4.61
2002	100	31.86	20.82	11.79	4.37	6.07	4.38	4.85
2003	100	29.67	22.84	11.32	4.39	6.53	4.82	4.98
2004	100	28.08	23.23	10.95	4.59	6.53	4.90	5.24
2005	100	27.64	22.31	10.00	4.96	6.13	4.72	5.01
2006	100	27.05	21.81	8.85	5.50	5.92	4.60	4.95
2007	100	25.28	22.23	7.87	6.28	5.99	4.66	5.03
2008	100	23.48	22.25	7.99	7.39	5.94	4.66	4.35
2009	100	24.41	21.58	8.76	8.62	5.76	4.58	3.76

of RMB sustained and substantial appreciation, the traditional method of settlement has brought great exchange rate risks.

There are three impacts of exchange rate risks on foreign trade enterprises in China: The substantial appreciation of RMB against USD has a direct impact on competitiveness of Chinese export enterprises. With the expectation of sustained appreciation of RMB at home and abroad, companies simply cannot avoid risks through hedging foreign exchange forward transactions. With large amount of claims and debts in foreign currency in hand, they were suffering a risk of currency exposure. Exchange rate volatility also makes a lot of foreign trade enterprises not accept orders rashly, which affects Chinese foreign trade volume.

$$R = P \frac{(1 + N \times i)}{N} + P \times r \quad (62.1)$$

P Price  
 N Times of installments  
 i Discount Rate  
 r additional rates

$$R = P \frac{i(1+i)^N}{(1+i)^N - 1} \quad (62.2)$$

$$R_{\text{new-old}} = \frac{C_{\text{old}} - C_{\text{new}}}{I_{\text{new}} - I_{\text{old}}} \times 100\% \quad (62.3)$$

Based on the reality of its sustained stability and expectation of increasing appreciation, RMB has formed a good credibility in neighboring countries and regions [2]. The introduction of RMB Cross-border Settlement will largely eliminate exchange rate risks for Chinese enterprises and their trade partners in surrounding areas.

### 62.3.2 To Reduce Transaction Costs

RMB Cross-border Settlement enables enterprises to settle their accounts directly without conversion to other currencies which can simplify procedures and avoid risks of transaction costs and exchange rate. Taking Letters of Credit as an example, if a foreign trade enterprise collects its receivables, the negotiation fee is 1.5 ‰, and the cost of conversion accounts for an average of 2–4 ‰ of transaction amount. If it hedges foreign exchange to avoid risks, the service charge is nearly 2–3 ‰ of the operating income, which is not a small burden on the low-profit Chinese enterprises engaged in import and export [3].

With the continuous improvement of the supporting measures of RMB Cross-border Settlement, the process will be more convenient and efficient, which cannot only reduce the cost of settlement and trade financing, but also increase exports, simplify exchange procedures, and improve the efficiency of fund settlement. It is undoubtedly a gospel for struggling enterprises in the financial crisis.

### 62.3.3 To Improve Competitiveness

Chinese long-term trade surplus accumulated vast foreign exchange reserves which brought big pressure on RMB appreciation. As the volume of RMB Cross-border Settlement business increases, the structure of Chinese foreign exchange reserves will be improved and the appreciation pressure will be gradually eased, all of which will put Chinese export enterprises in a better position in the international trade competition [4] (Table 62.3).

The premise of using RMB Cross-border Settlement in international trade is the right to say for import and export enterprises. However, many Chinese enterprises are in the end of the global value chain and lack bargaining power in negotiations with foreign partners [5]. Considering its favorable influence on import and export enterprises, there is an inevitable requirement of optimization for Chinese industrial structure and upgrading of modern management level for foreign trade enterprises, so that international competitiveness of our products can be strengthened continually.

**Table 62.3** Chinese commodities TCI

Years	Primary products	Manufactured goods	Textile, rubber mining product	Machine transport equipment
1981	0.12	-0.09	0.08	-0.69
1985	0.45	-0.46	-0.45	-0.91
1990	0.23	0.03	0.17	-0.5
1994	0.09	0.01	-0.09	-0.4
1995	-0.06	0.08	0.06	-0.25
1996	-0.07	0.07	-0.05	-0.22
1997	-0.09	0.17	0.03	-0.09
1998	-0.05	0.16	0.02	-0.06
1999	-0.15	0.12	-0.02	-0.09
2000	-0.29	0.11	0.0088	-0.0535
2001	-0.27	0.096	0.0219	-0.06
2002	-0.27	0.094	0.044	-0.038

Source National Bureau of Statistics of China <http://www.stats.gov.cn/>

### 62.3.4 To Expand the Area of Trade

The upgrading of RMB from quoting currency to settlement currency expands the channels of access and use of RMB for offshore organizations, which is conducive to promote trade between China and neighboring countries, and to alleviate the pressure caused by the financial crisis to foreign trade (Table 62.4).

After the financial crisis, in many countries in ASEAN, because of the shortage of foreign exchange, the ability to pay its foreign trade is badly affected, but using RMB yuan as the settlement currency will be a good solution to this problem. This makes the trade between China and ASEAN countries further strengthened and regional cooperation becomes more close [6]. To some extent, it reduces loss of foreign trade caused by shrinking of traditional international market, and also provides convenient conditions for the development of new markets.

### 62.3.5 To Explore the Space of Profitability

RMB Cross-border Settlement is not limited to trade, and it also includes FDI (Foreign Direct Investment) and ODI (Overseas Direct Investment), as well as the opening of the bond market, cooperation between central banks, MNCs (Multi-national Corporations) capital use, etc., which is a set of new pattern for opening up [7]. Using RMB in FDI and ODI, enterprises can change their industrial structures with two kinds of markets and resources, and adjust their products according to market supply chain, which makes their profits doubled.

**Table 62.4** The import and export figure of China (2001–Sep, 2010), unit: USD 100 million

Years	Import and export		Export		Import		Surplus
	Amount	Growth (%)	Amount	Growth (%)	Amount	Growth (%)	
2001	5096.51	7.5	2660.98	6.8	2435.53	8.2	225.45
2002	6207.66	21.8	3255.96	22.4	2951.7	21.2	304.26
2003	8509.88	37.1	4382.28	34.6	4127.6	39.8	254.68
2004	11545.54	35.7	5933.26	35.4	5612.29	36	320.97
2005	14219.06	23.2	7619.53	28.4	6599.53	17.6	1020.01
2006	17604.39	23.8	9689.78	27.2	7914.61	19.9	1775.08
2007	21765.72	23.6	12204.56	26	9561.16	20.8	2643.4
2008	25632.6	17.8	14306.93	17.3	11325.67	18.5	2981.26
2009	22075.35	-13.9	12016.12	-16	10059.23	-11.2	1956.89
2010.1-9	21486.74	37.9	11346.35	34	10140.39	42.4	1205.96

## 62.4 Countermeasures

### 62.4.1 A Correct Understanding

RMB Cross-border Settlement, not a master key, has risks too, so different enterprises should have different strategic choices. Its effect will vary due to different sizes and structures of import and export. Some companies import hi-tech products, so they lack power of pricing and decisions of the settlement currency. Some companies export less competitive products, so they lack negotiating capacity, resulting in the importer keeping prices down or choosing a soft currency for settlement. Table 62.5

In the above two cases, our businesses will not benefit from RMB appreciation. But enterprises with a strong trade status will benefit lot more. Even so, considering the expectation of RMB appreciation in the whole, RMB settlement is not impossible, but maybe Chinese enterprises could make some concessions in negotiations, all of which requires companies to judge and weigh [8]. Fig 62.1

### 62.4.2 To be Familiar with the Stipulations

There are many stipulations on RMB Cross-border Settlement. In order to control more effectively, the relevant provisions design a higher threshold: foreign trade enterprises must ensure the authenticity of transaction documents and the consistency of income and payment in RMB [9]; there is no poor record of taxing and import and export declarations. In the aspects of declaration of export refund (exemption), documentary evidence, such as declarations, purchase and sales invoices, contracts, etc., should be complete and detailed as much as possible.

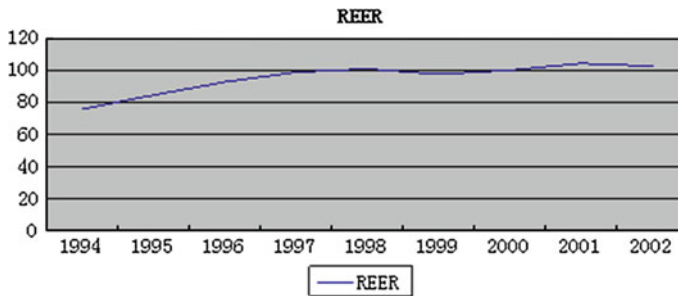
### 62.4.3 To Upgrade Products and Innovate Actively

On the whole, Chinese exports are still mainly concentrated in low-skilled and low value-added products with many substitutes. For foreign trade enterprises in China, if they want to share benefits of RMB Cross-border Settlement, they need to constantly improve product value in design, brand, and marketing, and realize differentiation of production and sales.

**Table 62.5** REER of RMB

Years	1994	1995	1996	1997	1998	1999	2000	2001	2002
REER	75.89	84.57	92.756	98.8358	100.813	97.5084	100	104.32	102.641

Source National Bureau of Statistics of China <http://www.stats.gov.cn/>



**Fig. 62.1** REER of RMB

In general, the export price elasticity of hi-tech products is small with fewer alternatives. Enterprises can take full advantage of technology spillover brought by international division of labor, then digest and absorb and finally create their own innovation platform to develop more products with core technology. Only by this way, they can have greater discretion in selecting the settlement currency [10]. Qualified enterprises should accelerate the pace of “going out” to expand ODI, and enhance the factor allocation and product pricing ability worldwide.

#### **62.4.4 Talents Training and Introduction**

When going out, the problem facing enterprises is the lack of financial talents, which brings greater operational risks. RMB Cross-border Settlement is a new business without precedent, which has a very high demand for the overall quality and innovation of business people who should be capable of analyzing international financial markets [11]. Therefore, it is imminent for enterprises to train and introduce management personnel with international strategic vision.

### **62.5 Conclusion**

RMB Cross-border Settlement means that enterprises have one more currency for settlement. But how to make use of it, all these factors should be taken into consideration, such as trade position, trade partner, trade structure, market trends, the exchange rate market, and so on. You should also develop a comprehensive trading strategy to choose the settlement currency. Enterprises should constantly sum up experience, solve various problems encountered in time, improve the management level, and become more skilled in selection. At the same time, they should also persuade more partners, expand the impact of RMB yuan, and create conditions for RMB internationalization.

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# Chapter 63

## Research on China's Service Trade Based on International Competitiveness Perspective

Fengli Zhuo

**Abstract** To analyze the current situation of China's service trade and research the international competitiveness of service trade in China is with three indicators including Market Share MS index, Revealed Comparative Advantage RCA index and Trade Competitive Index TCA index. The results show that the main problem of China's service trade development is a long-term trade deficit, unreasonable structure, the lag in goods trade development. Then the author puts forward some development measures which are optimizing service trade structure, further opening the service trade market, increasing service personnel training, and improving the service trade management mechanism.

**Keywords** China · Service trade · International competitiveness

### 63.1 Introduction

Since the reform and opening up, China's service trade has made an effective development. But because of our country's late start service industry, the low starting point, and weak competitiveness these seriously impact on the development of China's service trade. Therefore, how to enhance the international competitiveness of service trade is the key problem of China's Foreign Service trade.

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## 63.2 The Analysis on Current Situation of China's Service Trade

### 63.2.1 Service Trade Has Made Rapid Development

From Table 63.1, we can see China's service trade has made rapid development. From 71.9 billion US dollars in 2001, it has increased to 362.4 billion US dollars in 2010, including the service trade export volume 170.2 billion US dollars, up by 32.3 %, and the service trade import volume 192.2 billion US dollars, up by 21.6 %. After 10 years of development, China's service trade has increased five times as much. In the whole world, from 28th in 1982, export ranked up to 4th in 2010, and import ranked from 40th up to 3rd. According to the WTO statistics, during 2005–2009, the world service trade import and export increased by 7 %, and in the same period, China's growth rate was 17.5 % with two times over the world. In the year 2011, China's service trade hit a new record with total import and export volume reaching 420.9 billion US dollars [1].

However, we can also see from Table 63.1 and Fig. 63.1, China's service trade is not optimistic. There is a long-time deficit and it expands constantly from 6.1 billion US dollars in 2001 to 55.3 billion US dollars in 2011. This shows that the international competitiveness of China's service trade is lower and bears a lot of deficiencies.

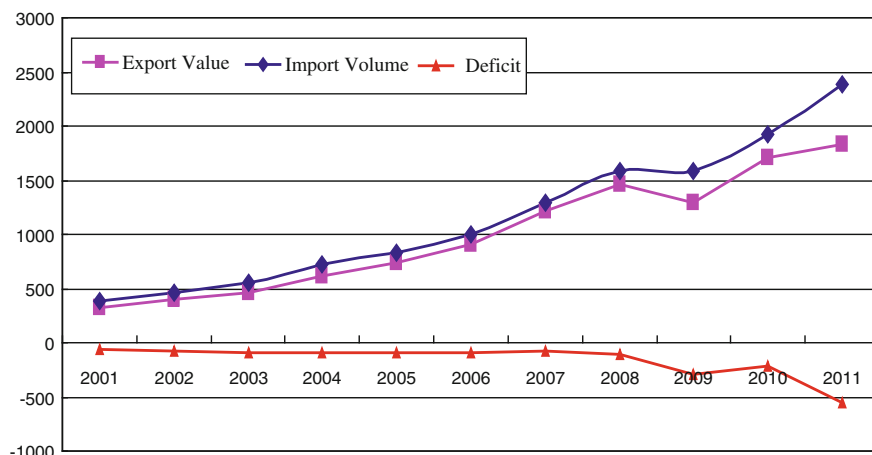
### 63.2.2 Service Trade Structure Needs to be Optimized

In the structure of China's service trade, two traditional service trade parts, transportation and travel have always accounted for the largest proportion [2].

**Table 63.1** Year 2001–2011 total import–export volume and balance of China's service trade (Unit Billion USD)

Years	Service trade export		Service trade import		Deficit
	Export volume	Growth (%)	Import volume	Growth (%)	
2001	329	9.1	390	8.8	–61
2002	394	19.7	465	18.1	–71
2003	464	17.8	549	18.3	–85
2004	621	33.8	716	30.5	–95
2005	739	19.1	832	16.2	–93
2006	914	23.7	1,003	20.6	–89
2007	1,217	33.1	1,293	28.8	–76
2008	1,465	20.4	1,580	22.2	–115
2009	1,286	–12.2	1,581	0.1	–295
2010	1,702	32.3	1,922	21.6	–220
2011	1,828	7.4	2,381	23.9	–553

Source Statistical yearbook of China



**Fig. 63.1** 2001–2011 years total import–export volume and balance of China's service trade (Unit Billion USD)

From Table 63.2, we can see service trade volume is 420.9 billionUS dollars, transportation and travel account for 27.56 and 28.77 % respectively with total accounting for 50 % above.

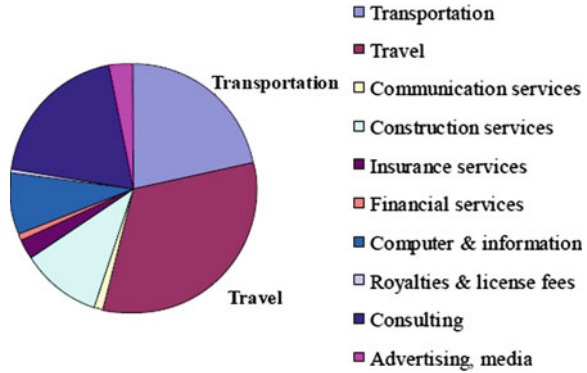
In recent years, travel has declined. The proportion of new service projects has increased, including finance, insurance, computer and information services, consulting, technology patent fees and royalties, and so on. The service trade structure has optimized continuously (Fig. 63.2).

**Table 63.2** Year 2001–2010 development trend of China's service trade structure (Unit Billion USD)

Years	Transportation		Travel		New service project	
	Total amount	Ratio (%)	Total amount	Ratio (%)	Total amount	Ratio (%)
2001	160	22.19	317	44.07	243	33.74
2002	193	22.62	358	41.87	304	35.51
2003	261	25.82	326	32.19	425	41.97
2004	366	27.39	449	33.59	522	39.02
2005	439	27.93	511	32.51	622	39.57
2006	554	28.88	583	30.39	781	40.72
2007	746	29.73	670	26.71	1,093	43.56
2008	888	29.15	770	25.29	1,387	45.27
2009	701	24.46	834	29.08	1,332	46.54
2010	1160	27.56	1,211	28.77	1,838	43.67

Source Ministry of Commerce, <http://www.mofcom.gov.cn/>

**Fig. 63.2** China's imports of services by sector in 2011



### 63.2.3 Service Trade Development Behind Goods Trade

China is a traditional goods trade country which gives priority to goods trade and then, trade in services accounts for less. In 2011, the service trade accounts for the proportion of total trade is only 10.36 %, and trade in goods is 8 times over service trade, at 89.64 % [3].

In Table 63.3, we can see that the service trade accounts for 10.49 % on average of total trade from 2005 to 2011, and the highest is just 11.49 % in the year of 2009. And in the same period, the world service trade in 2009 accounted for 20.4 % of the world total trade, and this ratio is higher in the developed countries.

## 63.3 Analysis on International Competitiveness of China's Service Trade

### 63.3.1 The Analysis of MS

Market Share MS index refers to the ratio of a country's total exports of services trade and the world exports of service trade, and reflects the proportion of a country's service trade exports in the world market, the higher the ratio, the stronger international competitiveness, on the contrary weaker.

$$MS_{ij} = \frac{X_{ij}}{X_{wj}} \tag{63.1}$$

- $X_{ij}$   $i$  Country service export
- $X_{wj}$  the world service export

**Table 63.3** Year 2005–2011 the data of China's service trade and goods trade and the proportion of total trade (Unit Billion USD)

Years	Total amount of import and export of goods	Proportion of total trade (%)	Total amount of import and export of service	Proportion of total trade (%)
2005	14,219	90.05	1,571	9.95
2006	17,604	90.18	1,918	9.82
2007	21,766	89.66	2,509	10.34
2008	25,633	89.38	3,045	10.62
2009	22,075	88.51	2,867	11.49
2010	29,740	89.14	3,624	10.86
2011	36,421	89.64	4,209	10.36

Source Ministry of Commerce, <http://www.mofcom.gov.cn/>

From Table 63.4, we can see that China's IMS of service trade has continuously improved and the international competitiveness has enhanced, but comparing with the developed countries, the overall ratio is too small. The United States, Britain, and Germany have taken one-third of the export market.

### 63.3.2 The Analysis of RCA Index

Revealed Comparative Advantage RCA index =  $[(i \text{ country } j \text{ merchandise export} / i \text{ country all the products total export}) / (\text{the world } j \text{ merchandise export} / \text{the world all the products total export})]$ , which reflects international competitiveness of some kind of industry [4]. It rejects the national total volatility and the effect of the fluctuation of the total world, and reflects better the relative advantages of the industry. Specifically, when  $2.5 < RCA$ , it indicates that the country's export products is with very strong international competitiveness; When  $1.25 < RCA < 2.5$ , it indicates that the country's export products have strong international competitiveness; When  $0.8 < RCA < 1.25$ , it indicates that the country's export products has comparatively stronger international competitiveness; When the  $RCA < 0.8$ , it indicates that the country's export products have weaker international competitiveness.

**Table 63.4** Year 1990–2010 ms of china and the developed countries

Years	China (%)	U.S. (%)	Britain (%)	Germany (%)
1990	0.73	17.03	6.89	6.48
2000	2.03	18.74	7.99	5.37
2005	2.97	14.55	8.20	6.44
2009	3.84	14.15	6.96	6.76
2010	4.54	13.95	6.58	6.22
Average	2.82	15.68	7.33	6.26

Source Ministry of Commerce, <http://www.mofcom.gov.cn/>

**Table 63.5** 2001–2010 years RCA index of China

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
RCA	0.52	0.49	0.44	0.43	0.41	0.41	0.41	0.43	0.40	0.45

*Source* According to WTO database to calculate

In the Table 63.5, we can find that RCA index variation is not big, all are under 0.8, and even more than 0.5 is very few. It fully explains that the international competitiveness of trade in services is very low which does not match China's international position.

$$RCA = \frac{X_{ij}/Y_j}{X_{iw}/Y_w} \quad (63.2)$$

- $X_{ij}$   $i$  country  $j$  merchandise export
- $Y_j$   $i$  country all the products total export
- $X_{iw}$  the world  $j$  merchandise export
- $Y_w$  the world all the products total export

### 63.3.3 The Analysis of TCA Index

Trade Competitive Index TCA = (total export in service trade of a country—total import)/(total export in service trade of a country + total import). It is usually used to analyze the competitiveness of service trade. As the index consider the import condition, it can be used as a good complement of RCA index [5].

$$TC = \frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}} \quad (63.3)$$

- $X_{ij}$   $i$  country  $j$  merchandise export
- $M_{ij}$   $i$  country  $j$  merchandise import

From the Table 63.6, we can know that the level in service trade industry is different and import and export structure is imbalance in our country. In most years, TCA index of travel is positive which shows some of the competitive advantage. Due to the influence of the financial crisis in 2008, it shows a negative value in 2009 and 2010. And TCA index of transportation are negative, which proves transportation is in disadvantages [6]. In the other hand, TCA index has been increasing which explains the transportation service competitiveness of China is low, but in slow increase. TCA index of construction service has changed

**Table 63.6** 2001–2010 TCA index of China service industry

Years	Transportation	Travel	Communication	Construction	Insurance	Finance	Computer and information	Consult	Advertisement
2001	-0.42	0.12	-0.17	-0.01	-0.85	0.12	0.14	-0.26	0.04
2002	-0.41	0.14	0.08	0.13	-0.88	-0.28	-0.3	-0.34	-0.03
2003	-0.4	0.07	0.2	0.04	-0.87	-0.21	0.03	-0.22	0.33
2004	-0.34	0.15	-0.03	0.05	-0.88	-0.2	0.13	-0.2	0.1
2005	-0.29	0.15	-0.1	0.23	-0.85	-0.04	0.06	-0.07	0.2
2006	-0.24	0.17	-0.02	0.15	-0.88	-0.72	0.26	-0.03	0.2
2007	-0.16	0.11	0.04	0.29	-0.84	-0.41	0.33	0.03	0.18
2008	-0.13	0.06	0.02	0.41	-0.8	-0.28	0.33	0.15	0.06
2009	-0.33	-0.05	0.00	-0.23	-0.75	-0.27	0.34	0.16	0.09
2010	-0.30	-0.09	0.04	0.48	-0.80	-0.04	0.51	0.20	0.16

Source: Ministry of Commerce, <http://www.mofcom.gov.cn/>

from a negative to a positive in recent years. It is mainly due to the construction industry labor resources, low labor costs. All of this results in comparative advantage of construction service. Consult, advertisement, computer and information services show positive in most years, especially computer and information services in recent years has the tendency of increasing, which indicates that our computer and information service has certain competitiveness due to developing service outsourcing in recent years. TCA index of the high value-added industry, such as Insurance, financial is negative in most years, which shows the lower international competitiveness in the capital and technology intensive service industry.

## **63.4 The Measures of Enhancing the International Competitiveness of China's Service Trade**

### ***63.4.1 Optimizing Service Trade Structure Actively***

In view of China's traditional service with big proportion, China should consolidate the traditional trade advantage, at the same time, expand new service trade. China can key support the childish service industry until it is mature. And then it can enter into international market, participate in the international competition, and create more profits and value [7].

### ***63.4.2 Expanding the Service Industry Opening-Up***

On the basis of original opening, we should be further expanding the monopoly industry such as telecom, railways, and civil aviation industry in order to amplify the opening-up of the whole service industry. Our enterprise in service industry should participate in the international competition which will improve its international competitiveness. The enterprise will not be left to survive in the monopoly environment. The survival of the fittest is a hard truth. If these enterprises can survive and grow up in the harsh competitive environment, the overall international competitiveness of China's service trade will be enhanced.

### ***63.4.3 Increasing the Service Personnel Training***

The competitiveness of the new service industry such as finance, insurance, and other international is weak. As for the reason, the most important is the lack of



senior talents and experts in these industries [7]. We should take measures, such as making regular talent introduction plan, increasing the proportion of the budget for services in the annual government budget, etc.

#### ***63.4.4 Perfecting Service Trade Management Mechanism***

With the accelerated process of service trade and opening up, China should speed up the process of legislation of service trade, and gradually narrow the gaps of the existing regulations with international norms, formulate laws and regulations matching with the goals of China's overall economic trade development to make China's service trade system more transparent. Efforts should be made to speed up building the objective environment of the service trade development, introducing market mechanism, establishing modern enterprise system, breaking trade monopolies and closing self service system, cultivating the more large-scale subject in service trade and constantly eliminating the institutional barriers in the development of international service trade.

### **63.5 Conclusions**

Service trade in the national economy is becoming more and more important. The total amount of service trade grows steadily, but the trade structure is more traditional single. The new service project is at a disadvantage obviously because the overall competitiveness is not strong with a long-time deficit. Owing to the problems we will continue to further open service trade market, optimize the structure of trade in services, and strive to do personnel training, improve the service trade legal system, etc., and speed up the development of the industry of new service trade. China's service trade will embark on the track of structural optimization and rapid development.

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# Chapter 64

## Study of Coordinated Development of Logistics Industry and Regional Economic Integration Based on Provincial Data

Li Zhao

**Abstract** By analyzing the mechanism of the development of logistics industry and regional economic integration, based on 29 provincial data of provinces (autonomous regions, municipalities) in China, and through the method of correlation and regression analysis, the development level of provincial logistics industry is evaluated and the correlation of development level of logistics industry and regional economic integration is also examined. The empirical findings show that there exists a negative correlation between the development level of logistics industry and inter-provincial trade barrier, and that regional economic integration can promote the development of logistics industry, and in turn, the development of logistics industry contributes to the reduction of inter-provincial trade barrier and the relief of domestic market segmentation, which can promote the development of inter-provincial trade and the realization of regional economic integration, while obvious regional differences appear in infrastructure and trade dependence between southeast coast area and Midwest China.

**Keywords** Logistics industry · Regional economic integration · Inter-provincial trade barrier

### 64.1 Introduction

With the progress of society and the rapid development of information, music production changes from the simple and nature sound to rich clear, and colorful pictures with high quality sound, video, audio and other effects in the fusion. Faced with further strengthen in the music generating technology, we have proposed an

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application based on the modern information technique in this paper. The computer fractal technology can be fully utilized in refining the fractal music [1]. The music becomes multiple iterative music effect based on fractal technology from the initial note scale with a time of fluctuation. It can realize the macroscopic and microscopic real music in very vivid simulation creation way.

## **64.2 The Mechanism and Effect Analysis of Logistics Industry to Regional Economic Integration**

According to Adam Smith's theory of labor division, the degree of division is determined by the market size, and the market size in turn depends on the transport conditions. The development of modern logistics promotes the division of labor to break geographical restrictions, thus, promoting regional economic integration [2]. The neo-classical economics applied the method of infra-marginal analysis to point out that the emergence and development of the logistics industry can reduce transaction cost and achieve the regional economic gradient and internal relations enhanced through the exchange of material objects, mobile, and playing the polarization and diffusion effect to economic growth.

The role of logistics industry to regional economic integration is guided by the aggregation functions, resource allocation (integration), catalytic and radiation functions of logistics, and meanwhile, it achieves the integration and configuration of resource in space and time dimensions by changing the supply structure of resource elements and forms a unified domestic market that can achieve the scale economy and full competition, produce the economy of scale, competition and diffusion effects and make the resource flow to the regions that of more efficient so as to achieve the role to the development of industries and the growth of regional economy and ultimately to promote regional economic integration [3]. The realization of regional economic integration will bring a further increase in demand for logistics, thus promote the development of infrastructure which associated with logistics, such as transportation, warehousing and distribution, post and telecommunication, which can improve the integration of resources in a wide range and create a more favorable conditions and spaces for logistics development [4]. Regional economic integration strengthens the reliance and cooperation between the regions and makes production factors and good flow freely by reducing or eliminating trade barrier and restrictions, so as to achieve regional market integration and expansion [5].

## **64.3 Empirical Tests**

A. Index selection and data source

### 64.3.1 Measure Index of Logistics Industry Development

Considering the availability of data, indexes of freight volume, passenger volume, total transportation distance, transportation, and total post employment are selected to reflect the level of logistics development (Table 64.1).

**Table 64.1** The basic data of logistics industry development of different regions (2009)

Region	Passenger volume (million people)	Freight volume (million ton)	Length of transportation (km)	Employment of transportation and post (people)
Beijing	129,534	20,470	1169.5	569,541
Tianjin	23,337	42,324	781.5	126,371
Hebei	77,773	123,065	4880.3	305,884
Shanxi	36,474	109,534	3536.3	244,837
Neimenggu	22,077	113,916	8074.2	194,606
Liaoning	95,505	135,055	4229.3	345,986
Jilin	58,580	34,771	3913.5	175,430
Heilongjiang	43,365	54,208	5756.1	291,735
Shanghai	9,571	76,669	317.7	371,500
Jiangsu	20,0713	152,581	1655.6	361,144
Zhejiang	199,068	151,566	1678.2	305,075
Anhui	141,229	196,654	2849.9	176,237
Fujian	75,009	58,163	2109.7	190,597
Jiangxi	70,496	86,057	2712.4	178,498
Shandong	234,564	284,086	3685.7	369,192
Henan	144,203	169,942	3949.2	314,121
Hubei	94,334	78,984	2980.2	348,139
Hunan	140,572	128,921	3693.0	258,113
Guangdong	418,938	169,653	2478.6	623,271
Guangxi	68,593	94,466	3126.0	204,087
Hainan	40735	18,393	387.3	47,289
Chongqing	113,981	68,566	1317.7	152,635
Sichuan	220,020	118,253	3257.9	283,163
Guizhou	64,918	34,803	1982.7	109,249
Yunnan	35,556	46,039	2474.8	175,992
Xizang	7,844	943	525.5	10,840
Shanxi	84,303	92,557	3319.5	234,129
Gansu	49,968	26,605	2435.4	117,491
Qinghai	10,071	9,874	1676.9	398,49
Ningxia	12,629	29,242	890.0	36,330
Xinjiang	29,886	45,046	3673.4	122,775

### 64.3.2 Measure Index of Regional Economy Integration

The indexes of inter-provincial trade barrier is adopted to measure the degree of regional economy integration, and the boundary effect indexes of China's provinces and cities are used, which were estimated by Zhao Yong-liang, Xu Yong, and Su Guifu using multiple panel data to represent the degree of inter-provincial trade barrier. The boundary effect values of provinces and cities which were calculated by per-capita GDP were seen from Table 64.2.

The proportion of total import–export volume accounts for total sales amount reflecting the export-oriented of each province, the intensity of import–export trade represents the level of convenience and unobstructed flow in various provinces and cities, which also represents the degree of regional economic integration to a certain extent. The logistics development and inter-provincial trade barrier data can be seen from Table 64.3.

### 64.3.3 B Empirical Results

Subregional logistics industry development indexes and trade barrier indexes of 2009 are selected as the analysis of raw data in 29 provinces of China to calculate the person correlation coefficient and measure their degree of close contact, meanwhile, the software SPSS17.0 is applied to calculate their result which can be seen from Table 64.4.

It can be seen that there is a clear negative correlation between the level of logistics industry development and the index which ratio is the government consumption measuring the inter-provincial trade barrier to GDP, the correlation coefficient were  $-0.364$ ,  $-0.589$ ,  $-0.122$ , and  $-0.156$ ; and there is a clear positive correlation between the passenger volume and freight volume that reflect the level of logistics industry development and import and export account for total

**Table 64.2** The boundary effect values of each province of China

Province	Boundary effect	Province	Boundary effect	Province	Boundary effect
Beijing	2.01	Anhui	33.12	Chongqing	20.91
Tianjin	1.46	Fujian	12.81	Sichuan	35.87
Hebei	11.13	Jiangxi	19.69	Guizhou	61.56
Shanxi	6.75	Shandong	11.02	Yunnan	21.33
Neimeng	12.55	Henan	18.73	Xizang	37.34
Liaoning	9.68	Hubei	15.18	Shanxi	19.89
Jilin	8.17	Hunan	24.78	Gansu	41.68
Heilongji	12.68	Guangdong	0.45	Qinghai	53.52
Shanghai	0.27	Guangxi	17.64	Ningxia	42.95
Jiangsu	2.77	Hainan	2.66	Xinjiang	83.93

**Table 64.3** The basic data of logistics development and inter-provincial trade barrier

Province	Passenger volume	Freight volume	Length of transportation	Employment of transportation and post	Proportion of government consumption account for GDP	Proportion of import-export value account for total sale amount
Beijing	4.35	0.72	1.37	6.37	0.2525	0.2662
Tianjin	0.78	1.5	0.91	1.05	0.1437	0.6423
Hebei	2.61	4.36	5.71	3.41	0.1354	0.9529
Shanxi	1.23	3.88	4.14	5.96	0.1294	0.3961
Neimengu	0.74	4.03	9.44	4.8	0.1602	0.3682
Liaoning	3.21	4.78	4.95	7.36	0.1028	0.6950
Jilin	1.97	1.23	4.58	4.03	0.1515	0.3419
Heilongjiang	1.46	1.92	6.73	6.55	0.1888	0.6612
Shanghai	0.32	2.71	0.37	1.45	0.1374	0.8020
Jiangsu	6.74	5.4	1.94	3.27	0.1427	1.5421
Zhejaing	6.69	5.36	1.96	1.37	0.1183	0.9524
Anhui	4.74	6.96	3.33	1.84	0.1042	0.3863
Fujian	2.52	2.06	2.47	1.76	0.1231	1.1179
Jiangxi	2.37	3.05	3.17	3.5	0.1169	0.8757
Shandong	7.88	10.06	4.31	3.79	0.1444	1.1708
Henan	4.84	6.02	4.62	5.31	0.1216	1.3275
Hubei	3.17	2.80	3.48	8.2	0.1471	0.2515
Hunan	4.72	4.56	4.32	4.2	0.1461	0.3758
Guangdong	14.07	6.00	2.9	3.17	0.1113	2.3122
Guangxi	2.3	3.34	3.66	2.69	0.1300	0.5490
Hainan	1.37	0.65	0.45	0.21	—	—
Chongqing	3.83	2.43	1.54	1.28	0.1605	0.2299
Sichuan	7.39	4.19	3.81	2.91	0.1281	0.3769
Guizhou	2.18	1.23	2.32	1.57	0.1766	0.3604
Yunnan	1.19	1.63	2.89	2.49	0.1508	0.2271
Xizang	0.26	0.03	0.61	0.01	—	—
Shanxi	2.83	3.28	3.88	5.39	0.0964	0.3312
Gansu	1.68	0.94	2.85	2.51	0.2118	0.3135
Qinghai	0.34	0.35	1.96	0.72	0.282	0.2049
Ningxia	0.42	1.04	1.04	0.72	0.1766	0.3792
Xinjiang	1	1.59	4.3	2.12	0.2558	0.6192

sales measuring inter-provincial trade barrier, and the correlation coefficient were 0.685, 0.549, which both have adopted the 1 % two-tailed test of significance.

The empirical results show that: (1) There is a significant negative correlation coefficient between the logistics industry development and regional trade barrier which indicates logistics industry can eliminate the factors that formed local trade protection and trade barrier, thus to promote the extension of commodity market and break the effect that the boundary value on inter-provincial trade. (2) There is positive correlation between logistics industry development and export-oriented of

Table 64.4 The person correlation results of logistics industry development and inter-provincial trade barrier

Index	Passenger volume	Freight volume	Length of transportation	Employment of transportation and post	Proportion of government consumption account for GDP	Proportion of import-export value account for total sale amount
Passenger volume	Pearson correlation Significant (bilateral) 1	0.667	-0.051	0.081	-0.364	0.685
Freight volume	Pearson correlation Significant (bilateral) 0.000	0.000	0.793	0.678	0.053	0.000
Length of transportation	Pearson correlation Significant (bilateral) 0.667	1	0.279	0.179	-0.589	0.549
Employment of transportation and post	Pearson correlation Significant (bilateral) 0.000	0.279	0.143	0.353	0.001	0.002
Proportion of government consumption account for GDP	Pearson correlation Significant (bilateral) -0.051	0.279	1	0.537	-0.122	-0.027
Proportion of import-export value account for total sale amount	Pearson correlation Significant (bilateral) 0.793	0.143	0.537	0.003	0.529	0.891
	Pearson correlation Significant (bilateral) 0.081	0.179	0.003	1	-0.156	-0.032
	Pearson correlation Significant (bilateral) 0.678	0.353	0.003	0.418	0.418	0.868
	Pearson correlation Significant (bilateral) -0.364	-0.589	-0.122	-0.156	1	-0.372
	Pearson correlation Significant (bilateral) 0.053	0.001	0.529	0.418	-0.372	0.047
	Pearson correlation Significant (bilateral) 0.685	0.549	-0.027	-0.032	0.047	1
	Pearson correlation Significant (bilateral) 0.000	0.002	0.891	0.868	0.047	1



regional trade, which indicates logistics industry development can keep the import–export of inter-provincial trade free and strengthen the integration degree of regional economy and domestic and international markets.

## 64.4 Conclusion

By analyzing the mechanism of the development of logistics industry to regional economic integration and empirical research, conclusions can be drawn as follows:

Logistics industry build regional logistics network in their own development process, realizing and promoting cross-regional flow of resources and optimal allocation and enhancing regional economic integration and openness by aggregating and configuring regional economic elements and playing its economies of scale and spillover effects. Higher degree of regional economic integration reacts on the development of logistics industry and regional economic growth by stimulating demand of logistics.

There is a correlation between logistics industry development and regional trade barrier, Inter-provincial barrier are major factors to restrict the development of logistics industry, local protectionism leads to the increase of transaction costs of inter-provincial trade, and uniform of national factors and commodity markets, and hinder the progress of inter-provincial trade smoothly. The fully displayed natural scenery also shows remarkable art visual effects with sight and dynamic effective combination.

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# Chapter 65

## Study of Educational Products in the Marketing Channels During Upgrading Process

Xiaojie Tang

**Abstract** With ceaseless economic growth and upgrading consumption structure, the proportion of educational consumption in total consumption expenditure constantly increases because of people's deep understanding about the importance of education. The enhancement of educational products in the marketing channels contributes to the suppliers in both public and private institutions home and abroad to stay in a dominant position in the competition. This chapter provides several ideas about the construction of educational products in the marketing channels during upgrading process.

**Keywords** Educational consumption · Consumption structure · Marketing channels

### 65.1 Introduction

The GDP and per capita disposable income of our country increased year by year and the consumption structure upgraded constantly in recent years [1]. Being aware of the importance of knowledge and gradually with the advent of the knowledge-based economy, people strengthened the consumption amount and diversified the demanding trend of educational products with the deep understanding of educational benefits as the double nature of education that of both consumption and investment.

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Educational reform promotes the rise of private education. After China's access to the WTO, the international education resources gradually entered the domestic market to attract domestic students and funding. Domestic public education is facing internal and external competitive pressures and the pattern of market seller's of educational products are gradually being broken. By constantly reforming, we could adapt to the new environment and stay in the initiative position in the new environment. Strengthening marketing and actively building marketing channels benefit educational products from possessing a competitive advantage in upgrading process of consumption structure. This article provides several ideas about the construction of educational products in the marketing channels during upgrading process.

## 65.2 An Inevitable Trend for the Progressively Promotion of Education Products in Consumption Structure

### 65.2.1 *The Economic Basis for Educational Consumption Growth by the Country's Economic Growth*

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The proportion of educational expenditure in consumption in national economy from 1999 to 2009

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*Currency Unit: billion, %*

Years	Consumption expenditure	Educational expenditure	The proportion of educational expenditure in consumption
1999	49723.00	3349.00	6.74
2000	54617.00	3849.10	7.05
2001	58953.00	4637.70	7.87
2002	62364.60	5480.00	8.79
2003	67442.50	6208.30	9.21
2004	87032.90	7242.60	8.32
2005	97822.70	8418.80	8.61
2006	110413.20	9815.30	8.89
2007	128793.80	12148.10	9.43
2008	149112.60	14500.70	9.72
2009	165526.80	—	—

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*Note* The data, which is rearranged, is from the total amount and speed indicators of the national economy and social development in 'China's Statistical Yearbook' [2]

National economy and social development has maintained a rapid growth in recent years, which provides a strong economic foundation for the growth of educational consumption. The proportion of educational expenditure in consumption grows year by year, as follows.

### ***65.2.2 The Promotion of Educational Consumption Growth by the Reform of Educational System***

The educational cost-sharing system has undergone significant changes with the development of the reform of educational system. The stage of compulsory education is still based on national investment. However, the situation of noncompulsory education stage gradually transmitted from the original national investment to the investment shared by country, society, and individuals. The extensive sources of educational funding objectively promote the growth of educational consumption because of the expansion of the subject scope borne by the cost of education.

### ***65.2.3 The Stimulation of Educational Consumption Growth by the Investment Income of Educational Consumption***

Human capital theory believes that human role in economic growth includes both quantity and quality, and human quality, which takes an important part in economic value will play a significant role gradually. It is chiefly the education that improves human quality chiefly. People, who deepened their understanding about the nature of educational consumption, are aware that the nature of educational investment is not only just that of consumption, but also that of investment income; meanwhile, it benefits both individuals and society and promotes people to spend more on education. Consequently, the investment income of educational consumption stimulates the growth of educational consumption.

### ***65.2.4 Upgrade of Educational Consumption: The Internal Need for the Comprehensive Human Development***

Life-long education believes that education runs through the whole life of human development instead of completing once and for all. Education should break away unreasonable rigid system and the influence of the formalism due to institutionalization and standardization so as to meet all needs of learning by the available educational resources in modern society and connect more with the nature of human beings, which contributes to the tendency of personification in education. In addition, social development requires individuals' constant learning to update knowledge and skills. Education consumption, which is lifelong and nonrefundable, is the internal need for the comprehensive human development because the consumption ability will be enhanced after one stage completion of educational consumption and it will lead to a higher level of educational consumption.

## **65.3 The Significance of Marketing Channel Construction in Consumption Upgrading Process**

### ***65.3.1 The Concept of Marketing Channel***

The authority of the American Marketing Philip Kotler has stated: “A marketing channel is a set of practices or activities necessary to promote the physical flow of goods and services, along with ownership title, from the point of production to the point of consumption and, as such, which consists of all the institutions and all the marketing activities in the marketing process. In brief, a marketing channel is the specific channel or path which transfers the goods and services from producers to consumers”. Then in education, we can consider marketing channel of education product as the specific channel or path which transfers education services from the provider to the consumer. See the marketing diagram of education products (services) as below.

### ***65.3.2 The Significance of Strengthening Marketing Channel Construction***

In economics, demand is the number of goods the consumers are willing and able to purchase in a certain period of time at a certain price level. Marketing is a process of discovering and meeting needs, in which suppliers and consumers create value through the exchange, while marketing manages this process in order to make it more effective and create maximization of value by management. The goal of marketing is to discover and meet the demand. Strengthening the construction of marketing channels of education products contributes to turn the potential demand into actual demand.. In addition, strengthening the marketing channel construction helps the supplier of education products to win competition with motivation.

## **65.4 The Characteristics and Deficiencies of the Existing Education Product Marketing Channels**

### ***65.4.1 An Important Channel for Existing Education Product Marketing is Admission and Employment Offices of Schools***

At present, admission and employment offices of schools remains an important channel for existing education product marketing. The advantage is its authority

which is widely recognized by the society while the disadvantage is that marketing channel construction is not appreciated and the high cost, low efficiency, and poor flexibility of existing marketing channels. In abroad, as education products and nongovernment education join gradually, the public education faces both opportunities and threats. Opportunities are that they can reorganize own advantages through reforming and enlarging the scale while threats are that if they do not adapt themselves to meet the requirements of social development, they will be phased out in the competition, even out of the market.

#### ***65.4.2 Nongovernment Education Develops Their Own Marketing Teams and Builds Their Own Marketing Channels Gradually, But Unstable***

As a useful complement to public education, nongovernment education grows gradually. Its growth cannot be separated from funds, and fundraising cannot be separated from the recruitment and tuition fees. Expanding enrollment to achieve scale economy helps nongovernment education reduce the cost of education. Expanding their own marketing teams and building their own marketing channels are beneficial to the enrollment expansion, but the marketing teams and marketing channels are unstable.

### **65.5 The Construction and Optimization of Existing Education Product Marketing Channels**

#### ***65.5.1 Strengthen the Marketing Function of Schools' Admission and Employment Offices***

At present, admission and employment offices of schools remains an important channel for existing education product marketing. Schools can expand enrollment through strengthening the marketing function of their admission and employment offices, and bring up a group of managerial personnel and a new marketing team as well. To strengthen the marketing function of schools' admission and employment offices, first, school leaders should attach importance to it and be aware of the role of modern education marketing; then give appropriate encouragement policies and financial support to admission and employment offices so as to ensure the harmony of the responsibilities, rights, and interests; finally, make a good job of attracting marketing talents, bringing up, and supervising them. Schools should strengthen the marketing function of schools' admission and employment offices as a whole.

### ***65.5.2 Marketing Channel Integration***

For another, we can integrate the marketing channels of educational products, including integration and unification, the establishment of specialized marketing companies of education products, opening up new marketing channels. Integration and unification refers to mutual permeation, blending, and coordination between education product providers and product sellers in functions, and product sellers can even control marketing channels by becoming a shareholder so as to form the ownership system. The specialized marketing companies established for education products can take advantage of their marketing network to serve various education products marketing to save the cost of sales. Opening up new marketing channels includes education products tour (exhibition), network marketing, overseas marketing, marketing which draws on others' experience.

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# Chapter 66

## Infiltration Characteristics Under Different Land Uses in Yuanmou Dry-Hot Valley Area

Zhiqin Liu, Nanjun Lang and Keqin Wang

**Abstract** On the basis of soil physical index determination of four land use types (arbor forest, shrub land, grassland, and bare wasteland) of Yuanmou dry-hot valley, the soil infiltration characteristics were studied. The results showed that there were differences on soil bulk density, soil porosity, initial soil water infiltration rate, and stable soil water infiltration rate. The steady infiltration rate and soil bulk density are exponential, Greater the soil bulk density, the lower the infiltration rate; smaller soil bulk density, the greater the porosity and porosity ratio, as well as the infiltration rate. Among different stands, It is observed from the research that from the average infiltration rate and steady infiltration rate, its order from high to low was arbor forest, shrub land, grass land, and bare wasteland.

**Keywords** Dry-hot valley · Forest land · Soil moisture · Infiltration characteristics

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## 66.1 Introduction

Soil water infiltration is a process of the distribution of ground water between surface runoff and subsurface runoff that has played a very significant role for the process of the water cycle and soil erosion [1]. The Study on soil moisture infiltration characteristics is of great significance for the regulatory mechanisms of hydrological processes to determine the soil water infiltration parameters of different landless types and the evaluation of soil water infiltration capacity [2, 3].

Yuanmou County in Yunnan province is the most representative districts and its habitat in southwest China is the most unique ecological environment in the Jinnah River dry-hot valley. The soil erosion becomes a serious problem in this area. To carry out the research on infiltration characteristics of soil, moisture is essential for the protection and management of the ecological environment in dry-hot valley and the local people's livelihood. This project works to study the soil permeability properties of four different landless types in Yuanmou dry-hot valley, which aims to expound the changes and laws of soil infiltration distribution of small watershed in Yuanmou dry-hot valley and provides a theoretical basis for the recovery of forestation and ecological environment in Yuanmou dry-hot valley.

## 66.2 The Overview of the Studied Area

The experimental field is within the area of the old urban and rural highway beam, a key treatment projects for water and soil conservation of the upper reaches Yangtze Region, which is 6 km away from the north of the Yuanmou county, situated at latitude  $25^{\circ}43'52''N$ ; longitude  $101^{\circ}51'03''E$ . The local climate belongs to semi-arid plateau monsoon between subtropical climate at low latitude to north tropical zone, which embraces abundant sunshine and energy resources [4]. The experimental field is situated in one of the highest area in dry-hot valley with 2670.4 h of annual sunshine hours and 6,420 MJ•m<sup>-2</sup> of solar radiation, The features vary with sufficient heat flux, high accumulated temperature, hot summer, warm winter, annual mean temperature at 21.9 °C, annual accumulated temperature at 7,796.1 °C, less rainfall, huge evaporation, low humidity. The climate is very dry with 614 mm of the yearly average rainfall. During the rainy season from June to October, this area is greatly influenced by southwest monsoon and southeastern monsoon so that the rainfall reaches 564 mm which accounts for 92 % of the total yearly precipitation. The rainfall during June – August accounts for 62 % with the maximum amount in the year.

This area is widely distributed with dry red soil with sin layer. The percentage of stone and gravel is high with bad water retention and few available nutrients [5]. The zonal vegetation type is savanna shrub grass which is with simple structure and monotonous types. With regard to the landaus types, the major types are arbor forest, shrub land, grassland, and bare wasteland.

## 66.3 The Research Contents and Methods

### 66.3.1 *The Research Contents*

Four different landaus types chosen are, arbor forest, shrub land, grassland, and bare wasteland, as the observation points of the old urban and rural areas which is 6 km away from the north of the Yuanmou county, Different landaus types have a direct impact on soil porosity. Therefore, this test works to measure the soil infiltration rates of four different landaus types, to analyze the characteristics of soil water infiltration.

### 66.3.2 *The Test Methods*

In order to eliminate the influence of soil moisture to infiltration, artificial sprinkling is implemented in advance in the observation points before the test begins. When the soil moisture is approaching to designed amount, the test can be carried out. Four different landaus types observation points are selected in the slopes of 7°–10°, The arbor forest is mainly composed of tamarindus indicia and the *Albizzia moll* with the coverage of 80 %; Shrub land is mainly constituted by the *Phyllanthus emblica*, *Barleria cristata* and other components with the coverage of 60 %; The grassland is made up of heteropogon contortus, pointier millennia, agave Americana with the coverage of 40–50 %. Bare wasteland is mainly used for grazing with low coverage due to the strong interference by local people.

### 66.3.3 *Water Infiltration Measurement*

The double-rings infiltrator instrument (the double-cycle method) can be used to observe the soil moisture infiltration. Observation lasts 120 min and can be implemented until the soil moisture reaches the state of steady seepage. At last, the infiltration capacity curve is drawn after the calculation of infiltration rate.

## 66.4 Results and Analysis

### 66.4.1 *The Soil Physical Properties of Four Different Land Use Types*

Soil porosity is a reflection of soil compactness and a sigh to reflect whether the soil ventilation permeability is rich or not. The measured results of physical properties of four different land use types are in Table 66.1. The Table 66.1 shows

that the total porosities of arbor forest and shrub land are higher than that of grass land and bare wasteland, which shows that the physical properties and structure of forest land are better than those of nonforest land. And for the total porosity, its order from high to low is arbor forest, shrub land, grass land and bare wasteland.

### 66.4.2 *The Infiltration Rates of the Different Landaus Type*

The landaus types, the average infiltration rate ,and steady infiltration rate of the first 120 min are shown in Table 66.2. It shows that the average infiltration rate of arbor forest at first 120 min is 6.67 mm/min, and the steady infiltration rate of it is 0.5 mm/min; and the steady infiltration rate of it is 0.16 mm/min which is 32.0 % of arbor forest [6, 7]. It is observed from the research that from the average infiltration rate and steady infiltration rate, its order from high to low was arbor forest, shrub land, grass land, and bare wasteland, which shows that the physical properties and structure of a forest soil are superior to that of nonforest land. Thus, this proves that the vegetation's important role is of improving soil structure.

### 66.4.3 *The Water Infiltration Characteristics of Different Landaus Types*

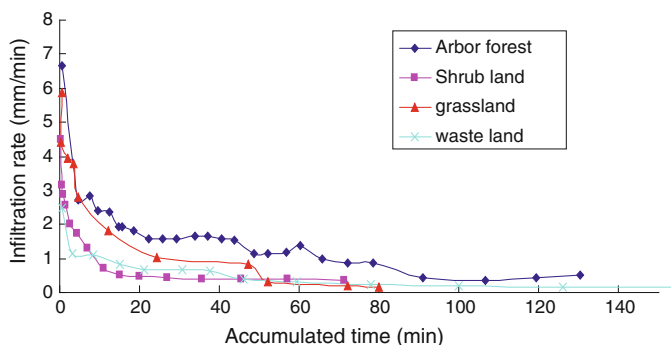
Infiltration refers to the whole process of the surface water infiltrating into the soil and migrating on the entire section. What the moisture content infiltrate the soil means the moisture content's physical movement process under the soil in the

**Table 66.1** The physical properties of soil in experiment area

Land use types	Soil thickness (cm)	Bulk density (g/cm <sup>3</sup> )	Capillary porosity (%)	Non-capillary porosity (%)	Total porosity (%)
Arbor forest	0–20	1.37	51.25	4.03	55.28
	20–40	1.57	46.54	2.12	48.66
	40–60	1.62	42.56	2.29	44.85
Shrub land	0–20	1.39	49.14	4.56	53.70
	20–40	1.61	37.28	3.37	40.65
	40–60	1.69	33.71	1.69	35.40
Grass land	0–20	1.48	48.51	4.30	52.81
	20–40	1.67	35.53	1.54	37.07
	40–60	1.77	24.95	2.06	27.01
Bare wasteland	0–20	1.62	36.13	4.79	40.92
	20–40	1.75	34.16	2.71	36.87
	40–60	1.81	22.65	1.86	24.51

**Table 66.2** The results of soil moisture infiltration experiment

Land use type	120 min mean infiltration (mm/min)	Steady infiltration (mm/min)
Arbor forest	1.67	0.5
Shrub land	1.45	0.37
Grass land	0.78	0.17
Wasteland	0.7	0.16

**Fig. 66.1** Soil water infiltration rate of four land use types

molecular force, capillary force and the combined effect of gravity. Infiltration can be divided into three stages: infiltration stage, leakage stage, and penetration stage. Soil water infiltration rates versus time of the arbor forest shrub land, grass land, and bare wasteland are plotted based on the test points, as Fig. 66.1.

Soil moisture infiltration process of different land use types is similar to each other. Extended over time, the moisture enters the soil continuously, and the soil moisture capacity is reduced and the infiltration rate decreases gradually. Figure 66.1 shows that the initial infiltration rates of arbor forest shrub land and grass land are all greater than 4.5 mm/min; The three stages are clear: the infiltration stage lasts about 30–60 min and the stable infiltration stage begins after 80–100 min. The steady infiltration rate of arbor forest is about 0.5 mm/min. And the steady infiltration of shrub land is about 0.37 mm/min, less than arbor forest. The soil water infiltration processes of shrub land and grass land are almost the same, but the shrub land's infiltration stage is shorter, lasting about 20 min, and the infiltration rate at the stage reduces significantly.

## 66.5 Conclusion

The total soil porosities of arbor forest and shrub land are higher than that of grass land and bare wasteland, which shows that the physical properties and structure of forest land are better than those of nonforest land.

Different landaus types have different characteristics of the soil water infiltration. Among them the average infiltration rate of the arbor forest is up to 1.67 mm/min and the steady infiltration rate of arbor forest is up to 0.5 mm/min, during the first 120 min of soil water infiltration process. For the average and steady infiltration rates of four landaus types, its order from high to low is arbor forest, shrub land, grass land, and bare wasteland.

Yuanmou hot-dry valley is the typical area of ecological degradation in the southwest of China, thus the management of degraded ecological environment has great significance for its economic and social development. When governing the ecological environment in Yuanmou dry-hot valley, the construction of forest plantation is an effective measure.

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# Chapter 67

## Geological Characteristic and Genesis of YuLu Pb–Sn Deposit Metallogenesis in HuiZe, YunNan

Chunzhong Ni and Shitao Zhang

**Abstract** The Yulu deposit is predominantly contained in the gray fine grained crystalline dolostone upper part of the Yuhucun formation. To determine metallogenic material source, the geological characteristics and genesis of the Yulu deposit of NE Yunnan are summarized according to lithofacies paleogeograph, the ore deposit, and isotope geochemical characteristics. From the result, this ore deposit is formed by the eruption deposit of marine volcanism and the later reformation. The gas–liquid for later alteration may be related to large area Emeishan basaltic magma eruption.

**Keywords** Yulu Pb–Zn deposit · Geological characteristics · Genesis · Huize county

### 67.1 Introduction

Yulu Pb–Sn deposit locates in Huize County, Qujing, and northeast Yunnan (Fig. 67.1). Tectonic position belongs to Yangzi par platform, plat formal fold belt east of Yunnan, seg basin, and boundary of north east direction structure zone, north–west direction structure zone and south–north direction structure zone [1].

In the mining area of Yulu, stratum is in good exposure, which reflects sedimentary environment stably [2, 3]. It is mainly for necrotic fancies of land surface which can be divided into two stages [4, 5].

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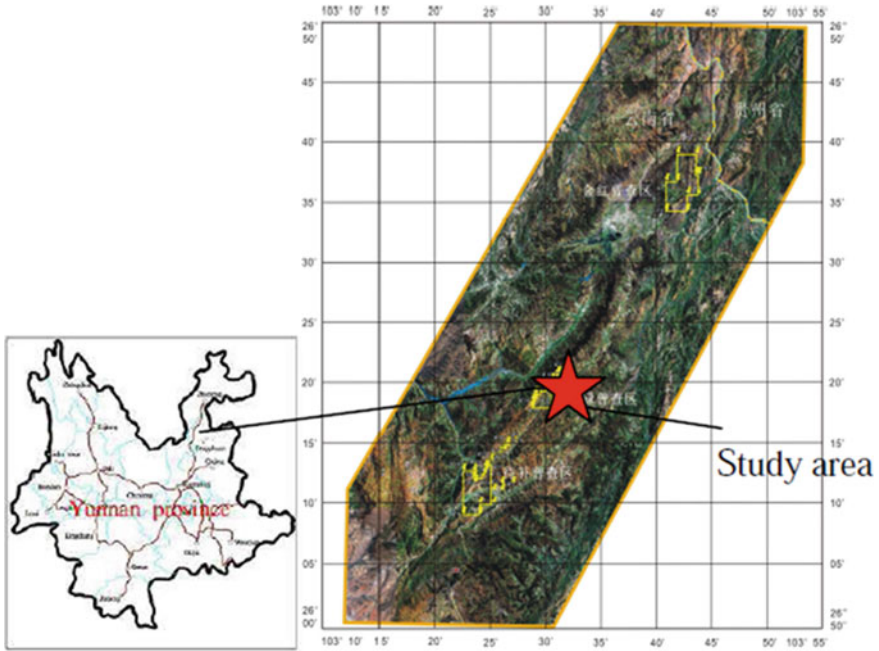


Fig. 67.1 Study area and its location

## 67.2 Geology and Lithofacies Paleogeograph Characteristic

Yuhucun formation is a diachronous stratigraphic unit which cuts across Simian Denying formation and lower Cambrian series. It is divided between Sichuan and Yunnan old land, east of Yunnan old land and northern Niushou Mountain. Yuhucun formation is also an important horizon bearing lead zinc ore, phosphorite, uranium, and rare-earth element [6]. According to two profiles, one is -Meishucun located in Wangjiawan, Jinning County and the other Xiaomaidi in Dahai, huize, Yuhucun formation can be divided into Jiucheng, Baiyanshao, Xiaowaitou Moutain, Zhongyicun, and dahai member from bottom to top.

### 67.2.1 Dahai Member ( $\in_1 y^5$ )

It is composed of gray-dark gray laminated dolomite, phosphorus dolomite, argillaceous dolomite, dolomitic limestone with limestone, and siliceous stripe on the top and lighter gray silicolites on the bottom.

### **67.2.2 Zhongyicun Member** ( $\in_1 y^4$ )

It can be split into four submembers from above to below. The first one is dolomite and phosphoresces. This submember is composed of dark gray-dark foliate-acinose stripped cherty nodule, organic matter, and biotritus with cross-stratification. The second one is dolomite phosphoresce with dark gray phosphorus silicolites and dolomite. The third one is siliceous-dolomite phosphoresce and phosphorus siltstone. The last one is concretion-breccia silicious phosphorite. The thickness of this member is from 32 to 92 m. Rocks contain  $\omega$  (Pb)  $200 \times 10^{-6}$ – $450 \times 10^{-6}$ ,  $\omega$  (Zn)  $100 \times 10^{-6}$ , and  $\omega$  (Cu)  $250 \times 10^{-6}$ .

### **67.2.3 Xiaowaitou Mountain Member** ( $\in_1 y^3$ )

On the top it is composed of gray white siliceous dolomite and phosphorus dolomite and dark quartzite with aleuvite on the bottom. The thickness is 11–125 m. it is rich in V, Cu, Pb, Zn, etc.

### **67.2.4 Baiyanshao Member** ( $\in_1 y^2$ )

It comprises light gray–gray dark-gray dolomite, siliceous dolomite, argillaceous dolomite, alleviate and aplitic algae crumb dolomite.

### **67.2.5 Jiucheng Member** ( $\in_1 y^1$ )

It is composed of purple- grayish green-dark gray stratiform silicarenite, dolomite-argillaceous shale, and contacts the underlie stratum with traces of waves.

## **67.3 Deposit Geologic Feature**

### **67.3.1 Host Rocks and Lithology**

Ore body occurred within the predominant gray fine grained crystalline dolostone upper part of the Yuhucun formation [7, 8]. Veined ore body can cut lithologic unit of Yuhucun formation. Mineralization can also be found in the feather joint of Qiongzhusi formation stratum [9].



### 67.3.2 Mineralization

Mine bodies shape and scale. Lead zinc ore bodies mainly occur in lenticular bedding along the stratum and a few as veins. Author has first discovered two Ore bodies (see Table 67.1).

Ore components. Mineral component. All the deposits are multiminerale ore bearing mainly blende, galena, pyrite, limonite, etc. The main gangue minerals are dolomite, quartz, calcite, clay, and barite.

Chemical components. The results show that the average Pb contents of main ore are 0.29–4.39 %, Zn 1.93–13.92 %. Ore usually associated with Cu, S, Mo, Mn, Fe, As, Sb, Hg, Ag, Cd, Ce, Ga, and sometimes Bi, Sn, Se, Te, Co, In, Ni, etc.

Texture and structure of ores. Ore textures are simple. They mainly have xenomorphic coarse-medium-fine particles and miasmatic relict texture. Massive, disseminated, stripped, laminated striation, breccias are the main ore structure.

### 67.3.3 Wall Rock Alteration

The most common alterations are solidification, fading, and recrystallization. Moreover, pyritization, baritone, calcification, Ferro-manganese carbonization, chlorite also can be found in the wall rock.

**Table 67.1** Isotope composition and model date of Pb–Zn ore in Yuhucun formation in yulu mining area

	Statistics number	9
Range value	$\frac{\omega(^{206}\text{Pb})}{\omega(^{204}\text{Pb})}$	16.014–19.38
	$\frac{\omega(^{207}\text{Pb})}{\omega(^{204}\text{Pb})}$	15.293–15.58
	$\frac{\omega(^{208}\text{Pb})}{\omega(^{204}\text{Pb})}$	35.728–40.37
	$\frac{\omega(^{206}\text{Pb})}{\omega(^{204}\text{Pb})}$	16.014–19.38
	$\frac{\omega(^{207}\text{Pb})}{\omega(^{204}\text{Pb})}$	15.293–15.58
Average value	$\frac{\omega(^{207}\text{Pb})}{\omega(^{204}\text{Pb})}$	35.728–40.37
	$\frac{\omega(^{208}\text{Pb})}{\omega(^{204}\text{Pb})}$	35.728–40.37
	$\frac{\omega(^{206}\text{Pb})}{\omega(^{204}\text{Pb})}$	16.014–19.38
Eigen value	$\frac{\omega(^{207}\text{Pb})}{\omega(^{206}\text{Pb})}$	15.293–15.58
	$\frac{\omega(^{208}\text{Pb})}{\omega(^{206}\text{Pb})}$	35.728–40.37
	$\frac{\omega(^{207}\text{Pb})}{\omega(^{206}\text{Pb})}$	16.014–19.38
Range value	Statistics number	9
	$\frac{\omega(^{205}\text{Pb})}{\omega(^{204}\text{Pb})}$	16.014–19.38
	$\frac{\omega(^{207}\text{Pb})}{\omega(^{204}\text{Pb})}$	15.293–15.58
	$\frac{\omega(^{208}\text{Pb})}{\omega(^{204}\text{Pb})}$	35.728–40.37
	$\frac{\omega(^{208}\text{Pb})}{\omega(^{204}\text{Pb})}$	35.728–40.37
	$\frac{\omega(^{206}\text{Pb})}{\omega(^{204}\text{Pb})}$	16.014–19.38
	$\frac{\omega(^{207}\text{Pb})}{\omega(^{206}\text{Pb})}$	15.293–15.58
	$\frac{\omega(^{208}\text{Pb})}{\omega(^{206}\text{Pb})}$	35.728–40.37
	$\frac{\omega(^{207}\text{Pb})}{\omega(^{206}\text{Pb})}$	15.293–15.58
	$\frac{\omega(^{208}\text{Pb})}{\omega(^{206}\text{Pb})}$	35.728–40.37
$\mu$	Average value	10.05
$\phi$	Range value	9.22–12.19
(T/Ma)		576
		300–1503

### **67.3.4 Ore Genesis**

Some new genetic evidences have been found on the basis of geological exploration in the region. SEDEX is related to Pb–Zn mineralization of Yuhucun formation in Yulu mining area [10, 11]. This ore deposit should be formed by the eruption deposit of marine volcanism and the later reformation.

### **67.3.5 Ore Forming Environments**

Yulu area is situated in the east margin of the Panxi rift valley at late Proterozoic era. In the west is the nearly north–south-trending Xiaojiang fault, and ZhaoTong-Qujing fault in the east. These translithospheric fractures supply abundant hot-water and all kinds of mineral matter for semi-restricted settling basin.

### **67.3.6 The Hydrothermal Sedimentary Rocks**

Lens shape baritic rocks along host stratum of the Yuhucun formation, porphyritic dolomite, silicolites such as laminated striation siliceous rock can be found in the north–west side of Tiechang.

Hydrothermal sedimentary rocks of Yuhucun formation, for example, opal, chert, chalcedony, barite, anhydrite, spathiciron, szaskaite, and kaolinite include higher Ba, Cu, Pb, Zn, Fe, As. The ore and wall rocks all have higher Ba especially. These characteristics show that syndepositional ore-forming fluid is a kind of pay hot brine different from normal seawater.

### **67.3.7 Isotope Geochemical Characteristics**

#### **67.3.7.1 Pb Isotope**

The Pb isotope constituents are very complex, weak, and intense anomalous lead both exit in the sample. Sample R7 and R3 have weak anomalous lead, and Sample R1 and R4 intense anomaly lead (see Table 67.2). The multistage of model age value is obvious. These dates show that the metallogenic matters of the deposit originated from mantle and crust. Material source is diversity and affected by the later stronger reformation.

### 67.3.7.2 S Isotope

The research results show that all samples' sculpture value is positive except that only one is negative. Negative value indicates Biological sulfur genesis while positive value ( $30.38 > S34\delta/10^{-3} > 8.84$ ) show that sulphur comes from brine sulfate.

### 67.3.8 Mineral Enclave Ingredients

Mineral enclave component of Yulu lead zinc deposit has abundant  $Na^+$ ,  $Cu^{2+}$ ,  $Pb^{2+}$ ,  $Mn^{2+}$ ,  $Ba^{2+}$ ,  $Sr^{2+}$ ,  $Co^{2+}$ . The enrichment of these elements are closely interrelated with volcano gas–liquid mobility undoubtedly.  $CO_2$ ,  $N_2$ ,  $CH_4$  content in mineral inclusions is high, and the ratio of  $H_2O$  to  $CO_2$  is low. These evidences indicate ore-forming fluids happened boiling, and mineralization is related with exhalation.

**Table 67.2** Isotope composition and model date of Pb–Zn ore in Yuhucun formation in Yulu mining area

Component	Statistics number	Range value	Mean value
$K^+$	3	0.520–4.240	2.367
$Na^+$	3	7.67–24.69	15.36
$Ca^{2+}$	2	11.55–13.85	12.69
$Mg^{2+}$	3	0.002–2.61	0.96
$F^-$	2	0.046–0.619	0.333
$Cl^-$	3	4.03–9.68	6.800
$SO_4^{2-}$	2	0.49–0.91	0.703
$CO_2$	3	18.88–133.4	64.63
$CO$	3	1.02–3.4	1.98
$CH_4$	3	0.088–1.24	0.736
$H_2$	3	0.013–0.44	0.201
$N_2$	3	6.72–14.32	10.8
$H_2O$	3	326–1408	994
$Cu$	3	1.60–2.38	2.047
$Pb$	3	0.96–1.29	1.161
$Mn$	3	5.23–8.80	6.626
$Co$	3	0.83–1.08	0.953
$Ni$	3	0.34–0.40	0.370
$Sr^{2+}$	3	2.62–144.33	49.644
$Ba^{2+}$	2	84.00–183.39	49.644
$NaCl(\%)$	3	2.77–5.73	4.710
Homogenization temperature $t/^\circ C$	3	115–282	202

**Table 67.3** S isotope measurements

Sample ID	Mineral	$\delta^{34}S/10^{-3}$
D4012	Barite	+30.38
D3021	Pyrite	+19.86
D3022	Gelenite	+8.84
D3023	Blende	+11.50
D3024	Blende	+13.94
D3026	Pyrite	-10.50

## 67.4 Conclusion

Lead zinc ore in Yulu deposit is related to Sedimentation–exhalation. It is generated in interceded fragmentation fracture. Stringer mineralization crosses the stratum. Primitive ore bed or vein enriched in interlamination slipping and feather fault through activated movement of hot brine, finally formed the stratoid, lenticular, veined rich lead–zinc mine body. The gas–liquid for later alteration may be related to large area Emeishan basaltic magma eruption.

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# Chapter 68

## Community Care Platform Based on Interviews with Typical Health Care Institutions

Haiying Wang and Suting Li

**Abstract** At present, the health care institutions tend to have small development ability and medical care that only focus on basic life care. In this paper, a community care platform structure provides the integrated care and large hospital that form a complete set of community nursing regime. In this study, we will explore some of the classic development themes of digital solutions, based on a typical medical and health institutions' interview, and then analyze the pain.

**Keywords** Community care · Architecture · Collaborative regime

### 68.1 Introduction

Provided seamless help community takes care of elderly, it covers the many organizations, such as hospitals, day care centers, nursing homes, building, and so on. However, each organization often plays a different role in the community care. For example, the institutional care service scattered on three management systems [1].

Department of health: Business units to provide nursing journals and technologies, such as journal hospitals, nursing homes, nursing home care, and daily health.

Department of social affairs: Provides service institutions in the daily courses, such as care center, auxiliary life, family services, and nursery.

Veterans' affairs commission: The system acts across health systems and social affairs systems, and it provides veterans' health and medical care.

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Due to the lack of interoperability, all the resources in these three types of system are independent and cannot be shared.

In addition, there are a lot of applications of information technology, such as medical, mobile medical, safety of drugs, health and nutrition, electronic health records, e-nursing tram that are used in order to realize the hospital needs of medical treatment. But information process in different care institutions and many backward hospitals may hinder progress in digital nursing [2, 3].

## **68.2 Requirement Analysis and Development Tendency**

### ***68.2.1 Requirement Analysis***

This study has several session experts' speech and interviews, and the goals include the execution of the high level medical center in relevant project, the main doctors, nutritionists, owner of the care, therapists, and so on, in discussed institutionalization innovation service mode to take care of. Based on the discussion of the results, we put forward three requirements viewing all areas of the requirements to achieve [1, 4].

#### **68.2.1.1 Hospitals' Perspective**

Most people think that any disease is best treated in a medical center; many patients would rather spend money to live in medical center, thus refused to enter institutions; thus, it influences acute disease distribution of resources. Large public hospitals cooperate with care institutions, so that patients can get in the process of continuous treatment organization, which is additional and pure transfer service investment. Private medical center can control their money and design cooperative strategy using reputation and looks to attract health care as strategic partners, and form a chain of institution care systems. However, the country's largest hospitals are often public medical institutions having less choice as partner [5].

#### **68.2.1.2 Care Institutions' Perspective**

Turnover rate is very high in the agency personnel, nursing quality is uneven, when the situation happened to residents, and they tend to be sent directly to the hospital, in order to avoid unnecessary medical liability. This requires standardized guidelines and on-the-job training, so that agency personnel can increase their service ability and the quality of care. However, in addition to daily service, a lot of time spent on the construction of the need to record on paper. If further education is necessary, the service time will be compressed. Meanwhile, resident's

nutrition depends on the mastery of care in institution between the key unit cost and quality of care.

### **68.2.1.3 User Residents' Perspective**

Usually, people spend more money in the hospital to get better care and refuse to transfer into institutions. Institution residents often have several types of disease; cross-medicine conflict is often ignored. Chinese traditional “caring about yourself at home“ is also a reason for elderly patients with agency to refuse to enter.

## **68.2.2 Development Trends**

At present, they tend to do publicity in small units in the family, but in large numbers. This is compatible with national policy “as the main body, community care added”. According to the researchers’ understandings on the present situation and by discussing the experts, we put forward the following suggestions: The development of information organization care.

Small health care for limited resources, so they can rely on other medical institutions in partnership with the hospital, and use information technology to provide the exchange between hospital and institutions. It exchanges Information, including medical data, and inquires hospital, and nutrition, recovery, and drug management, and so on.

At present, health care institutions lack this kind of information. In exchange for information of the hospital, in care of the informatization level up. Improving university informatization level can start from emphasizing the information level of organization the information management of evaluation criteria, financial aid.

In the development of information, hardware, this would solve the problem of some of the files. In the days ahead, we can introduce e-nursing work outside the tram, reduce the daily record the activities of the association.

The current health level seven (an HL7) association is propose agreement standard data exchange, and medical IC card storage contents of research. In the future, when doctors prescribe, they can point to their medical history and industry use electronic data security precedent reducing conflict and cross-medicine [6].

Care institutions executive focuses on types of nursing activities, relative to the home visits and door cover NWS-door to take care of the patient. The doctor can regularly provide mobile medical services, and add appointment through the remote access convenience, it can reduce the time and money spent on health care workers due to the traffic problem.

The use of standardized records, rice, and nutrition health care system, nutritionists need not really care institutions to provide proper nutrition evaluation institutions residents, nutrition plan, nutritional diet, and personalized nutrition care.

## 68.3 Solution Design

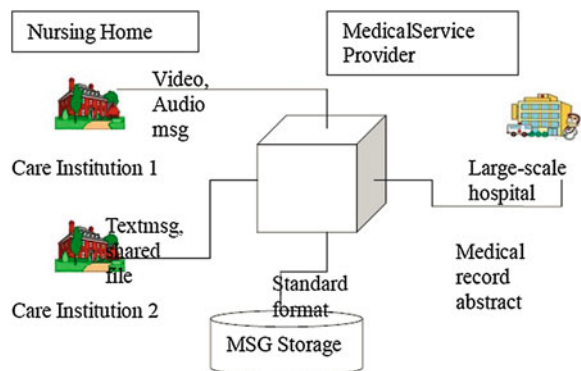
### 68.3.1 Community Care Platform Architecture

According to the mentioned requirements above, we propose a Community Care Platform Architecture (C. C. P. A.). Based on the C. C. P. A., the medical staffs of the nursing homes and hospitals would provide collaborative care service for the patients. The electric health records, electric patient records, real time vital signs of the patient for monitoring, and the video and voice for medical interacting will be exchanged between different care service providers via the C. C. P. A. The messages exchanged on the C. C. P. A. will follow the standard protocols such as HL7, DICOM, PACE, and stored in a central database system. The structure is shown in Fig. 68.1.

### 68.3.2 Function Blocks Description

Figure 68.2 indicates how the interaction operating between the care institution and large-scale hospital. The platform provides many function blocks for care service integration, like vital sign monitoring, rehabilitation management, nutrition evaluation, medical consultation, transfer instruction, distance learning, event handling guideline, and so on. Care institution and hospital can provide collaborative service using the function blocks by going through the institution service portal. These function blocks are designed for the common function to fulfill the interoperation among different organizations. The platform also provides the interface for integrating the existed legacy system, such as video conference system, case management system, nutrition care system, HER system, wireless medical devices, and so on. Therefore, many remote medical services and seamless services are constructed based on the platform. Hospital can help nursing home to monitor the resident's vital sign and provide medical consult when

**Fig. 68.1** Structure of C. C. P. A





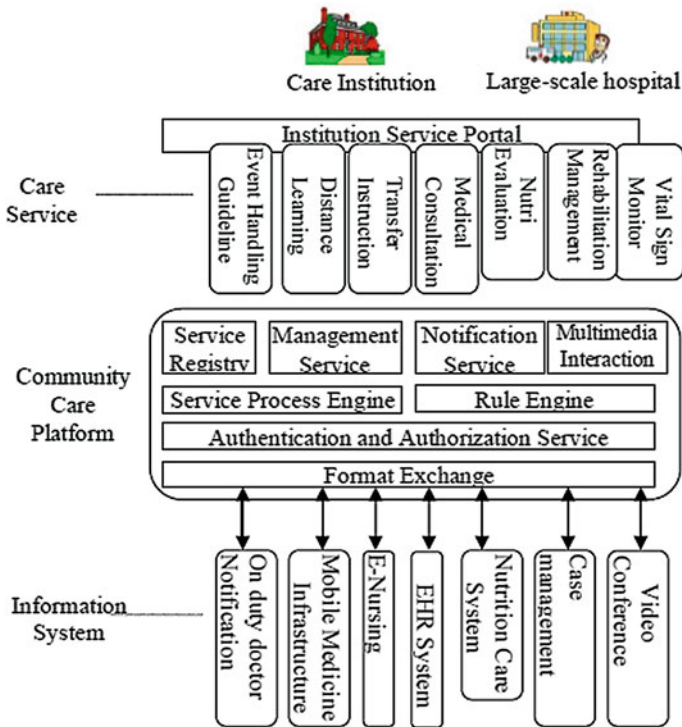


Fig. 68.2 The function block of C. C. P. A

needed. Doctors in hospital can help rehabilitation management in nursing home. When emergency will occur, the resident in nursing home will be transferred to the hospital immediately, the medical records and health record will be transmitted from nursing home to hospital via platform rapidly.

The core components of the C. C. P. A. include Service Registry, Management Service, Service Process Engine, Notification Service, Multimedia Interaction, Rule Engine, Authentication and Authorization Service, Format Exchange. Multimedia interacting platform framework is shown in Fig. 68.2. We briefly describe them as follow.

### 68.3.2.1 Service Registry

Services providers register services information in the platform. After verification, Services are open to users. Register information includes: network address, WSDL address, and encryption, provides reliable message mechanism, and so on. Each service must register in C. C. P. A. before providing service.

### **68.3.2.2 Management Service**

As a result of C. C. P. A. integrating lots of diversify services, the platform provides logging tools. Users can use this tool to monitor and trace services execution status. This module requests the special account to acquire access permission.

### **68.3.2.3 Services Process Engine**

This module is the core module, which handles services lifecycle management, check point restoration, and message interflowing. Be the control center of service, a lot of control signals and messages are delivered here from Service Registry and Management Service.

### **68.3.2.4 Notification Service**

It provides e-mail and cell phone messaging mechanism in order to notify patients and family events or messages. A Web-based control site is provided for setting the delivery rules, which includes the message type, message receiver, delivery frequency, and so on. The events to invoke the notification are made by Rule Engine, which monitors all signals around the platform.

### **68.3.2.5 Multimedia Interaction**

The audio and video communication encoder and decoder are integrated in this module. It provides multimedia signal transferring function for calling the net meeting, distance learning, telemedicine, or teleconsult between care institution and large-scale hospital.

### **68.3.2.6 Rule Engine. C. C. P. A.**

C. C. P. A. has many management functions, and it also needs some rule comparators to determine the follow-up action. These rule comparators are integrated in this module. The rules are set by configuration files and a basic webpage, which is decided by the configuration files.

### **68.3.2.7 Authentication and Authorization Service**

All security related services are provided by this module. It provides methods that include accounts/password, certificate for authentication, and resources that have limits of authority. Before each service invokes other functions to complete the service, an authorization will be generated in this module, and all modules need authorization to respond to the request.

### 68.3.2.8 Format Exchange

All the formats of multimedia, messages, and records are transformed by this module. Different signals are transformed to standard format. This module also provides the interface between platform and legacy information system.

## 68.4 Application Scenario Description

Community nursing existing legacy system integration platform is provided by health care institutions. Medical personnel in the organization can be connected through services portal platform to get help of large hospitals. Below are two typical application scenarios: important living organisms to monitor service and remote teaching services.

In the usual teaching hospitals and nursing home care personnel in synchronization. This platform can be used to share knowledge distance between the different medical institutions teaching services. Video conference system service not only set, case management system, but teaching materials and data can be transferred to discuss any member to join in the same class. The distance teaching service will help to improve the ability of professional medical personnel nursing home.

## 68.5 Conclusion and Suggestion

Institutions and hospitals, and use remote access technology, reduce unnecessary medical diagnosis and speed up the time between response times, so as to improve the quality of medical institutions. We also provide typical health care institutions' function of ideas. Medical equipment businessman and information integration merchant can find a new direction of development, and the input domain for good early opportunity.

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# Chapter 69

## Research on Improving the Effectiveness of Blended Learning

Shengjian Chen

**Abstract** Using action research method, the blended learning strategy, and learning model of public course Modern Education Technology for the normal students of the previous time is analyzed and improved, and also the learning attitude and effect of students after the improvement of the teaching are empirically researched.

**Keywords** Blended learning · Modern education technology · Action research

### 69.1 Introduction

In blended learning, high importance is attached to the combination of the advantages of both traditional learning way and digital learning way, thus making the two sides mutually complement in advantages and achieving the optimal learning effect [1]. However, in the process of the implementation of the blended learning, how should teachers make blended learning achieve the desired objectives? With the purpose of discussing the effective strategies of applying blended learning in public course Modern Education Technology of education program of Qujing Normal University, an action research on the blending learning based on the network learning platform (i.e., Moodle) is conducted in this paper.

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## **69.2 Research Problems Proposed**

Typical problems include (1) the attitude of students in learning is not positive enough and (2) the learning effect of students is not ideal.

## **69.3 Causes of the Problems**

Through investigation main causes of the problems can be concluded from the following four aspects.

First, the timeliness of teaching contents is not strong: 37 % of the students generally reflected that what they have learnt does not have a close relationship with their program.

Second, the way of evaluation is not scientific enough: 45 % of the students thought that the way of evaluation applied in courses could not give a reflection to the learning effect of students.

Third, in network learning, 51 % of the students thought that the learning contents provided online are repeated with the teaching contents in paper-based textbooks.

Fourth, in network teaching platform, the interface of the platform is too dull and boring and also shortage of artistic quality.

## **69.4 Determining and Implementing the Methods of Solving Problems**

### ***69.4.1 Changing Classroom Teaching and Learning Tasks of Students***

Table 69.1 shows the comparison on classroom teaching and learning tasks after and before course reform.

### ***69.4.2 Updating the Resources of the Network Learning Platform***

Resources in platform, in addition to electronics teaching materials, are necessary to play the advantages of digital textbooks.

**Table 69.1** Comparison on classroom teaching and learning tasks after and before course reform

Teaching content	Teaching method in control group	Teaching method in reference group
Introduction to education technology	Classroom teaching: teach the concept, intension, emergence and development of education technology as well as the importance for students in education program to learn education technology to students through PPT	Classroom teaching: view and emulate a case about “a middle school teacher teaches English with multimedia and network” at classroom and discuss it with students for guiding students to understand related concepts and nature of education technology
	Learning task: browse Relevant resources on teaching platform and complete online test	Learning task: discuss how to analyze and define the case with AECT94 in the network teaching platform
Basic theories of modern education technology	Classroom teaching: teach the main ideas and teaching applications of behaviorism, constructivism, audio-visua,l and other learning theories one by one through PPT	Classroom teaching: show students application cases of various learning theories English education technology and draw up a conclusion on views of theories
	Learning task: browse relevant resources on teaching platform and complete online test	Learning task: discuss what theory is applied in a case by combining the given theory application cases online and the promotion role of theory in the learning of students
Acquisition and edition of text materials	Classroom teaching: introduce methods of acquiring text materials at computer room, and demonstrate texts and images mixing-arrangement technology through electronic classroom broadcast	Classroom teaching: demonstrate a process of making a middle school English exam paper at computer room
	Learning task: complete a case of texts and images mixing-arrangement with word	Learning task: complete the making of an English exam paper of “.PDF” given on the teaching platform
Acquisition and edition of image materials	Classroom teaching: introduce the methods of acquiring image materials at computer room and learning simple image processing techniques such as screenshot, sectional drawing and image synthesis with Photoshop	Classroom teaching: introduce the methods of acquiring image materials at computer room and learning simple image processing techniques such as screenshot, sectional drawing, and image synthesis with Photoshop
	Learning task: cut, render, remove speckles, buff skin and synthesize person’s given photos to achieve given effect	Learning task: shoot a group of your own photos with a digital camera, and cut, render, remove speckles, buff skin, and synthesize images and make these photos into a personal digital photo album.

(continued)

**Table 69.1** (continued)

Teaching content	Teaching method in control group	Teaching method in reference group
Acquisition and edition of sound materials	<p>Classroom teaching: introduce fundamentals of sound and the functions of sound editing software Goldwave one by one using PPT through at computer room</p> <p>Learning task: 1. Recording sound and contents “I am XXX (name)...” with sound editing software Goldwave</p> <p>2. Synthesizing sound: three students are in one group, and synthesize the sounds recorded on step 1 with Goldwave, and then add into background music and save as “.wav”</p> <p>3. Converting format: convert the sound files synthesized on step 2 to “.mp3” format with “format conversion factory”, and then compare the size of two sound formats</p>	<p>Classroom teaching: students are required to independently learn at computer room; no teaching but guidance is provided for them</p> <p>Learning task: complete a task under the help of sound editing software “Gold wave” network video tutorial and application cases</p> <p>1. Record an introduction to school with mobile phone in English and also copy it in computer</p> <p>2. Three students are in one group, and integrate sounds recorded on step 1 with sound editing software “Gold wave”, and also add into school song as background music and save as “.wav”</p> <p>3. Convert format</p>
Making of multimedia courseware	<p>Classroom teaching: teach types and basic design/development flows of multimedia courseware through PPT</p> <p>Learning task: choose any of teaching contents, design and make middle school English multimedia courseware for an hour with PowerPoint; the courseware is required to be completed</p>	<p>Classroom teaching: teach types and basic design/development flows of multimedia courseware through PPT, and demonstrate PPT courseware design/development cases</p> <p>Learning task: 1. Design and make middle school English multimedia courseware for an hour with PowerPoint; template is required to be independently made and courseware has to be completed</p> <p>2. Three students are in one group, and carry out multimedia teaching with designed and made PPT, and also give evaluations mutually</p> <p>3. Integrate teaching video and PPT into streaming media courseware with software Producer</p>

(continued)



**Table 69.1** (continued)

Teaching content	Teaching method in control group	Teaching method in reference group
Acquisition and edition of network resources	<p>Classroom teaching: introduce types of education resource, common education resource websites, network resource download tools, blogs, and other network education application tools at classroom through PPT</p> <p>Learning task: apply for a Blog and search an interested thesis related to the application of information technology in middle school English, upload the thesis into the Blog and also write down personal experience, and then post the Blog address in the attachment of homework</p>	<p>Classroom teaching: introduce types of education resource, common education resource websites, network resource download tools, blogs and other network education application tools through electronic classroom broadcast PPT courseware of computer room</p> <p>Learning task: 1. Select a blog host and register a personal blog 2. Search an interested middle school English courseware with BAIDU and upload it into your blog, and also evaluate its advantages and disadvantages, and then post your blog address into the attachment of your homework</p>

### ***69.4.3 Cultivating the Habit of Students in Network Learning***

First, some network learning contents that have a close relationship with teaching contents are necessary to be carefully selected, and also learning contents can be expanded through the way of hyperlinks. Second, topics that can stimulate students to make discussions can be created. Third, because students often browse information that has nothing to do with course learning in network learning course, a tour of inspection at classroom and electronic screen monitoring measures can be taken.

### ***69.4.4 Improving the Way of Evaluation on Learning***

New way of evaluation is “total scores = attendance result (10 %) + online learning result (10 %) + daily assignment completion (30 %) + final exam result (20 %) + final closed-book written exam result (30 %)”.

### ***69.4.5 Improving the Teaching Platform***

The measure of improving the teaching platform can be taken.

**Table 69.2** Statistical data of observation on learning attitudes and network learning of students

Statistical item		Experiential group	Control group
Statistical items in observation of learning attitudes of students	Person-times of students attending class late	18	62
	Person-times of students cutting school for no reasons	14	34
	Percentage of students distractible at classroom	7	12
	Person-times of students handing in homework late	34	52
	Person-times of students plagiarizing homework of others	5	73
	Number of students discussing superficial posts	43	82
	Person-times of students often browsing web pages irrelevant with course in intensive online learning class	22	108
	Online learning track items (automatic tracking statistics of network teaching platform)		
	Person-times of students browsing network resource	2182	1621
	Number of posts replied by students online	1860	925

## 69.5 Implementing Evaluation on Effect

Empirical research method was used for testing.

First, students in two teaching classes of the same grade and the same program in the current semester were selected as research objects. They were divided into two groups: experiential group included 68 students; control group included 60 students.

Second, research tools included (1) self-made “table for recording the observation on learning attitudes of students” and statistical table of network platform learning and (2) final written exam paper.

Third, research results and analysis are shown below. First, record data on observation on learning attitudes of students is analyzed. From Table 69.2, students in experimental group after course reform were significantly better than students in control group in all sorts of data.

Second, results of final exam are analyzed. After the end of course reform, closed book exam was taken in experimental group and control group with course

**Table 69.3** Descriptive statistics of two groups

	Group	<i>N</i>	Mean	Standard deviation	Standard error mean
Score	Group1 (experimental group)	60	78.9167	9.7754	1.9954
	Group2 (control group)	60	70.9545	12.1596	2.5924

**Table 69.4** *F*-test and *t* test results of exam scores

		Levenes's test for equality of variances				<i>t</i> test for equality of means				
		<i>F</i>	Significance	<i>t</i>	df	Significance(2-tailed)	Mean difference	Standard error difference	95 % confidence interval of the difference	
								Lower	Upper	
Equal variances assumed		1.276	0.254	-2.463	44	0.018	-7.9621	3.2203	-14.389	-1.421
Equal variances not assumed				-2.474	40.23	0.019	-7.9621	3.2614	-14.57	-1.342

reform test papers, and there were 60 students to participate in the exam, respectively. Then, data was statistically analyzed with SPSS13.0.

Through Tables 69.3 and 69.4, it can be known that learning results of students in the class improved blended learning and there was significant improvement.

## 69.6 Finding the Shortcomings

First, the recognition of students on the importance of course learning is necessary to be increased. Second, the information learning environment of students is necessary to be improved.

## 69.7 Conclusion

Through this research, the author becomes more powerful in the teaching of Modern Education Technology than previous time, and also can get an understanding of the learning, progress and direction of students through systemic and scientific method, and thus the teaching objective can be achieved [2].

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# Chapter 70

## Study on Model of Industries to Relocate to Less Developed Regions

An'ning Cai

**Abstract** Industrial transfer is influenced by governments, the centrifugal force of transfer regions and attraction to industries to relocate. The role of local government is obviously stronger than the role of market forces in Chinese regional industry transfer. Compared with developed regions in the eastern coastal areas, less developed regions have a comparative advantage in land, labor, energy, space. Because developed regions are suffering the rising cost of land and labor, the shortage of energy, the development of small space, the diminishing of enterprise marginal utility. Under centrifugal forces and attraction forces, there are massive industries transferring from developed regions to less developed regions. In order to integrate with the developed regions, the less developed regions should seize the great opportunities of massive industrial transfer, identify the direction of industrial transfer, build the industrial zones and clusters, and optimize the developmental environment.

**Keywords** Less developed regions · Industrial transfer · City belt along the Yangtze river in Anhui

### 70.1 Introduction

Reducing regional difference and seeking balanced regional development is one of the goals of the “national twelfth five-year” regional plan. Also, industrial transfer is an effective way for optimizing the space layout of productivity and generating a

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reasonable industrial division system. In the theory of industrial transfer, there are global value chain theory [1], labor-intensive industrial transfer theory [2], industrial multinational gradient transfer flying-geese development model theory [3], marginal industrial expansion's industrial transfer theory [4, 5], international production compromise theory [6], and product life-cycle theory [7] from foreign countries; the domestic scholars mainly focus on technology transfer gradient [8, 9] and anti-gradient [10] theory, similar industry industrial transfer theory [11], and industrial transfer location theory [12]. In this paper, from the perspective of less developed regions, undertaking industrial transfer mechanism and mode are analyzed.

## **70.2 New Trend of Industrial Transfer**

Globalization and informatization have changed the trends, characteristics, backgrounds, and conditions of the international and domestic industries, and have also greatly promoted the development of emerging industries and the transfers of declining industries and vulnerable industries in the world's developed countries (areas) and China's eastern coastal developed regions.

### ***70.2.1 Asia-Pacific Region Becomes a Key Region for the Transfer of International Industry***

Seen from the international scale, the Asia-Pacific region has changed into an ideal investment location of international capital and multinational company transfer. Meanwhile, China's eastern coastal developed regions have become the main places for undertaking the international industrial transfer because of the constant improvement of the investment environment.

### ***70.2.2 Mass Industrial Transfer has been Implemented in China's Developed Regions***

First of all, the scale of industrial transfer becomes bigger and bigger. Second, transferred industries are mainly majored processing and manufacturing industries. Third, the transfer of upstream industries mainly rely on energy resources trends to be more obvious. Fourth, product origins are relatively concentrated.

### ***70.2.3 Industrial Transfer is Accelerated by International Financial Crisis***

The outburst of financial crisis in 2008 made the progress of new industrial transfer accelerated. Because of the impact of the global financial crisis 2008 on the eastern region, the export volume was quickly reduced, and simultaneously confidence of investors was in a serious shortage [13]. With the purpose of reducing cost and developing huge potential domestic market, enterprises in the eastern region chose to transfer to less developed regions in the provinces or the middle and western regions.

## **70.3 Dynamic Mechanism for China's Developed Regions to Undertake Industrial Transfer**

### ***70.3.1 Power of Local Government***

Power of local government can play a more significant role in the regional industrial transfer of China than the market power of the international industrial transfer.

The role of the power of local government in industrial transfer can be classified into positive role and negative role. The positive role comprises of providing finance and tax subsidies, and land preferential, improving regional infrastructure and institutional environment, influencing cost-benefit of enterprises, and comprehensively promoting industrial transfer [14].

### ***70.3.2 Transferring Regional Centrifugal Force***

At present, more than 80 % of China's processing enterprises are concentrated at the eastern region, and also the international industry that is cored at the manufacturing of electronics, information, automobile, and automobile parts is accelerated to transfer to the eastern region.

### ***70.3.3 Attractions of Regions to Undertake Industrial Transfer***

In China less developed regions, the industrial development spaces are large, element cost advantages are highly significant, market is considerably broad, and

also the return on investment is high. In similar industries, the eastern regions own a powerful competitiveness comparatively, and have changed into new advantageous production locations for declining industries in developed regions with each passing day.

## 70.4 Model of Industrial Transfer

According to the scale, scope, dominant factors, and motivation of industrial transfer, the model for less developed regions to undertake industrial transfer can be divided into the following seven modes [15].

First, industrial transfer is oriented at cost reduction. According to the theory of gradient transfer, the manufacturing industries are transferred from the countries and regions with high gradient-industries to the countries and regions with lower gradient industries. Second, industrial transfer is oriented at resource utilization. Seen from the increase of upstream supply efficiency and the reduction of logistics cost, it is an optimal selection scheme for manufacturing enterprises to be closer to the raw materials. Third, industrial transfer is oriented at market development. Generally, the places with large market demands will be selected by enterprises. For the enterprises that focus on domestic market, they often seek to break the limitations of regions and expand market cross regions in the process of development and expansion. Fourth, industrial transfer is oriented at cluster attraction. Cluster transfer refers to the transfer of industrial clusters as a whole. A network system can be commonly formed because there are closer geography, high correlated business, and tight cooperation for enterprises within an industrial cluster. Fifth, industrial transfer is oriented at strategic investment. Industrial transfer oriented at strategic investment means that the enterprises, which take diversified management as the goal, can often take over the business, technology or brand of the enterprises of middle and western regions under a poor business management by injecting investment via joint venture cooperation, restructuring, and merging. As a result, they can access to a new industry and own a mature business, technology or brand. Sixth, industrial transfer is oriented at independent innovation. It is necessary to take resource carrying ability and ecological environmental capacity as an important basis for the undertaking of industrial transfer. Also, it is necessary to strictly control the threshold into an industry and promote resources to be intensively conserved and utilized. Seventh, Industrial Transfer is Oriented at Policy Guidance. Through the arrangements of institutions and policies as well as the legal and economic means, government plays an influence on the economic relationship of people, and thus achieves all kinds of purposes such as promoting economic growth, carrying out fair distribution, increasing employment, protecting innovation, and encouraging invention [16].



## 70.5 Empirical Example

In January 2010, the state council of China officially approved the plan of constructing a demonstrative industrial transfer region in the city belt along the Yangtze River in Anhui. Since then, the demonstrative industrial transfer region in the city belt along the Yangtze River in Anhui was incorporated into the national development strategy. The demonstrative industrial transfer region in the city belt along the Yangtze River in Anhui comprises of nine cities (Hefei, Wuhu, Ma'anshan, Anqing, Chizhou, Chaohu, Chuzhou, and Xuancheng) as well as Jin'An District and Shucheng County of Liu'an. By the end of 2009, nearly 45 % of the population, 68 % of the industries, 42 % of the agriculture, and 56 % of social purchasing power of Anhui province are concentrated in the Yangtze River in Anhui [17].

### *70.5.1 Analysis on the Dynamic Mechanism for the City Belt Along the Yangtze River in Anhui to Undertake Industrial Transfer*

The city belt along the Yangtze River in Anhui owns a good investment environment, location advantage, industrial advantage, education as well as science and technology advantage, resource advantage and cultural advantage, and other attractions. All these are helpful for undertaking industrial transfer and promoting rapid economic growth. First, location advantage is good. The city belt along the Yangtze River in Anhui connects the west and the east of China and also links the south and the north of China, and owns a gold waterway of nearly 800 m. Therefore, it is obvious that the city belt to own a good geographical advantage, and is an important part of the Yangtze River Delta. Second, industrial advantage is good. The city belt along the Yangtze River in Anhui also owns a good industrial foundation and a comprehensive supporting capacity. At present, there are a great number of well-known domestic enterprises such as Ma'anshan Iron and Steel, Cherry Automobile, Anqing Petrochemical and CONCH. Third, scientific education advantage is good. There have been 95 higher learning schools, more than 200 provincial or above scientific research institutions, and 45 national and provincial key laboratories in Anhui province. In fact, most of them are concentrated in the city belt along the Yangtze River in Anhui. Fourth, Resource Advantage is good. There are abundant mineral resources, sufficient land resource as well as rich tourism resources. Fifth, cultural advantage is good. The city belt connects with Jiangsu, Zhejiang, and Shanghai, and also has common historical culture and similar customs with the three provinces. Therefore, there is a profound industrial foundation in this city belt.

### ***70.5.2 Model for the City Belt Along the Yangtze River in Anhui to Undertake Industrial Transfer***

First, industries oriented at cost reduction can be undertaken by the city belt along the Yangtze River in Anhui. At present, industrial transfer from the eastern region is mainly oriented at cost reduction; most of the transferred industries are labor-intensive industries that need a large number of labors, lands, water, and electricity, in which a strong industrial transfer tendency, therefore, is reflected. Second, industries oriented at market development can be undertaken by the city belt along the Yangtze River in Anhui. At present, it is urgent for some traditional processing industries in the eastern region to develop new markets. They are highly necessary to transfer industries to the regions with a market covering a large area, so as to promote products to the wider domestic markets. Third, cluster supporting industries can be undertaken by the city belt along the Yangtze River in Anhui. Industrial supporting advantage is one of the most important conditions for the city belt along the Yangtze River in Anhui to undertake industrial transfer. Currently, many advantageous industries as well as backbone enterprises have been cultivated in this city belt.

### ***70.5.3 Strategies for the City Belt Along the Yangtze River in Anhui to Undertake Industrial Transfer***

First, it is necessary to make an update to idea. That is, it is necessary to get innovation development idea, positively learn new things, and make full use of the successful practices and experience of Jiangsu, Zhejiang, and Shanghai in innovating development idea. Second, it is necessary to make an update to industries. That is, it is necessary to closely focus on the local leading industries and actively implement differentiated undertaking policies. Third, it is necessary to make an update to institutions. That is, it is necessary to speed up institution mechanism innovation and the connection with Jiangsu, Zhejiang, and Shanghai in investment promotion, foreign trade, salary and compensation system, tax system, and social insurance, etc. Fourth, it is necessary to make an update to infrastructures. That is, it is necessary to construct infrastructures at the same time, commonly promote the major infrastructure network construction under the guidance of government, seamlessly and overall combine and develop the comprehensive infrastructures in transportation, water transport, aviation, energy and information, and speed up the “same city effect” in the Yangtze River Delta. Fifth, it is necessary to develop human resources. Peasants returning from urban areas are valuable human resources, because they used to receive technical trainings and had been influenced by the sense of commodities. Thus, these peasants can play a helpful role in making an update to new industries. Therefore, it is necessary for the city belt

along the Yangtze River in Anhui to be firmly rooted in the modern industrial system and new industrialization road, and be constructed into an inland modern manufacturing base that is not only new and also open.

## 70.6 Conclusion and Suggestion

In the new trend of international industrial transfer, China's less developed regions to undertake industrial transfer possess their own mechanism and model. First, the power of local government is the main motivation for China's less developed regions to undertake industrial transfer. The power of local government plays a directly decisive role in the motivation of undertaking industrial transfer. Second, under the action of the eastern coastal developed regions' centrifugal force and the less developed regions' attraction, industrial transfer tends to feature increasingly greater capital scale and diversified transfer models. Third, the city belt along the Yangtze River in Anhui owns a good regional environment in undertaking industrial transfer and exerting regional advantages, and therefore can be created into an inland modern manufacturing base and a demonstrative region of undertaking industrial transfer. China's less developed regions, to undertake industrial transfer, are necessary to seize the gold time of recent 3–5 years, positively exert the role of government, and make an improvement to investment environment and promote industrial concentration distribution, two-sided industrial transfer development and structural optimization under the guidance of market and the premise of voluntary cooperation, and by taking the structure adjustment as main line and the institutional mechanism as driving force.

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**Part VIII**  
**Green Management Engineering**  
**and Applications**

# Chapter 71

## A Locating Approach of Sharing-Resource in Business Collaboration System

Jing Li

**Abstract** In computer-support coordination working systems that coincide with the total target is achieved and partners individual profit also being involved in, becomes an effective way to solve the rival conflict. The sharing resource itself in the system as a partner inevitably has its profit appealing. Locating the sharing resource in an optimal position to improve the utilization of resource, can moderate every side. To address this problem an adaptive resource locating strategy is introduced, which is dynamically depending on current conditions, offering improved scalability of the overall system, able to achieve global optimized placement location. Through experiment and analysis, we show that our approaches are effective.

**Keywords** Business coordination · Distributed system · Resource sharing · Contest

### 71.1 Introduction

Computer-supported cooperative work (CSCW) is a term that indicates supporting multiple individuals working together with computer systems, which will improve the human being's working efficiency and quality [1–5]. Along with development of the grid and cloud computing, CSCW enters a new phase [6]. Conventional CSCW researches focus on mutual cooperation of individuals, but do not pay

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enough attention to the individuals' universal content and conflict. For example, a few participants cooperatively accomplish a business, and of course they have a pursuit of an overall goal, however, there are benefit conflicts, so they usually make their best to get themselves more profitable. In a word, participants need to negotiate among each other to form a solution that is satisfiable by all parties. Accordingly, a new topic of research arises.

We want to get harmonious in a group, but the existence of individuals' benefit conflicts doubtlessly adds the complexity of CSCW. CSCW system is made up of four fundamental elements, namely member role, sharing-resource, cooperative activity, and cooperative affair [7]. In the system, sharing-resource itself is a participator, certainly having its benefit appealing. How to ensure the best location of sharing-resource, improve its efficient availability, realize optimization of resource collocation, and then accomplish the coordination of benefit, is the problem we want to address.

## **71.2 Problem Analysis**

A scenery with respect of problem is built up: for an ultimate product, there is a manufacture as a core enterprise, surrounding which a cooperation system is formed including a lot of assistant enterprises brings component, sales, after service, and so on. These assistant enterprises are called first class assistant nodes, which also could be core enterprises, and surrounding with many second class suppliers, sellers called as the second class assistant nodes of the chain. Similarly, under the second class assistant nodes, there might be subordinate assistant nodes. So this is a multicore Business cooperation system.

In terms of large-scale dynamic distributed system environment such as grid, excepting one or more leading enterprises, the other assistant companies can dynamically take part in the business. In the cooperative project involving sharing-resource, the provider of sharing-resource can be looked as an assistant enterprise. Then there is an issue that should be resolved: how to dynamically select or locate the provider enterprise of sharing-resource.

## **71.3 Model of Resource Location**

### ***71.3.1 Model Definition***

For establishing a model of resource location, we have the following definitions.

**Definition 1:** Business cooperation system BC (t)

We define a business cooperative system as a four-tuple for a task t, denoted as  $BC(t) = (E, R, C, A)$ . E represents the set of all the enterprises  $E = \{e1, e2 \dots\}$ . R is a set of enterprise role, which can be classified as core enterprise, assistant enterprise, and so on, and assistant enterprise also can be subdivided as dealer and server et al. Core enterprise may be one or several, and all the cooperation relations are established and managed surrounding core enterprise. In the process of industrial chain cooperation, one assistant enterprise may be as 2 or multiple roles. For instance, an assistant enterprise in a car industry chain can be as dealer and server. C is a set of cooperation type. The collaboration types between assistant enterprise and core enterprise can be classified as tight type, normal type, and loose type. A is a set of area of the enterprise. The enterprises in the industrial chain are distributed in the country or the world.

**Definition 2:** Cooperative Enterprise CE (e)

In a business cooperative system, the model of a given cooperative enterprise is denoted as  $CE(e) = (Ri, c, a)$ ,  $e \in E$ .  $Ri$  is the role of e, can be a set,  $Ri \subset R$ ; c is the cooperation type of e,  $c \in C$ . a is the area of e,  $a \in A$ . E, R, C, and A refers to the model of Business cooperation system  $BC(t)$  mentioned above.

**Definition 3:** Group of business cooperation area (AG)

$$AG = (0047 N, S_n)$$

GN is a set of node in group.

$$GN = \{n1, n2 \dots nr\}, GN \subseteq N, r \text{ is the number of node.}$$

Suppose N can be divided into k GN, denoted as

$$N = \cup_{i \in K} GN_i$$

Where  $K = \{1, 2 \dots k\}$ . For  $\forall i \in K, \forall j \in K, i \neq j, GN_i \cap GN_j = \emptyset$ .

If AG having:

For  $\forall ni \in AG, \forall nj \in AG, ni \neq nj$ , there is network baud rate between  $ni, nj$

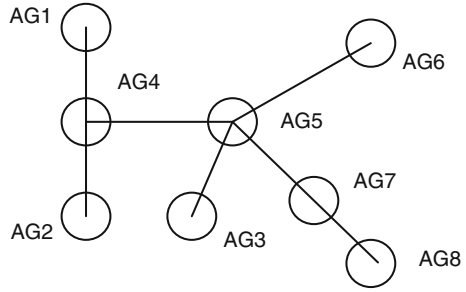
TransferRate ( $ni, nj$ ) > v (v is a threshold of network baud rate set previously)

Thus, we call AG is a group of business cooperation area.

All the nodes in a business cooperation system can be divided into several AG which can be setup by system administrator, or can be dynamically generated according to the status of network. When new node joins in the system, the network baud rate between new node and the other nodes in the system can be analyzed by tools of network performance analysis such as MRTG, to decide which AG it belongs. If there is no proper AG, the node itself will construct a new AG. As a result that the transmission delay within the local area network is lower, and contending request is fewer, network baud rate between the nodes in the local area network therefore is higher than that in the wide area network. Thus, we can divide AG in terms of network management field. In practice, baud rate between the nodes in the local area network may be tens fold than that in the wide area network.



**Fig. 71.1** The topology of 8 AGs



In Definition 3,  $S_n$  is a super node, usually in a core enterprise. The super node is the node with high-bandwidth, light-load, and fine-performance in the group. On account of the dynamics of large-scale distributed systems, super node is generally chosen in the stable-performed nodes, so that it will not be changed constantly. If  $S_n$  exits the system or breaks down, the  $S_n$  backing up will become the new  $S_n$ .

The approach of sharing-resource position-finding will be decided on the base of specific application environment and users' visiting features. Generally, a special application environment is relevant to baud rate, topology, and so on. The users' visiting features are demonstrated on various locality, including time locality, region locality, and space locality [7].

The design of our model takes consideration of the specific cooperative application environment and users' visiting features. The nodes in the system are divided into multiple AG based on which the location of resource is decided. In which AG is to select resource, it is decided considering baud rate, topology, and users' visiting rate. For that purpose, we need to construct a cost function, defining as follows.

$$\text{Cost} [AG_i] = \alpha \sum_{i=1}^m \text{MinReplicaDistance}[i] * \text{Request}[i] \tag{71.1}$$

Equation (71.1) is used to compute the cost of depositing sharing-resource in different AG. In Eq. (71.1),  $\alpha$  is a coefficient determined by the size of AG.  $\text{Request}[i]$  represents the request number of times from uses in the AG.  $\text{Min-Resource Distance} [i]$  shows the routing cost between an AG and the nearest AG. The routing cost of Each AG is depending on application environment parameters, such as available baud rate and topological structures. Obviously, there are following factors affecting the cost function: first,  $\text{MinResource Distance}$  takes account of baud rate and topology of network; Second, takes account of request number of times, reflecting the locality feature of users' visit; finally,  $\alpha$  take account of the number of cooperative enterprises in an AG, showing the potential users' requests, since the more the node in an AG, if sharing- resource is put in, the more benefit will be achieved as a whole.

An example is presented to illustrate our method in detail. Fig. 71.1 is a topology with 8 AGs, and Table 71.1 shows the users' request, and Table 71.2

**Table 71.1** Users' request

AG	AG <sub>1</sub>	AG <sub>2</sub>	AG <sub>3</sub>	AG <sub>4</sub>	AG <sub>5</sub>	AG <sub>6</sub>	AG <sub>7</sub>	AG <sub>8</sub>
Request	3	4	2	0	1	2	3	2

**Table 71.2** Routing cost

AG	AG <sub>1</sub>	AG <sub>2</sub>	AG <sub>3</sub>	AG <sub>4</sub>	AG <sub>5</sub>	AG <sub>6</sub>	AG <sub>7</sub>	AG <sub>8</sub>
AG <sub>1</sub>	0	30	29	14	22	37	26	31
AG <sub>2</sub>	30	0	20	16	24	39	28	33
AG <sub>3</sub>	29	20	0	23	15	38	27	32
AG <sub>4</sub>	14	16	23	0	8	23	12	17
AG <sub>5</sub>	22	24	15	8	0	15	4	9
AG <sub>6</sub>	37	39	38	23	15	0	19	24
AG <sub>7</sub>	26	28	27	12	4	19	0	5
AG <sub>8</sub>	31	33	32	17	9	24	5	0

shows the routing cost of the 8 AGs. Now we will determine the best location of the sharing-resource according to Eqn (71.1).

Supposing there is sharing-resource on AG<sub>1</sub>, now due to the business demand, new sharing-resource must be located. If sharing-resource is placed on AG<sub>4</sub>, the total cost can be figured out as follows:

$$\begin{aligned}
 \text{Cost}[AG_4] &= \sum_{i=1}^m \text{MinReplicaDistance}[i] * \text{Request}[i] \\
 &= 0 * 3 + 16 * 4 + 23 * 2 + 0 * 0 + 8 * 1 + 23 * 2 + 12 * 3 \\
 &\quad + 17 * 2 \\
 &= 234
 \end{aligned}$$

where we suppose  $\alpha = 1$ . Be noted, because that there are sharing-resources both on AG<sub>1</sub> and AG<sub>4</sub>, and the cost of AG<sub>2</sub> getting resource from AG<sub>4</sub> is less than from AG<sub>1</sub>, AG<sub>4</sub> will be the optimal selection for AG<sub>2</sub>. AG<sub>1</sub> gets resource from itself. It will be analogized for the other situations.

In the same way we count the total cost of sharing-resource placed on the other AG, and with comparison, the minimum is the best AG we locate the resource

The method mentioned above addresses the problem of AG where sharing-resource is placed, and the specific position is Sn in the AG.

Our model has the following advantages:

- (1) It is adapting dynamics of business cooperative system.
- (2) The location placing resource is global optimal.
- (3) It is scalable.

### 71.3.2 Resource Location Algorithm

According to the model given above, we propose the resource location algorithm, showing the mechanism as follows:

Step1: The nodes in the system are divided into several AGs.

Step2: Detect if the visiting amount for sharing-resource is over the threshold, and in case of yes, trigger the location serve of new sharing-resource according to Eq. 71.1 Note the original resource is an exception not including in computation.

Step3: Compare the total cost of sharing-resource placed on each AG, Choosing AG with the minimal cost.

Step4: Repeat step 2 and 3, ensuring AG where the next sharing-resource is placed.

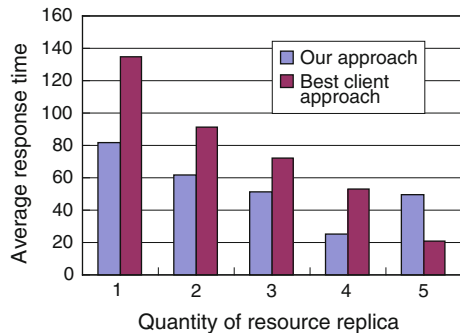
## 71.4 Simulations

We make use of the simulation platform developed by ourselves to verify our algorithm. This simulation platform is developed on the base of OptorSim [8], to realize the approach we present, and make comparison with the resource creation policy namely the best client strategy.

Experiment environment is set up as follows:

The system has 200 nodes, which form the initial network topology using PLOD [9] algorithm. The parameter  $\alpha = 0.3$ , node degree = 7, simulating the network with power-law characteristics. In the light of the demand of our approach, we divided the node into 8 AGs, as is shown in Fig. 71.1. The baud rate between the nodes in the same AG is set as 100 Mbps, while the baud rate between the nodes in different AGs is set as 10 Mbps, background throughput being poured randomly. The original resource is 100M, and 50 nodes randomly selected send out 500 requests in 10 s, and the visiting amount threshold of creating new sharing-resource is set as 20 times/s. The simulation system adopts our approach and the best client approach [10]. The result is shown as Fig. 71.2.

**Fig. 71.2** The relation of the average response time and the resource quantity



From Fig. 71.2, along with the increase of resource number, when two different approaches are adopted respectively, the average response time is decreased by distinct degree. It is obvious that with the increase of resource number, the decrease speed of average response time of two approaches is both being slow down. When the resource quantity is the same, the average response time of our approach is less, while that of best client approach is greater. Therefore, our approach has higher performance.

## 71.5 Conclusions

In computer-support coordination working systems, coincide with the total target is achieved, partners individual profit is also being involved in, becomes an effective way to address the problem of rival conflict. As the sharing-resource it in the system as a partner inevitably has its profit appealing, we present a model to protect the partners' interest. Locating the sharing resource in an optimal position to improve the utilization of resource, can moderate every partner. Through experiment and analysis, we show our approach is effective.

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# Chapter 72

## Research of Encodation Schemes Selecting Optimization for Character 2D Barcode

Fan Jiang, Zhi Liu and Xiaofei Feng

**Abstract** Character 2D barcode is a new type of 2D barcode which is designed based on the theory of traditional 2D barcode. Unlike the traditional 2D barcode image, character 2D barcode represents information encoded with a limited character matrix. In character 2D barcode, there are several encodation schemes like in the traditional 2D barcode. But in the encoding process, these encodation schemes can be selected through different strategy in order to get better compression ratio. In this paper, encodation scheme selecting optimization based on dynamic programming algorithm is proposed. An iterative process model is built up and the decision-making model is given. Then the iterative flow and algorithm steps are provided. Finally, a case of encoded information is analyzed. The experiments show that the algorithm in this paper is overall better than the traditional method.

**Keywords** Character 2D barcode · Encoding · Encodation schemes selecting optimization · Dynamic programming

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## 72.1 Introduction

The character 2D barcode is a new 2D barcode which consists of textual characters. Differing to traditional graphic 2D barcode like Data Matrix [1], character 2D barcode stores data in a limited character matrix area. By this method, it reduces the cost of barcode transfer and improves the transfer efficiency. It is designed basing on the encoding theories of Data Matrix and QR Code. The generation procedure of character 2D barcode is similar to the traditional 2D barcode. It is generally clarified into three steps: first, encode the data and convert it to information codewords according to encodation schemes or compression algorithms. Then, generate the codewords of error correction according to the information codewords. Finally, convert the generated codewords to a binary stream, transform the binary stream to symbolical symbols, and arrange them in a matrix.

## 72.2 Encodation Schemes

Generally, each barcode is corresponding to a character set and its encoding rule. This character set and its encoding rule is named encodation scheme. And there are several encodation schemes in one barcode standard. For example, in Data Matrix ECC200 [1], there are six encodation schemes mentioned. As the table below shows, there are various encodation schemes. In an encoding solution, any combination of the encodation schemes can be used as a solution. Obviously, the effects of different combinations differ. Therefore, how to select encodation schemes will be an important topic in barcode generation procedure.

The encodation schemes of Data Matrix ECC200 are extended in character 2D barcode. However, there are some limitations of encodation schemes in Data Matrix ECC200. For instance, there are many characters in the shift sets of C40 and Text are remained default. In other words, the encodation character set is not fulfilled. Therefore, some selecting strategies need to be improved.

In character 2D barcode, five new functional characters are arranged in the Shift 1 Set (value 35–39) of C40 and Text. These characters mentioned are remained default in Data Matrix ECC200. In character 2D barcode, these characters are “Jump to C40/Text”, “Jump to ASCII”, “Jump to Base 256”, “Jump to X12”, “Jump to EDI-FACT”. These “jump characters” are used as the marks of encodation switching. They mean “stopping the current encodation scheme and switch to the designated one”. In Data Matrix ECC200, 2 codewords are used in scheme switching, one for stopping the current encodation scheme and the other for switching the current scheme to the designated one. Therefore, the cost of encodation switch is 16 bits. However, using “jump characters” (cost 10.67 bits), 5.33 bits can be directly saved and the encodation switching solution becomes more flexible.

### 72.3 Encodation Schemes Selecting Optimization

In Data Matrix standard, there is an encodation schemes selecting algorithm proposed for Data Matrix ECC200. This algorithm is based on look-ahead test. Look-ahead test is used to decide the encodation scheme for the next codeword to be encoded when encoding is at the point of starting a new symbol character. In look-ahead test, the algorithm allocates counters for every encodation schemes, calculates the length of encoding for each scheme, and indicates the less one as the suggested encodation scheme. This algorithm will be called until the data encoding ends and error correction codewords encoding starts.

Define  $w_i$  to the codeword  $i$  and the look-ahead test has the definition of  $\varphi(w,i)$ . Considering the condition of  $n$  codewords to be encoded, the encodation scheme selecting algorithm of Data Matrix ECC200 can be written as:

$$w_{i+1} = \varphi(w_i, i + 1), \quad i \in [0, n - 1] \tag{72.1}$$

However, because the look-ahead test can only check the following characters, in some of the conditions, this algorithm cannot stop the current encodation scheme and switch to a more suitable scheme promptly. For example, encoding a string of character like “a...aA...A”, there are  $3n + 1 (n > 1)$  of character “a” and  $3m (m > 1)$  of character “A”, according to Table 72.1, Text has the best effect of encoding for character “a” substring and C40 has the best effect of encoding for character “A” substring. When selecting the encodation scheme by the algorithm mentioned above, it will encode the last “a” in the next encodation scheme, C40. However, the character “a” is in the shift set of C40. Encoding it with C40 will cost 2 C40 codewords. The better solution of encodation for this condition is to stop the encoding of Text in the point of the  $3n$  one of character “a” and encoding the last “a” by ASCII, then switching the scheme to C40. In this situation, the length of encoding is 2 codewords (16 bits) less than the first encoding solution.

In this paper, an encodation scheme selecting algorithm is proposed based on dynamic programming to solve the problem of encodation scheme selecting.

Dynamic programming algorithm is an important design technique which is used to solve problems whose solutions involve recursive or iterative subproblems.

**Table 72.1** Encodation schemes for data matrix ECC200 [1]

Encodation scheme	Characters	Bits per data character
ASCII	Double digit numeric	4
	ASCII values 0–127	8
	Extended ASCII values 128–255	16
C40	Primarily uppercase alphanumeric	5.33
Text	Primarily lowercase alphanumeric	5.33
X12	ANSI X12 EDI dataset	5.33
EDIFACT	ASCII values 32–94	6
Base 256	All byte values 0–255	8

See the details of compression algorithm in Ref. [1]

The dynamic programming algorithm is widely used in many technical areas. In recent years, people have explored many aspects of the dynamic programming solution procedure and achieve [2–10]. In encodation schemes selecting procedure, the decisions of the encodation scheme for one character or a part of characters can be regarded as subproblems. Therefore, the encodation schemes selecting algorithm can be solved by solving these subproblems.

### ***72.3.1 Formulating the Problem***

For Data Matrix ECC200, there are two factors which affect the encoding length: the length of the encoding characters themselves and the length of codewords for switching encodation scheme. After improvements in 2, “jump characters” are used in the encodation scheme switching for the encodation of character 2D barcode. In the meantime, only the character of double symbol characters can be encoded in the encodation schemes of C40, Text and X12, and only the triple symbol characters can be encoded in EDIFACT. Therefore, in the encodation scheme selecting, the encoding scope which decides the amount of characters shall be adjust in some conditions.

### ***72.3.2 Establishment of Decision-Making Model***

In encodation scheme selecting, the decisions of the encodation scheme for one character or a part of characters can be regarded as subproblems. In selecting, the making procedures of those decisions are regarded as steps of dynamic programming. Considering the situation of encoding a character string whose length is  $n$ , these definitions are clarified as below.

**State:** Define  $\lambda_k$  ( $k < n$ ) to the encodation scheme selecting solution for the whole string in the  $k$  step.

**Decisions and Policies:** Define  $x_k$  to the optimal modification for the encodation scheme in the  $k$  step. Define  $X_k$  to the set of decisions (policies). In each step, the decision of it means whether combine the scopes of the two neighbor encodation schemes. The combination means to encode the characters in the scope of another encodation scheme by the current encodation scheme and add them to the scope of current encodation scheme.  $X_k = X = \{0: \text{No modification, } 1: \text{Combine the current scheme to the previous one, } 2: \text{Combine the current scheme to the next one, } 3: \text{Combine the previous scheme to the current one, } 4: \text{Combine the next scheme to the current one}\}$ .

**Objective function:** Define  $v_k$  to the objective variable in  $k$  step. The objective variable refers to the length of encoding. The  $v_k$  is defined by objective function  $V_k(\lambda_k, x_k)$ .

**Optimal policy:** The minimum encoding length encodation schemes selecting solution with state  $\lambda_k$  is defined as optimal policy.



Optimal function: Define  $g_k(\lambda_k)$  to the selection of optimal policy in state  $\lambda_k$ .  $g_k(\lambda_k) = \min [V_k(\lambda_k, X)]$ .

Equation of state transition: Using optimal function, we can define the state recursion:  $\lambda_{k+1} = T(\lambda_k, x_k)$ .

With the definitions given above, we now write the encodation schemes selecting iteration:

$$\begin{cases} \lambda_{k+1} = T(\lambda_K, X_K), K \in [0, n], K \in N^* \\ g_{k+1}(\lambda_{k+1}) = \min[V(\lambda_{k+1}, X), g_0(\lambda_0)] \\ g_0(\lambda_0) = v_0 = \min[V(\lambda_0, X)] \end{cases} \tag{72.2}$$

### 72.3.3 Implementation and Results

According to the establishment of decision-making model in Sect. 72.3.2, the decision-making model is implemented in this section. With the types of characters in Table 72.2, the best encodation scheme matching of the characters is given below (without considering scheme switching and encodation scope).

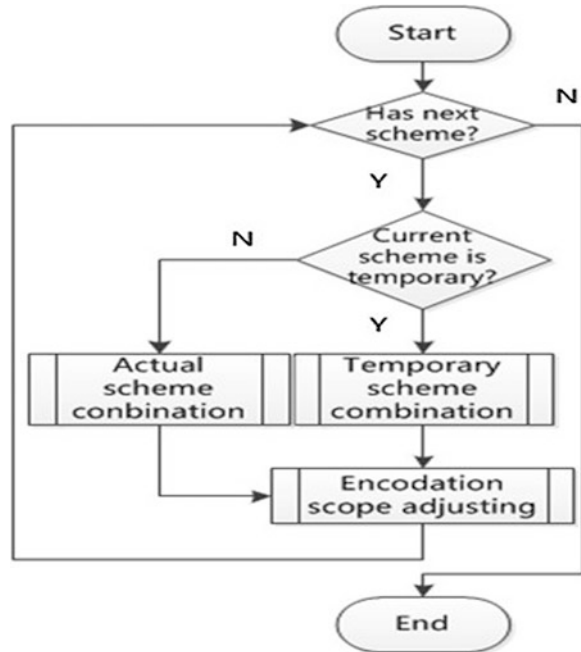
In Table 72.2, the encodation schemes with \* are “temporary scheme”. The temporary scheme is not used for encoding but for optimization. The temporary scheme must be replaced by an actual scheme at end of optimization. The CTX scheme means the encoding lengths are the same when C40, Text or X12 is used; the CX scheme means the encoding lengths are the same when C40 or X12 is used. Those schemes mentioned will be the first choice of the temporary scheme replacement, and the second choice of them is EDIFACT model, last is ASCII.

The initial state  $\lambda_0$  is matched by Table 72.2. By this method, when the encoding length of the character is considered without scheme switching and encodation scope, it is the optimal selecting plan for encodation. Therefore, the follow-up programming is to find out the least cost of scheme switching in consideration of encodation scope. The flow of the follow-up programming is showed in Fig. 72.1:

**Table 72.2** Matching best encoding schemes

Encodation scheme	Characters	Bits per data character
CTX*	Space, single numeric	5.33
CX*	Uppercase alpha	5.33
X12	CR(13), *(42), >(62)	5.33
EDF	Values 32–94 except those in X12	6
Text	Lowercase alpha	5.33
ASCII	The single ASCII value 0–127 except the	8
	characters mentioned above	4
	Double digit numeric	16
	Extended ASCII values 128–255	
B256	All byte values 0–255	8

**Fig. 72.1** Recursion flow of dynamic programming



In this flow, the two types of combination algorithms achieve the work of combining among the current scheme, the previous scheme and the next scheme, that is the decision of optimal policy. The encodation scope adjusting algorithm adjusts the encodation scope of the schemes to comply the encodation rules [1]. In C40, Text and X12, only the character of double symbol characters can be encoded in the encodation schemes of C40, Text and X12, that is, characters shall be dividable by 3. In EDF, only the triple symbol characters can be encoded in EDIFACT, that is, the amount of characters shall be dividable by 4.

The detailed algorithm steps are given as:

### 72.3.3.1 Temporary Scheme Combination Algorithm

If the previous scheme is C40 or X12, or the previous scheme is Text and the current model is CTX, then combine the current scheme to the previous one;

Otherwise, if it is not the last scheme of encodation and the next scheme is C40 or X12, or the next scheme is Text and the current model is CTX, then combine the current scheme to the next one;

Otherwise, the previous scheme is EDF, then combine the previous scheme to the current one;

Otherwise, if it is not the last scheme of encodation and the next scheme is EDF, then combine the next scheme to the current one;

Otherwise, set the current model to C40, calculate all the executable policies in policies set  $X$ , and choose the shortest encodation length policy as decision;

Actual scheme combination algorithm:

Calculate all the executable policies in policies set  $X$ , and choose the shortest encodation length policy as decision;

### 72.3.3.2 Encodation Scope Adjusting Algorithm

If the current scheme is C40 or Text, calculate the amount of C40/Text characters  $s$  in this encodation scope. If  $s < 3$ , that means it cannot construct a double character symbol, then set the current scheme to ASCII; otherwise, if  $s$  modulo 3 equals to 2, then delete characters from the end of encodation scope until  $s$  modulo 3 equals to 0. After deleting add the deleted characters to a new ASCII encodation, and insert it after the current scheme.

If the current scheme is X12, calculate the amount of X12 characters  $s$  in this encodation scope. If  $s < 3$ , that means it cannot construct a double character symbol, then set the current scheme to ASCII; otherwise, if  $s$  is not divisible by 3, then delete characters from the end of encodation scope until  $s$  is divisible by 3. After deleting add the deleted characters to a new ASCII encodation, and insert it after the current scheme.

If the current scheme is EDF, calculate the amount of EDF characters  $s$  in this encodation scope. If  $s < 4$ , that means it cannot construct a triple character symbol, then set the current scheme to ASCII; otherwise, if  $s$  is not divisible by 4, then delete characters from the end of encodation scope until  $s$  is divisible by 4. After deleting add the deleted characters to a new ASCII encodation, and insert it after the current scheme.

Otherwise, do no adjusting to the current scheme;

If the current scheme is the last scheme in the encodation, then end the data encoding and start the encoding of error correction codewords.

Using this algorithm, we test 1,000,000 strings of 20 random characters a time to compare with the encodation selecting algorithm given in Data Matrix. And we have the following result as Fig. 72.2. It shows the results except the equal ones. The optimization result means the subtraction from the codewords amount of Data Matrix algorithm to the result of the algorithm given by this paper.

For instance, the character 2D barcode example of encoding the string “<http://www.zjut.edu.cn>” is shown as below.

```

    Z Z L S Y Q
    S T X Q L X J I
    R N I W Y L M I
    Z Q V K K W Y Q
    Z K K M R A A A
    A A Q L X I K J
    A W I V A N A
  
```

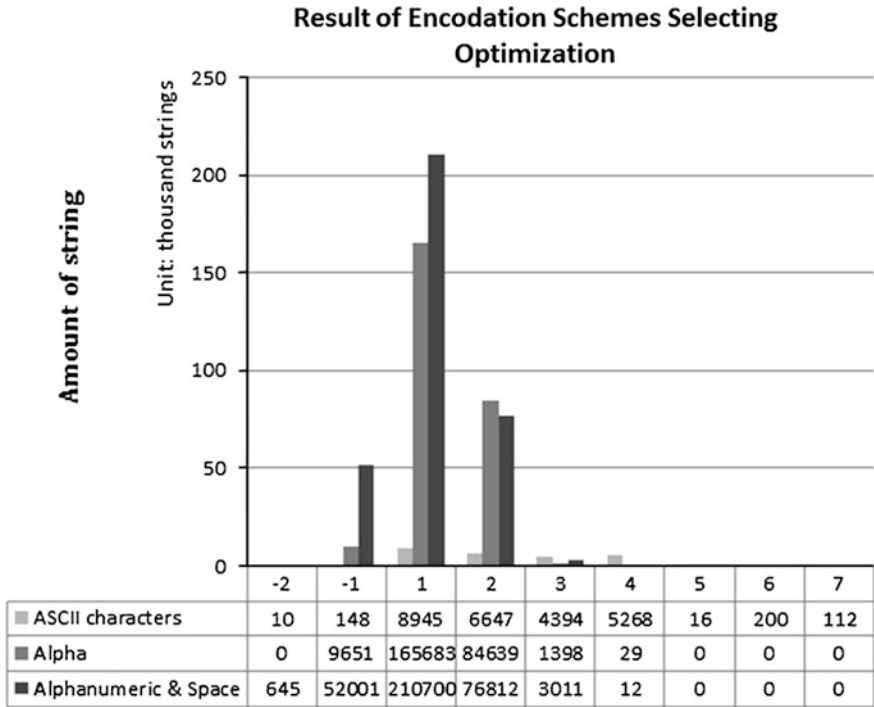


Fig. 72.2 Result of encodation scheme selecting optimization

### 72.4 Related Work and Conclusion

This paper improved the design of encodation schemes in the original barcode standard. It solves the encodation schemes selecting problem by dynamic programming. Using the algorithm given by Data Matrix standard, it can usually produce the shortest encodation plan for an encoding string. From Fig. 72.2, we can infer that the algorithm given by this paper can have an overall better result of optimization; it will usually produce the shortest encodation scheme selecting plan comparing with the algorithm given by Data Matrix standard.

The encodation schemes selecting problem is one of the keys in the encodation of character 2D barcode. Besides, the specifications of the barcode, error correction scheme, and symbology representation are also important parts of barcode encoding. These key problems are also solved by us already. Therefore, the encoding procedure is entirely implemented. However, due to the difference in scanning and reading between traditional 2D barcode and character 2D barcode, not only the identification of finder pattern and the distortion correction for barcode image, but also the identification for the characters in the matrix will be the core part of the following work.

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# Chapter 73

## Study on the Relationship Between Social Support and Burnout of Civil Servants in Tangshan

Xiaotong Zhu, Xue Yao and Xiuqi Hu

**Abstract** The aim of this paper is to discuss the relationship between social support and burnout of civil servants in Tangshan. It investigates 702 civil servants in Tangshan by using Social Support Rating Scale (SSRS) and Chinese Maslach Burnout Inventory (CMBI). The results indicate that the total score of the social support and three dimensions and the total score of burnout and three dimensions is correlativity ( $P < 0.05$ ,  $P < 0.01$ ). Among them, objective support is positively correlated with the score of burnout and three dimensions while subjective support, support availability and the total score of support is negatively correlated with the score of burnout and three dimensions. The regression analysis shows that objective support is a significantly positive predictor of the score of burnout and three dimensions while subjective support is a negative predictor of the decrease of the score of burnout, depersonalization and personal achievement, the support availability is just a negative predictor of depersonalization and the score of support is a negative predictor of the reduce of emotional exhaustion and personal achievement. It indicates that social support is closely related with the burnout of civil servants in Tangshan, and the more social support civil servants acquire, the better the condition of burnout becomes.

**Keywords** Civil servants · Social support · Burnout

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## 73.1 Introduction

Burnout refers to the individual's physiological and psychological fatigue caused by work pressure. With the rapid development of our social economy and high pace of social change, the issue of civil servant burnout has been increasingly emerging. Related data show that the civil servant burnout ratio is much higher than other professions [1]. Burnout will not only affect the physical and mental health of the civil servants, the Government's ability to govern, but will also bring negative impacts on social stability and national development, hence solutions to the civil servants burnout are desperately needed. However, researches in China on burnout started relatively late, and there are few studies relating to the civil servant burnout. Besides, those researches comparatively focused on the analysis of the causes and countermeasures of the civil servant burnout, barely on the relationship between the specific influencing factors and burnout. Related literature shows that social support can relieve individual's physiological and psychological fatigue caused by work pressure. Nevertheless, the study on the relationship between civil servants and social support has not been reported. This study aimed to explore the relationship between support and burnout of civil servants in Tangshan, and provided a reference for the effective prevention and intervention for the problem of the civil servants burnout from the perspective of social support.

## 73.2 Subject and Methods

### 73.2.1 Subjects

The civil servants in Tangshan were surveyed by using questionnaire during December 2011 to March 2012. Altogether 750 questionnaires were sent out and 702 valid ones were retrieved, the effective rate was 93.6 %. Among them, 405 persons are male, 297 persons are female. In age distribution, 239 people with age less than 30 years old, 115 persons are in the age-bracket 31–40, 269 persons are in the age-bracket 41–50, the rest 79 persons are in the age-bracket 51–60. In administrative level distribution, 18 people are department level and above; 38 are vice department level; 97 persons are section chief rank; 241 persons are vice section rank; the rest 308 persons are common civil servants.

### **73.2.2 Instrument**

#### **73.2.2.1 Chinese Maslach Burnout Inventory (CMBI)**

The inventory was compiled from the simplified Chinese version burnout inventory by Li Yongxin and his colleagues based on burnout inventory [2]. The CMBI includes 15 entries and three factors named exhaustion, depersonalization, and reduced personal accomplishment. Each factor contains five entries. Likert seven levels assignment method was used for analyzing the answers of the 15 entries. “1” stands for “totally inconsistency”, “7” means “fully consistence”. The sequence from 1 to 7 was in accordance with the extent from lowest to highest, and the reduced personal accomplishment subscale was scored from 1 to 7. The total  $\alpha$  coefficient was 0.746 and the coefficient of half-split was 0.728. The questionnaire mainly used for evaluating the burnout states of subjects.

#### **73.2.2.2 Social Support Rating Scale**

SSRS were designed and revised by Xiao Shuiyuan, which includes 10 items of 3 dimensions, i.e., objective support (4 items), subjective support (3 items) and the rate of social support utilization (3 items) [3]. Objective support mainly assesses the emotion experience and the satisfaction degree of individuals been respected, supported and understood in society. Subjective support refers to the visible or real support, including direct material aid and the existence and participation of social network and the relationship between groups. Social support utilization refers to how often the supports were used by individuals. All the questions were positive sequence scored, the higher score of one dimension, and the more support that individual got. The amount of social support that one gets can predict the results of the individual physical and mental health, i.e. the higher the score of social support, the more health in Physiology and psychology.

### **73.2.3 Survey Methods**

Survey Scales were distributed to civil servants in Tangshan City by the investigators with a unified introduction of the way to fill the questionnaire. The respondents were asked to fill the questionnaire the on spot. The following processes were taking back all questionnaires and checking and sorting them, then eliminating invalid questionnaires, and numbering the effective questionnaires.



### 73.2.4 Statistical Method

The collected data were analyzed by using correlation analysis and T tests testing method through SPSS 17.0 software ( $P < 0.05$ ).

## 73.3 Results

### 73.3.1 The Relationship Between Social Support and Burnout of Civil Servants in Tangshan

The result shows that the total score of support of Tangshan civil servants and three dimensions have relations with the burnout and three dimensions. The objective support has positive correlation with burnout total score and three dimensions, which shows that the more objective supports the civil servants in Tangshan get, the more serious the burnout is. The subjective support, support utilization and total score of support have negative correlation with burnout total score and three dimensions, which shows the more subjective support, support utilization and total score of support get, the better the burnout is (Table 73.1).

### 73.3.2 Prediction Analysis of Social Support to the Burnout of Tangshan Civil Servants

For the purpose of discussing the influence of social support on burnout of Tangshan civil servants, the burnout total score and three dimensions are regarded as induced variables and social support total score and three dimensions are regarded as predictive variables to conduct stepwise multi-regression analysis, so as to study the regression effects of the social support on the burnout of the civil servants in Tangshan. The result is shown in Table 73.2.

**Table 73.1** The correlation between social support and burnout of civil servants in Tangshan

	Objective support	Subjective support	Support utilization	Total score of support
Emotional exhaustion	0.626**	-0.169**	-0.197**	-0.197**
Depersonalization	0.501**	-0.447**	-0.387**	-0.061**
Decline of sense of personal achievement	0.525**	-0.010*	-0.143**	-0.239**
Total score of burnout	0.444**	-0.404**	-0.298**	-0.041*

Note \* $P < 0.05$ , \*\* $P < 0.01$

**Table 73.2** The regression effects of social support on the burnout of the civil servants in Tangshan

Induced variables	Predictive variables	<i>R</i>	<i>R</i> <sup>2</sup>	$\beta$	<i>t</i>
Total score of burnout	Objective support	0.671	0.449	0.548	19.143**
	Subjective support			-0.514	-17.958**
Emotional exhaustion	Objective support	0.704	0.494	0.930	25.149**
	Total score of support			-0.442	-11.958**
Depersonalization	Objective support	0.756	0.570	0.616	24.360**
	Subjective support			-0.473	-12.899**
	Support utilization			-0.134	-3.699**
Decline of sense of personal achievement	Objective support	0.579	0.333	0.371	5.389**
	Subjective support			-0.445	-5.782**
	Total score of support			-0.323	-3.087**

Note \*\**P* < 0.01

From the above table, the social support variable are predictable variable, which shows great effects on the total score of burnout and three dimensions of civil servants in Tangshan. The objective support has positive prediction effect on the total score of burnout and three dimensions. The support utilization only has negative prediction effect on the depersonalization. The total score of support has significant negative prediction effect on emotional exhaustion and the decline of sense of personal achievement.

### 73.4 Analysis and Discussion

Job burnout is some comprehensive symptoms of physical and mental over-consumption and energy failure from long-term working pressure. It may be weary, anxious, and physical impairment etc. These manifestations will have tremendous negative impacts on individual conditions of body and mind, work situation and working group [4]. Social support which takes individual as the core refers to an interpersonal communication system formed through supportive behaviors of individuals and others. Social support can divide into objective support, subjective support and utilization of support. With the development of social reform, social and public expectations to the government become higher and higher [5], and the huge expectations and pressure which government is facing are decomposed into every civil servant. A survey shows that civil servants are under unprecedented professional pressure, and become the high-risk groups of Job burnout. A large number of studies show that [6] social support is an important factor affecting job burnout, and individual is physical and mental health in strong social support system and not prone to job burnout. This has been verified in this study. The results of this study show that in Tangshan City, civil servants total points of social

support, subjective support, utilization of support and job burnout scores and the three dimensions are significantly negative correlation, objective support and job burnout score and three dimensions are significantly positive correlation. The results of this study and previous empirical research conclusions are consistent in general. That is to mean social support on burnout has significantly negative impact: the higher social support, the lower the degree of burnout; the lower degree of social support, the higher the degree of burnout. This shows that social support does have an easing effect for job burnout of civil servant in Tangshan City. Through improving the overall social support, subjective support and utilization of support and decrease the objective support can reduce the job burnout degree for civil servants. Thus, a good social support is an effective weapon in reducing the job burnout. Therefore, in order to solve the job burnout and enhance the mental health of Tangshan City civil servants, improving the social support for civil servant is an important way to solve this problem [7].

Further regression analysis revealed that civil servants objective support has a significant positive predictive effect on burnout total points and three dimensions, subjective social support has a significant negative predictive effect on total points of burnout, depersonalization and reduced personal accomplishment, utilization of support only has a significant negative predictive effect on depersonalization, total score of emotional exhaustion has a significant negative predictive effect on personal accomplishment reduction and utilization of support. Results from this study shows that subjective social support can be able to provide emotional support for the civil servants in Tangshan City, so that civil servants can feel supported, respected, and help them vent negative feelings, ease the stress brought by work, and gain recognition, increase self-confidence, and enhance individual satisfaction. Therefore, subjective support in mitigating burnout, depersonalization and personal accomplishment reduction plays a significant role. That is to say Tangshan Civil Servants subjectively experience the better from family, friends and people, the more be able to feel respected, understood and supported, and they are less troubled by the negative factor in burnout. Objective support may affect the satisfaction of material conditions for civil servants. While too much material support and complex interpersonal relationships will bring more mental stress and enhance negative emotions, and then increase the tension during work, result in the situation of job burnout. Therefore objective support plays a great role in strengthen the burnout total points, emotional exhaustion, depersonalization and personal accomplishment reduction. That is civil servants of Tangshan City gain the more objective support, the more likely mental stress burden ed, and be likely impacted by negative burnout factors, and then prone to appear burnout conditions. This study found that when we put subjective support and objective support the two factors into the regression equation of the job burnout score, they can jointly explain 44.9 % variance in job burnout. It indicates that the two factors of objective support and subjective support are important predictor variables of Tangshan civil servant job burnout. Therefore, when to intervene in the civil service job burnout in Tangshan City, we should specially realize improve subjective social support and reduce the objective support.

Building a social support system of Tangshan Municipal civil servants based on these above-mentioned researches is a very effective method which helps to relieve the job burnout situation and improve their mental health. The related departments should give full play to the social dominant force, formulate relevant counter-measures, increase the overall social support, and lead the Tangshan civil servants to be conscientious and meticulous in their work, make the rational allocation of resources and reasonably handle interpersonal relationship so as to promote the physical and mental health of civil servants, and make contribution for the construction of a harmonious socialist society.

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## Chapter 74

# Study on Relationship Between Role Type and Job Satisfaction of Student Leaders in University

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**Abstract** To study the relationship between role type and job satisfaction of student leaders in university. Method: Using role type questionnaire survey and job satisfaction scale on 97 student leaders in university. Result: Student leaders in university had relatively high degree of job satisfaction among. There were significant differences between student leaders of different genders in satisfaction toward tasks ( $t = 3.660$ ,  $p < 0.01$ ), work environment ( $t = 74.984$ ,  $p < 0.05$ ), promotion ( $t = 2.580$ ,  $p < 0.01$ ) and supervisors ( $t = 2.848$ ,  $p < 0.01$ ). There were also significant differences between student leaders of different grades in satisfaction toward tasks ( $t = 2.918$ ,  $p < 0.01$ ) and supervisors ( $t = 2.646$ ,  $p < 0.01$ ). There was also significant difference between student leaders of different administrative levels in satisfaction toward supervisors ( $t = -2.746$ ,  $p < 0.01$ ) Job satisfaction of student leaders was positively correlated to their role type. Conclusion: There is relatively high degree of job satisfaction among student leaders in university; Male student leaders have higher job satisfaction degree than female ones; student leaders of senior grades have a higher job satisfaction degree than that of junior grades; role type of coordinators is positively correlated to their job satisfaction.

**Keywords** Job satisfaction · Role type · Student leaders

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## **74.1 Introduction**

As a significant bridge between teachers and students, student leaders play an important role in ensuring smooth running of activities in campus as organizers and coordinators [1, 2]. They plan, organize, participate and ensure the smooth running of events and activities. To some degree, their ability and enthusiasm determines the success of the construction of a harmonious campus [3]. This thesis studies on relationship between job satisfaction and role type of student leaders, providing evidence for motivating and selecting student leaders.

## **74.2 Objects**

### **74.2.1 Objects**

Sampling among 104 students of 08 and 09 grades in a university in Tangshan, the effective objects were 97 student leaders, accounting for 93.3 %, among which 40 was male students, 57 was female students; 37 student leaders of 08 grade and 60 student leaders of 09 grade, 53 student leaders from student union, 44 students leaders from class [4, 5].

### **74.2.2 Tools**

#### **74.2.2.1 Role Type Questionnaire**

It was consisted of seven questions, each composed of eight sentences. 10 points would be allocated to these eight sentences, under the principle of priority. A most extreme case would be 10 points for one sentence only. In this way, role types are classified into eight kinds: implementer, coordinator, impellor, innovator, information provider, overseer, organizer and improver. Each type consists of seven sentences [6]. Their total score becomes the score of corresponding type. The cronbach  $\alpha$  in this survey was 0.9925.

#### **74.2.2.2 Job Satisfaction Scale**

It mainly used for measuring student leaders' current job satisfaction toward tasks, salaries, environment, promotion and guidance from supervisors. There are 20 questions in total, using Likert 5 points scoring methodology, 1–5 points are assigned accordingly from “totally disagree” to “totally agree”. Higher score indicates higher job satisfaction degree of student leaders. The cronbach  $\alpha$  in this scale is 0.8533.

### 74.2.3 Methodologies

Gathering all student leaders in a classroom, making introduction and conducting the survey. Questionnaire would be collected on site. Survey data would be recorded into SPSS11.5 For Windows software package for analysis, using description statistics, independent sample *t* testing, relative analysis methodologies, etc.

## 74.3 Results

### 74.3.1 Current Status of Job Satisfaction Among Student Leaders

#### 74.3.1.1 The Whole Condition of Job Satisfaction Among Student Leaders

As shown in Table 74.1, five points scoring methodology is used for the rating of job satisfaction. Average point of each determinant is above 3.0, indicating a relatively high degree of job satisfaction among student leaders. Satisfaction toward environment is the highest, while satisfaction toward promotion is the lowest.

#### 74.3.1.2 Comparison Analysis of Different Job Satisfaction Between Student Leaders of Different Genders

As shown in Table 74.2, student’s leaders of different genders have different degree of satisfaction in tasks, environment, promotion and supervisors. Male student leaders are evidently scoring higher than female ones.

**Table 74.1** The whole condition of job satisfaction among student leaders

	Min	Max	$\bar{x} \pm s$	Sequence
Tasks	2.25	5.00	$3.73 \pm 0.48$	3
Environment	2.40	5.00	$3.82 \pm 0.46$	1
Promotion	2.00	4.75	$3.28 \pm 0.60$	4
Supervisors	2.00	5.00	$3.79 \pm 0.59$	2

**Table 74.2** Comparison analysis of different job satisfaction between student leaders of different genders ( $\bar{x} \pm s$ )

	Male ( <i>n</i> = 40)	Female ( <i>n</i> = 57)	<i>t</i>
Task	$3.93 \pm 0.39$	$3.59 \pm 0.49$	3.660**
Environment	$3.93 \pm 0.47$	$3.74 \pm 0.44$	1.984*
Promotion	$3.46 \pm 0.62$	$3.15 \pm 0.55$	2.580*
Supervisor	$3.99 \pm 0.58$	$3.66 \pm 0.57$	2.848**

Note \**p* < 0.05, \*\* *p* < 0.01

### 74.3.1.3 Comparison Analysis of Different Job Satisfaction Between Student Leaders of Different Grades

As shown in Table 74.3, student’s leaders of different grades have different degree of satisfaction in tasks and supervisors. 08 Grade student leaders are evidently higher scores than 09 Grade ones.

### 74.3.1.4 Comparison Analysis of Different Job Satisfaction Between Student Leaders of Different Administrative Levels

As shown in Table 74.4, student’s leaders of different administrative levels have different degree of satisfaction in supervisors. The score of student leaders from student union is significantly lower than that of student leaders from class.

## 74.3.2 Relationship Between Job Satisfaction and Role Type of Student Leaders

By comparing and analyzing scores on job satisfaction and role type of student leaders, a result comes out as Table 74.5.

As shown in Table 74.5, scores of coordinator are evidently in positive correlation to four facets of job satisfaction, while scores of innovator are negatively correlated to satisfaction in promotion.

**Table 74.3** Comparison analysis of different job satisfaction between student leaders of different grades ( $\bar{x} \pm s$ )

	08 Grade ( $n = 37$ )	09 Grade ( $n = 60$ )	$t$
Task	3.90 ± 0.44	3.62 ± 0.48	2.918**
Environment	3.85 ± 0.43	3.80 ± 0.48	0.541
Promotion	3.38 ± 0.57	3.22 ± 0.61	1.265
Supervisor	3.99 ± 0.61	3.67 ± 0.56	2.646**

Note \* $p < 0.05$ , \*\*  $p < 0.01$

**Table 74.4** Comparison analysis of different job satisfaction between student leaders of different administrative levels ( $\bar{x} \pm s$ )

	08 Grade ( $n = 37$ )	09 Grade ( $n = 60$ )	$t$
Task	3.65 ± 0.47	3.82 ± 0.49	-1.663
Environment	3.77 ± 0.46	3.88 ± 0.45	-1.194
Promotion	3.22 ± 0.59	3.36 ± 0.60	-1.159
Supervisor	3.65 ± 0.59	3.97 ± 0.56	-2.746**

Note \* $p < 0.05$ , \*\*  $p < 0.01$



**Table 74.5** Relationship between job satisfaction and role type of student leaders

	Task	Environment	Promotion	Supervisor
Implementer	0.032	0.107	-0.025	-0.062
Coordinator	0.216*	0.344**	0.292**	0.207**
Impellor	-0.065	-0.087	-0.013	-0.088
Innovator	-0.147	-0.184	-0.216*	-0.136
Information provider	0.174	-0.039	0.003	0.158
Overseer	-0.065	-0.125	-0.039	-0.090
Organizer	0.062	-0.056	0.011	0.067
Improver	0.030	0.042	-0.013	0.125

Note \* $p < 0.05$ , \*\*  $p < 0.01$

## 74.4 Discussion

### 74.4.1 Status of Job Satisfaction of Student Leaders

In this survey, the scores of job satisfaction of student leaders in four facets are all above three points, which indicates a relatively high degree of job satisfaction of student leaders. This complies with research result of Peng Guo: Student leaders are from junior grades. Their jobs are acquired by competing in the recruitment, so they cherish their job very much, which makes them enthusiastic in job. They keep close relations with supervisors, and want to grow through organizing events and activities.

It is also found out that male student leaders score higher than female student leaders, which may be rooted from gender gap. Under social orientation as “men orders; women obeys” and “men should go out more while women should stay home”, men naturally act as leaders more often than women, who are more accustomed to be subordinate. After entering the university, as female students continually adjusting their self-recognition, their plans toward future, they become less enthusiastic toward their jobs, and the meaning of job as student leader becomes less than that to male student leaders.

The research also shows that student leaders of different grades have different job satisfaction in tasks and supervisor. Student leaders of 08 Grade have an evidently higher score than that of 09 Grade. The reasons are as follows:

Student leaders of higher grades have more opportunities than that of lower grades. They are in dominant positions more often, ordering junior student leaders and classmates to participate in activities, while student leaders of lower grades more often take action in person. Therefore, student leaders of higher grades are more easily recognized and approved, which leads to higher satisfaction degree in tasks and supervisors.

To be a student leader is a tough job. One has to accept various criticisms. For junior student leaders who just walked out from mechanical high school life, they are more easily motivated by various activities, and more easily hurt by criticisms. While senior student leaders are more adapted and more mature in handling any

criticism, which also makes them more satisfied in tasks and supervisors than junior student leaders.

Future plan is another factor. Junior student leaders compete for the position out of curiosity, as time goes by, they would make their own plan as preparing for postgraduate exam, studying abroad, etc., then job as student leaders would be a waste of time to them. For senior student leaders, since they've chosen to continue this job, most of them hope to do it better in order to help them with getting a good job after graduation.

It is also found out that student leaders from student union score lower than student leaders from class in satisfaction to supervisors, which may be rooted from their contacts with teachers. Which lead to get to know each other, even trust each other?

#### ***74.4.2 Analysis Between Role Type and Job Satisfaction of Student Leaders***

The research shows that among all roles, coordinator is evidently in positive correlation with four facets of job satisfaction, while innovator is negative correlated to promotion. Coordinator can illustrate objectives, help with assigning tasks and responsibilities, they trust other, they are more prudent, justice, self-disciplined, confident, have a medium level of intelligence and inborn leadership, so they would be more satisfied in tasks, environment, promotion and supervisors. While innovators are good at coming up new ideas and suggestions, offering new perspective for an activity, they are more individualistic, less detail-oriented, which easily drive other away and gives them less opportunity for promotion.

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# Chapter 75

## Study on Innovation of Mandarin Teaching in Universities

Xue Yao, Haijuan An and Shanhui Lv

**Abstract** The University is where talents needed by society are developed, Mandarin for college students is very important. However, the teaching of Putonghua, aimed to meet tests, is rigid, inefficient, and this phenomenon is relatively serious, so reform and innovation is very necessary. According to the present situation of Putonghua teaching, this chapter is focused on the strategies about the innovation of Putonghua teaching.

**Keywords** University · Mandarin · Teaching · Innovation

### 75.1 Introduction

Nowadays, with the rapid development of information as well as science and technology, people communicate with each other more frequently. Language is the most important tool of communication and all kinds of communication depend on the use of language [1]. Therefore, having a good command of common language is necessary for modern people. In our country, the public language is Mandarin [2, 3]. Nowadays, Mandarin is the common language of the modern Han nationality, the standard Chinese and the most important communication tool for the modern Han nationality [4, 5]. The university is where talents needed by society are developed, Mandarin for college students is very important. In many primary and middle schools of our country the Mandarin teaching is ignored because of the

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impact of exam-oriented education [6]. However, the Putonghua teaching in universities is rigid, inefficient, aimed to meet tests and this phenomenon is relatively serious, so reformation and innovation are very urgent.

## 75.2 The Present Situation of Putonghua Teaching in Universities

### 75.2.1 *The Students' Basic Language is Very Different, Thus Causing Some Difficulties in Carrying out Putonghua Teaching*

Now, college students' pronunciation and language habits have long been fixed, and they come from all corners of the country and especially now most parts of the country still belong to dialect areas or half dialect areas, with few real Mandarin areas. Owing to the effect of different dialects area students "Mandarin" is not the same. On the other hand, because of the differences of accepting language education and teachers as well as social environment at the foundation stage of education the students have great differences in Mandarin. Some college students have standard pronunciation, with clear articulation and a mellow and full tune. But others even have difficulty in communicating with classmates. The "It is hard to please all" phenomenon caused by different objects of education increased the difficulty of Mandarin teaching.

According to the survey of our school: when the first students will say language is a dialect or language minority is significantly higher than the percentage of Mandarin and they are respectively 84.82 and 15.18 %. At the same time, the school is the most important way to learn Mandarin, and respondents highly recognized teaching language for respondents, in proportion to 55.73 %. In addition, in the study of Mandarin motivation, the majority of students choose to the need of learning or work. The table below (Table 75.1):

### 75.2.2 *Language Awareness is not Strong*

Now in addition to normal schools, in most colleges and universities teachers and students do not have strong language standard consciousness, even far less than the English in the standard degree. Many universities have great randomness and

**Table 75.1** Students learn (said) Mandarin for a variety of purposes ratio (%)

Learning needs	And more to the people	In order to get a good job	Personal interest
39.44	23.9	34.74	1.92

blindness in Mandarin Teaching, and even some schools do not offer Mandarin teaching. Even if this course is set, its aim is to just meet the need of the Mandarin level test training. In the Putonghua training, teacher's weak language awareness also leads directly to the inefficient teaching of Mandarin. So, strengthening the consciousness of language standard and promoting Putonghua Education are imperative.

### ***75.2.3 The Information Society Affects College Putonghua Teaching***

On one hand, network entertainment activities occupy students' large amount of spare time, which directly leads to students' reading time being reduced; on the other hand, network image data reading gradually replaces text reading, students spend less time reading words than they do reading the text, contributing to reducing their ability to use the language. The norm of using language, which is brought about by reading, is also greatly reduced.

## **75.3 The Strategies of Putonghua Teaching Innovation in Universities**

University Putonghua teaching innovation based on the characteristic of its current situation and combined with the existing problems, should be carried out with a certain aim. Its main measures are as follows.

### ***75.3.1 The Innovation of Educational Ideas***

Putonghua teaching is not equal to the education of Chinese or Mandarin Level Test training. Now the weak language standard consciousness is the fact that the Mandarin teaching is not paid attention to in universities. Many universities treat Mandarin teaching as Chinese education or the training for the students before taking the Mandarin level test. But these two are not equal. Chinese education consists of literature and language, which take different tasks. The task of literature education is to make students know about life, experience destiny, pain and happiness, and take interest in literature. It is mainly determined by Chinese "humanity". Language education is to make students not only understand the law of language grasp, and apply it correctly but also speak and write the language correctly. It mainly depends on the language "tool". Now in our country both language education and literature education go to Chinese education, in reality,

at the stage of higher education, the function of Chinese education tends toward humanity, while at the stage of basic education, Chinese education is more inclined to the instrumental function. At the stage of higher education, the students' language habit has been formed and the language standard is somewhat neglected. In this case, Chinese education has become the substitute of literature education and the instrumental function of Chinese education is thrown aside.

Now there lies in another case, that is, the Mandarin teaching is equally treated as the Mandarin level test training; it is thought that students' passing the training of Putonghua level test is the success of Mandarin teaching. Of course, we cannot deny that Mandarin level test is an important indicator to measure the extent of using Mandarin. According to the requirements of the state and relevant departments, the Mandarin level of college teachers and students should reach above level two, the level of using Mandarin is described as, in reading aloud and talking freely, there is a phenomenon where some pronunciation is not completely accurate and sometimes the initial consonant and vowel pronunciation is not in place. There are some mistakes in difficult pronunciation and the intonation of dialect is not clear. Sometimes dialect words and grammar are used. But we must see that the purpose of Mandarin teaching is far from the case and its purpose is to promote the use of the standard language as much as possible.

### ***75.3.2 Teaching Innovation***

Mandarin teachers must constantly improve their own comprehensive qualities. As a Mandarin teacher, first of all, one must have a good language sense and perceptive ability so that he can correct students' wrong pronunciation. This also requires teachers to give the students more time to practice pronunciation when they teach theoretical knowledge in class. In this way, students' mistakes can be timely corrected and illustrated, thus making learning and using combined very well. Second, Mandarin teachers should have a good ability of expression and communication. As a qualified Mandarin teacher, one should set a good example to students. Only when students feel the gap, compared to teachers, can they take interest in going beyond and imitating the teachers. At the same time, because the students have formed a long-term natural language, it is difficult to accurately grasp the correct pronunciation. Therefore, teachers need to persuade the students by using brief and-to the point language. In addition, Mandarin teacher should be an "eclectic", and will be good at applying the art forms of daily life, such as, hosting, reciting, and speech to teaching so as to arouse students' learning enthusiasm.

### ***75.3.3 The Innovation of Teaching Methods***

First, according to the characteristics of dialect train with classification and aim.

Our country has a vast area, a large population and complex dialects. Different dialects have different pronunciation, vocabulary, and grammar system therefore, studying and understanding Chinese dialects, finding out the differences between dialects and Mandarin, and the corresponding law can help the students in dialect areas to learn and master Mandarin. At the same time, because different dialects and Mandarin have differences and corresponding rules, students speaking different dialects have different sensitivity to Mandarin pronunciation system, if the student in different dialect areas are taught and trained together, its target is somewhat off the track and will get no good teaching effect. The ideal approach should be to teach and train according to different dialect areas. Of course, if the students come from the same dialect area, teachers can make use of the dialect area characteristics to teach with aim.

Second, create the Mandarin language atmosphere by using it and set the Mandarin context.

In language learning, the importance of context is self-evident, the third week of September each year is the Putonghua promotion week, its purpose is to create atmosphere and environment to speak Mandarin together, and making a person really realizes the importance of Mandarin. However, owing to the regulations of Mandarin level to all walks by the relevant departments and the gradual development of Mandarin level test, there is a tendency towards Mandarin Teaching, that is, the Mandarin Teaching is increasingly treating Putonghua level test as the basis and target. The direct result of Mandarin's test-oriented teaching is that students' pronunciation and grammar errors are decreased, but in actual life their ability of using the language has not been improved quickly. This is the consequences of valuing pronunciation and grammar but ignoring the ability of communication in the current classroom teaching. To improve the students' language communicative ability, we must let students in the learning process to make full use of language to communicate and learn in practice. Compared with the other courses, the teaching of Mandarin is more easily carried out. In the Mandarin class we can set up the open practice context, ask one or several students to narrate, comment, illustrate and express feelings while the other students listen carefully and then under the guidance of teachers, students can point out the spokesman's mistakes in pronunciation, vocabulary and grammar. By analyzing the mistakes they can find out the correct pronunciation, articulation, choose accurate words, and correct grammar errors. Practice of setting up the context can include the hot topics students are concerned about, such as love, friendship, honesty, money, examination, employment as well as the students personal experience of life, feelings, and so on. In a relaxed and friendly atmosphere, middle school students can take turns to practice speaking, which can make the class active, exercise the students' mental tolerance, and enhance the students' confidence in using Mandarin.

Of course, the open context practice requires Mandarin teachers to possess not only considerable linguistic expertise, but also a positive guiding ability to the students' speech. When the students learn their professional knowledge, they can also virtually enhance the moral culture and correct their way of looking at the world and attitude.

Third, establish personal pronunciation files through multimedia teaching.

In Putonghua teaching, we find the difficult point of learning pronunciation is that it has its instant characteristic, which makes the personal pronunciation transient and not easy to catch and recall, and even more difficult to correct. Teachers can first use the ways of personal talk, answering questions, testing language points to arouse the students' positive pronunciation, record by using the multimedia teaching system, reserve every student's individual pronunciation data, establish different pronunciation files and create the basis of teaching students in accordance with their aptitude in class through comprehensive, meticulous, accurate analysis of the students' live pronunciation data. At the same time, students can also use their pronunciation files to analyze personal pronunciation problems, experience phonetic differences and the progress in class, and enhance the confidence of language learning. Because human's cognitive law is from intuition to abstraction and then from abstraction to specificity thus in the memory of our activities, image information memory is much stronger than the language information memory. One of the advantages of multimedia teaching is that it can mobilize a person's various sensory systems from all aspects, change the abstract into the concrete and integrate vision and hearing as well as illustration and words. It can make teaching contents which are hard to express by using the traditional teaching methods or the phenomenon that cannot be observed vivid, intuitive and full of image, and it can also change the previous static teaching content and planar teaching methods into stereo type teaching mode.

Fourth, remind students to often listen to and watch the news and other programs.

Good listening is the basis of learning Mandarin well, so listening a lot is one of the important aspects for students to learn Mandarin. They can choose China National Radio and CCTV programs, especially news. They can listen, at the same time imitate, and also can compare the Mandarin standard recording with theirs, find out differences, and improve their own pronunciation.

Fifth, hold small reciting and speech contests in class.

Through these activities, Mandarin teachers can comment systematically and the students' Mandarin ability can be improved and consolidated. At the same time, the Mandarin teaching content can be further enriched.

### ***75.3.4 The Innovation of Teaching Process***

The innovation of Putonghua teaching process mainly refers to the exchange of feelings and esthetic education.



Language is not only the tool of communication but also the direct embodiment of the idea. Therefore, paying attention to student's own condition, spiritual desire, thoughts and feelings, valuing students' individual development, and improving students' spiritual life and the moral realm become a new requirement of Putonghua teaching. The realization of students' all-round development, mainly depends on carrying out quality education in Mandarin teaching process, including knowledge, moral quality, etc. and also depends on promoting their individual development on the basis of language. The Putonghua teaching emotional exchange cannot be limited to teachers' educating students, more importantly, it is the expression of care and love during the course of communication between teachers and students in and after class. Teachers not only make students become a person who can talk and use language, but also make them become thinking and emotional individuals.

Putonghua teaching is not to cope with the examination, and also not to force students to change the inherent pronunciation and language habits and its purpose is not limited to the use of language. More importantly, Mandarin teachers and the students should feel Mandarin's charm as an art of language. Only in this way, can we love and use it from deep inside. This requires that Putonghua teaching should have esthetic education. Strengthening esthetic education can adjust students' state of mind in the process of learning, arouse students' enthusiasm and initiative in learning, and increase the effectiveness of Mandarin teaching. Guiding the students to use Mandarin with emotion can not only increase students' control ability to use language, but also can influence the surrounding people's cognition to express things or emotions.

## 75.4 Conclusion

With the growing popularity of Putonghua and more and more people using increasingly standardized Mandarin, speaking fluent standard Mandarin which is fit for the context represents a person's overall image. This puts forward a new and higher demand for Putonghua teaching. We hope that through the Mandarin teaching innovation, college students can get higher level, which improves all National Putonghua level.

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# Chapter 76

## Research on Setting of Traffic and Patrol Police Service Platforms

Qingfeng Song, Yan Yan, Mingyue Zhao and Sha Wang

**Abstract** It is a practical topic how to set traffic and patrol police service platforms reasonably. This chapter, using the improved Dijkstra algorithm, establishes the most short-circuit model and calculates the shortest distance from nodes to platforms. Then designs a reasonable dispatch plan applying 0–1 integer programming, an assignment theory which is efficiency in solving combinatorial optimization problem so as to blockade the vital communications lines quickly. Simultaneously, this chapter makes use of the average probability to optimize police strength of the service platform.

**Keywords** Dijkstra algorithm · 0–1 integer programming · Combinatorial optimization · Average probability distribution algorithm

### 76.1 Introduction

Because the reality is complicated and changeable, for the convenience of analysis, assume that the following premises:

Police vehicle travel at the speed of 60 km/h; there is no peculiar circumstance.

The state of the road between two neighboring street intersection nodes is similar.

The police travel paths are double paths.

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In any police time, there is no lack of police vehicle and police forces provide. Under those premises, analyze the setting of traffic and patrol police service platforms from four aspects of the problems.

### ***76.1.1 Assign Control Areas for the Police Service Platforms***

According to the existing transport network and the schematic drawing of traffic and patrol police service platforms, we can conclude that the police will arrive at the spot in 3 min if the police vehicle travel at a certain speed (60 km/h).

### ***76.1.2 The Fast and Entire Blockade Plan for A Area***

This area has 13 key communication lines which are interlinked with the outside. We may use the distances between two spots to replace the travel time (constantly supposition police vehicle speed), the question essence is to realize the shortest goal optimization. Using the designation model, determine 13 platforms in correspondence with 13 key communication line street intersections, then assign the additional 7 platforms to 13 key communication line's street intersections randomly.

### ***76.1.3 Building Additional Platforms Plan***

In view of the situation that the work load is imbalanced and it takes too long time to arrive at the pot, we plan to increase 2–5 platforms in A area and try to confirm the integer and concrete position.

### ***76.1.4 Analyze the Rationality of the Existing Service Platforms' Establishment Plan***

Each service platform functions and the police presence in the city equipped with basic the same. According to the principle of setting platforms and duty, analyze the rationality of the existing platforms. Using the average probability model, to analyze the workload and police time.

## 76.2 Model Building and Solution

By introduction, we know that this chapter establishes corresponding graph model, assigned model, and the average probability model about the setting problems of the traffic and patrol police service platforms [1]. The analysis of the problems, the setting of the model, and the setting of scheme are as follows [2]:

### 76.2.1 To Assign the Control Area for the Service Platform

Abstract the schematic drawing of A area’s platform situation as graph theory model. According to street intersections node’s coordinate and their adjacency relations on the schematic drawing, we may abstract one undirected chart  $G(V, E)$ , whose street intersections have replaced the node on the schematic drawing. The street was taken place by the edge in the chart and the path’s length calculated using Matlab act as the edge weight [3].

$$S_j = \{ \min L_{a_j b_i} \}$$

$$L_{a_j b_i} = \sqrt{(x_j - x_i)^2 + (y_j - y_i)^2}$$

- $b_i(21 \leq i \leq 92)$  The street intersection node of A area;
- $a_j(1 \leq j \leq 20)$  Nodes of service platform in A area;
- $S_j$  The set of the shortest distance [4].

Improved Dijkstra algorithm: what Dijkstra algorithm solves is the shortest distance path question in the undirected graph  $G(V, E)$  with the weight. Moreover, all side the weight is nonnegative. Calculate the shortest distance as  $\min L_{a_j b_i}$  by Dijkstra algorithm. Then we make a matrix of  $20 \times 70$  with Excel. Thus, calculate the jurisdiction scope each service platform and see Table 76.1.

Simultaneously, we also obtain the time that 28, 29, 38, 39, 61, 92 street intersection nodes to serve the platform surpass 3 min, they are: 4.75, 5.7, 4.19, 3.6, 3.41, 3.68 min. Therefore, we revise their control area and see Table 76.2 [5].

For the cross-section of the adjacent service platform, each part bears half of the cross. The midpoints of those are as the demarcation point to the adjacent.

### 76.2.2 The Dispatch Plan for Area A to Block Fast

For major emergencies, police of each platform can only be dispatched to an intersection. Choose the shortest corresponding five service platforms. Blocking the 13 key communication lines quickly means the distance to the farthest platform is

**Table 76.1** Respective jurisdiction of each service platform

Service platform	Street intersection node
1	67 68 69 71 73 74 75
2	40 43 44 70 72
3	54 55 65 66
4	57 60 62 63 64
5	49 51 52 53 56 58 59
6	50
7	30 32 47 48 61
8	33 46
9	31 34 35 45
10	
11	26 27
12	25
13	21 22 23 24
14	
15	
16	36 37
17	41 42
18	80 81 82 83
19	76 77 78 79
20	84 85 86 87 88 89 90 91

**Table 76.2** Revisions of the respective control area of service platform

Service platform	Street intersection node
1	67 68 69 71 73 74 75
2	39 40 43 44 70 72
3	54 55 65 66
4	57 60 62 63 64
5	49 51 52 53 56 58 59
6	50
7	30 32 47 48 61
8	33 46
9	31 34 35 45
10	
11	26 27
12	25
13	21 22 23 24
14	
15	28 29
16	36 37 38
17	41 42
18	80 81 82 83
19	76 77 78 79
20	84 85 86 87 88 89 90 91 92

**Table 76.3** The distance from key communication lines to the platforms

	12	21	22	23	24
10	75.87	95.11	77.08	91.13	82.44
11	37.91	50.72	32.70	46.75	38.05
12	0	86.85	68.83	64.77	35.92
13	59.77	27.08	9.06	5.00	23.85
14	119.50	32.65	50.68	64.73	83.59

shortest [6]. Analyzing the relative position of these lines, conclude we need to arrange the platforms to the 12, 21, 22, 23, 24, 29 communication lines. The distance from those communication lines to the platforms is as follows (Table 76.3):

To 12, 21, 22, 23, 24 key communication lines establish designation model: introduce variable  $x_{ij}(i = 10, 11, 12, 13, 14; j = 12, 21, 22, 23, 24)$ , its value can only be 1 or 0.

And command:

$$x_{ij} = \begin{cases} 1 & \text{Designate ird platform to block jrd street intersection} \\ 0 & \text{Don't appoint the ird platform to block the jrd street intersection} \end{cases}$$

$c_{ij}$  Expresses the distance from platform  $i$  to street intersection  $j$ .

Establish minimizing mathematical model:

$$\min z = \sum_i \sum_j c_{ij}x_{ij}$$

$$\begin{cases} \sum_i x_{ij} = 1 \\ \sum_j x_{ij} = 1 \\ x_{ij} = 1 \text{ or } 0 \end{cases}$$

The optimal allocation plan is:

$$\begin{vmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{vmatrix}$$

Then:  $\max z = 75.87$

Analyzes 28, 29 key communication lines  $\max(\min z) = 80.15$ , because only the fourteenth key communication line has the distance bigger than 80.15; therefore arrange the fourteenth important highway again, the rest of the traffic arteries can be assigned into the shortest possible arrangements, and the plan is as Table 76.4.

The rest seven the service platforms can be arranged as the principle of proximity.

**Table 76.4** Blockade plan of key communication lines

Key communication line	Platform	Distance
12	10	75.87
14	16	67.42
16	9	15.33
21	14	23.65
22	13	9.06
23	11	46.75
24	12	35.92
28	15	47.52
29	7	80.15
30	8	30.61
38	2	39.82
48	5	24.76
62	4	3.50

### 76.2.3 To Set up More Platforms for Police Service

From Table 76.2, the existing traffic and patrol police service platform exist workload imbalance and out of the problem of excessive, leading to inadequate police power resources, so we plan in the A zone for an additional 2–5 platforms, in order to make full use of traffic and patrol police functions, meet the people's production and living needs [7]. Additional traffic and patrol police service platform include the principle of:

In the jurisdiction's scope, police arrives in less than 3 min.

In the jurisdiction's scope of this platform, the comprehensive rate of cases should be controlled under 10 times.

The distribution of the addition plat platform and the original platform must be balanced, and not be too crowded.

The service platform had better be set up at the node where the rate of cases is relatively high [8].

According to the charge scopes of the platforms in Table 76.2 and the case rate, we made out the work load of the 20 platforms, which were in the following table: (Table 76.5).

Additional traffic patrol service platform should be added where the total rate of incidents are above 10 types.

We can discover that there is a scope where the time is surpass 3 min in a section in 62 to 85, and 28, 29, 38, 39, 61, 92 are all the police time surpass 3 min street intersections. Because the distance of the edge of the street which is under not more than 10 can be neglected, in 62–85 road sections  $8.0 < 10$ ; therefore it can be ignored, then we can consider increasing service platform suitably in 28, 29, 38, 39, 61, 92 scopes, because the 92 road is closed to the twentieth road, so we can consider to combine them and add one service platform. And because twenty-eighth street intersections with twenty-ninth street intersections, thirty-eighth



**Table 76.5** The workload of each platform

Platform	Comprehensive cases rate
1	7.6
2	9.7
3	5.6
4	6.6
5	8.6
6	3.6
7	9.6
8	5
9	8.2
10	1.6
11	4.6
12	4
13	8.5
14	2.5
15	4.8
16	5
17	5.3
18	6.1
19	5.3
20	11.5

street intersections with thirty-ninth street intersections are the neighboring street intersections, we can increase four service platforms.

There are too many intersection nodes in the jurisdiction of twentieth service platform. The total incidence rate in the platform is too high; therefore, we can consider to add intersections near the eighty-sixth and eighty-eighth street where has a high rate of cases. Considering the distances between 92 intersections and their neighboring platform edge, increase a service platform in 91 junctions.

Regarding twenty-eighth, twenty-ninth street intersections are far away from the respective service platform, and the twenty-ninth has a higher rate of cases, because the distance from the twenty-ninth intersection to the edge of the seventh platform is 50.2, so set a service platform in the place which is nearest to the twenty-ninth intersection and not further than 40 from the edge of seventh platform namely is to increase a service platform in the spot (256.8, 340.5). Regarding 38, 39 street intersections to respective platform's distance are both big and long. Because 39 incidence rates are higher, so we set up a service platform in 39 street intersections.

Because the sixty-first junction is further to its platform and the nearest distance is 42, so we establish service platform in 39 street intersections.

In conclusion, considering the workload of the traffic and patrol services platform is uneven and the police time is too long, additionally builds four junction policemen to serve the platform for (256.8,340.5) and 39,61,91 street intersection nodes .

### 76.2.4 Analyze the Rationality of the City’s Traffic Patrol Service Platform and Correct Program

According to the setting of traffic and patrol police service platform principle and task, analysis of the six existing city traffic and patrol police service platforms provided the rationality of scheme. Because the rate of incidence and population density is different, the police resource equipped of each platform is also different. Then, we can conclude the city’s setting project is unreasonable. The relationship of  $Y_i$  and  $X_i$  is:

$$Y_i = kX_i + \alpha\rho \tag{76.1}$$

$k, \alpha$  Are the scale-up factors,  $\rho$  is  $i$  in the city population density.

To the police forces of the service platform by the average probability model to carry on the optimization, assuming that  $\bar{y}$  is the service platform for each average police forces,  $\bar{x}$  is the service platform for each average incidence rate of cases,  $N$  is the relative police forces which need to be adjusted:

$$\bar{x} = \frac{1}{n} \sum_i^n X_i \tag{76.2}$$

$$\bar{y} = \frac{1}{n} \sum_i^n Y_i \tag{76.3}$$

$$N = \frac{Y_i - \bar{y}}{\bar{y}} \tag{76.4}$$

Through (76.1), we can get  $N = \frac{kX_i + \alpha\rho - k\bar{x} - \alpha\bar{\rho}}{k\bar{x} + \alpha\bar{\rho}}$ .

The relationship of the relative police forces needs to be adjusted and the rate of cases and population density is:

$$N = \frac{kX_i + \alpha\rho - k\bar{x} - 0.231\alpha}{k\bar{x} + 0.231\alpha}$$

Command:

$$\gamma = \frac{\alpha}{8.48k + 0.231\alpha}$$

Then the optimal allocation plan is:

$$N = (\rho - 0.0272X_i)\gamma + \frac{X_i}{8.48} - 1$$

$X_i, \rho$  is the whole incidence rate of  $i$  service of platform and population density of the platform’s jurisdiction, respectively.  $k, \alpha$  are constant which are defined

according to the city's basic situation.  $N$  is an adjustment of the platform's police resources?

**Acknowledgments** Qinggong College, Hebei United University Students' innovative projects, The Research on the Setting of Traffic and Patrol Police Service Platforms.

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# Chapter 77

## Forecasting Incidence Age of Coal Workers' Pneumoconiosis Based on BP Neural Networks

Xiaohong Wang, Jianhui Wu, Sufeng Yin, Guoli Wang and Zhengjun Guo

**Abstract** Retrospective analysis of the data of hospitalized coal worker patients suffering from pneumoconiosis in the Tangshan money home since 2005. Using these data which provide seniority of exposure to dust, time of exposure to dust, age and the dust class as the influence factors of length of service, which build the model of the BP neural network, and forecast the length of service of coal worker's pneumoconiosis. Making use of SPSS statistical software package, using matching t test comparison before and after the length of service of the forecast, prediction the  $D$ -value of the length of service before and after is  $0.095 \pm 2.399$ ,  $t = 1.225$ ,  $P = 0.221$ . The importance of each variable distribution result shows that the importance of the biggest is seniority of exposure in dust to forecast coal worker's pneumoconiosis (0.632), followed is the dust class (0.247), time of exposure in dust (0.061), and age (0.060). BP neural network model has high forecasting accuracy to forecast the length of service of coal worker's pneumoconiosis.

**Keywords** Coal workers' pneumoconiosis · BP neural network · Incidence seniority · Prediction

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## 77.1 Introduction

On April 28, 2010, the situation of the national occupational disease report which published by Ministry of Health showed that there were 14,495 new pneumoconiosis patients in 2009, and 748 death cases. Out of the 14,495 new pneumoconiosis patients, coal worker's pneumoconiosis and silicosis occupied 91.89 %. Over the years, the correlation study on the factors control measures of the coal worker's pneumoconiosis makes some effect. But because of poor mining conditions, multiproducing dust and the difficulty of dust control and so on [1]. Coal worker's pneumoconiosis is the extrude problem affect the health of coal workers. At present, there are no cure drugs in treatment, so accurately predicted, put effective prevention and control strategy are particularly important. At the moment, there are many ways to predict coal worker's pneumoconiosis. As Multiple linear regression, exponent decline curve, GM (1,n), Time Series Analysis, Markov model, and so on [2]. But each prevention model has its usage situation, and there are many factors to influence the coal worker's pneumoconiosis disease of the length of service work. And the relation is complex. Thus, this may dissatisfaction the requests of traditional models [3, 4].

At present, the forecast of coal worker's pneumoconiosis mainly on the prediction of groups. But fewer study on the incidence ages of the individual. Thus, it is significant to control the pneumoconiosis disease if we could forecast the incidence ages of dust exposed workers exactly. the incidence ages are continuous variable, so we could use multiple linear regression, but the model also requests meet "LINE". There are many factors to influence the coal worker's pneumoconiosis disease of the length of service work, and the relation is complex. Thus, it did not satisfy the requirement of multiple linear regressions.

Artificial Neural Networks are networks constructed by many simple neurons; they were connected by weight between each other and each neuron concludes some network information. BP network is a feed-forward neural network practiced by back-propagation (BP) algorithm, is one of neural network modes applied widely [5–7]. Because of BP network does not have any requirement for the distribution of the type of date and has definite fault tolerance. Could study by it, and achieve adjustment the complex mapping relationship between input and output variables. Thus, we could consider the study that forecast the incidence ages to use BP network.

## 77.2 The Realization Process of BP Network Use SPSS

Multilayer perceptron is used in this application, the construct progress as follows:

First step: Analyze—neural networks—Multilayer Perceptron, see Fig. 77.1.

Select one dependent variable and one factor or one covariate at least, according to the need, we could change covariate on variable tab.

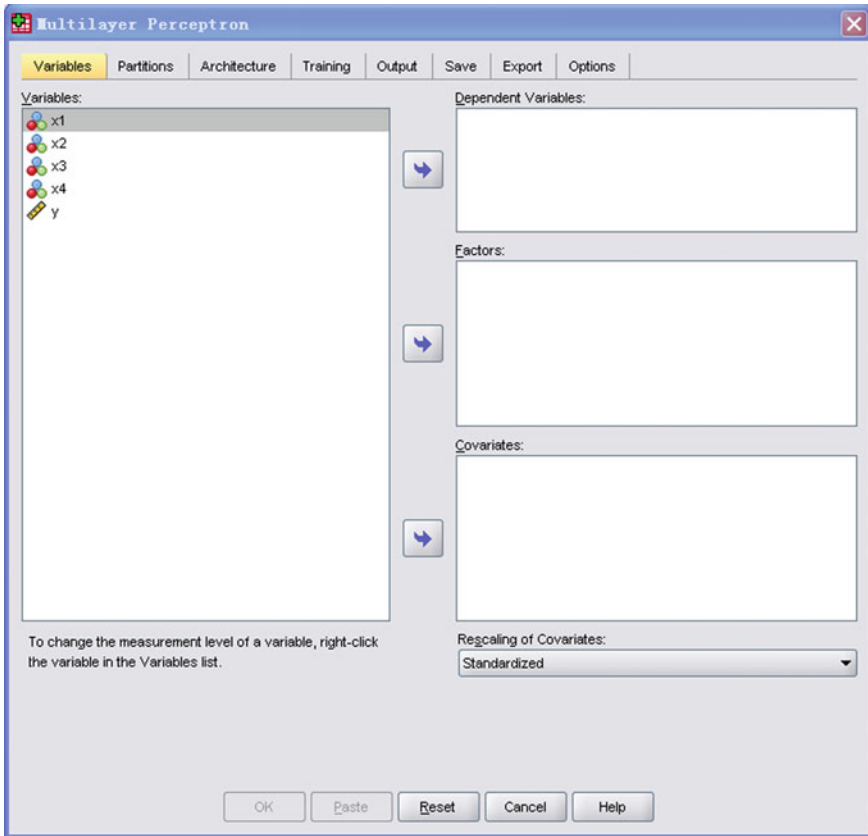


Fig. 77.1 Multilayer perceptron

Second step: click Partitions tab: see Fig. 77.2

In this application, we use zoning variable to distribute case, and select zoning as zoning variable.

Third step: click output tab: see Fig. 77.3

We abolished selecting icon at “network structure” group in this application, but selected Predicted by observed chart and residual by predicted chart and select Independent variable important analysis.

Forth step: click save. See Fig. 77.4

In order to calculate predict value of each incidence age, we select save predict value or type of each dependant variable in this application.

Fifth step: click OK. The analysis result will turn up.

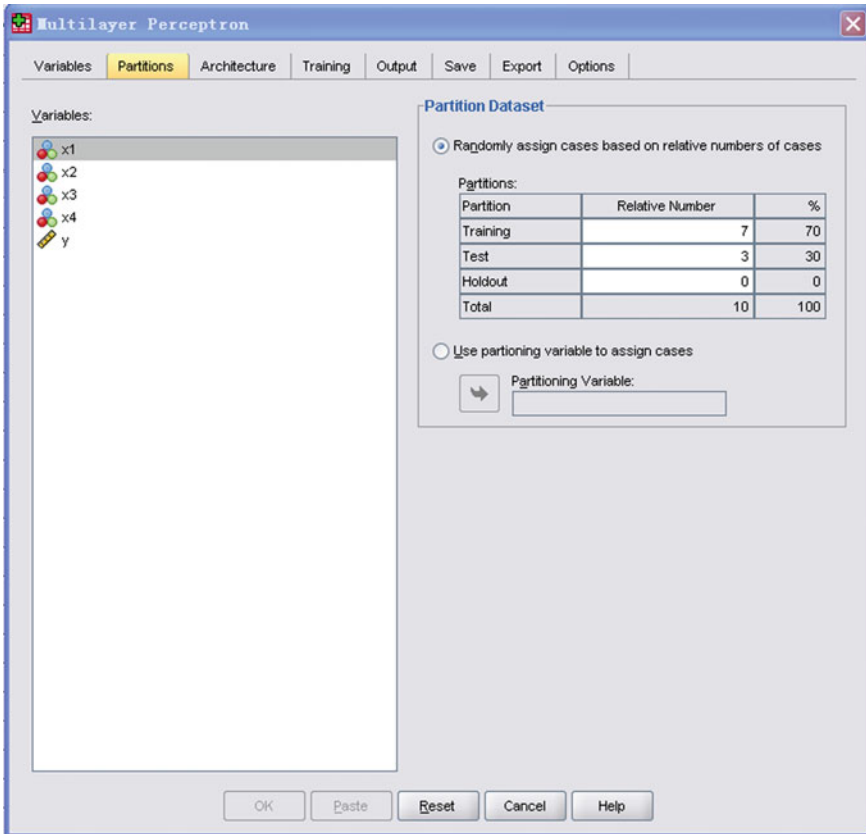


Fig. 77.2 Multilayer perceptron

## 77.3 Result

### 77.3.1 The Descriptive Analysis of Date

In the object of study, the youngest is 40 years old, and the average age is  $67.57 \pm 10.360$ ; the shortest exposure time is 3 years, the longest is 55 years, and the average time is  $30.43 \pm 7.028$  years. The shortest incidence age is 3 years, the longest is 55 years, and the average time is  $27.97 \pm 7.432$  years. The main dust was rock dust (53.7 %); the main dust exposure time is 1950–1980 (83.7 %). See Tables 77.1 and 77.2.

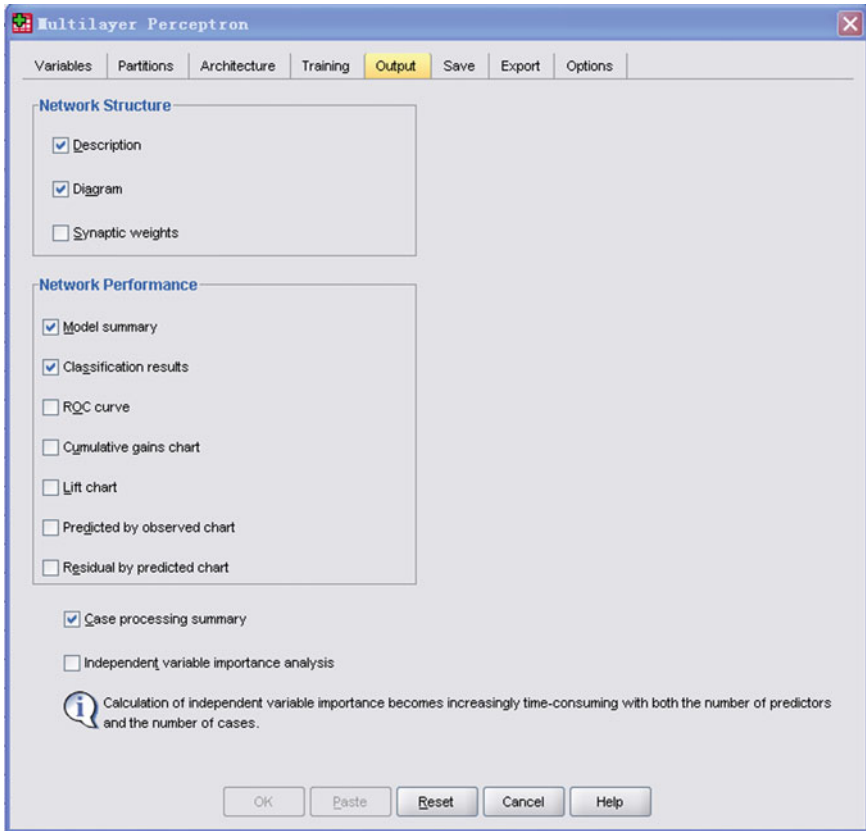


Fig. 77.3 Multilayer perceptron

### 77.3.2 Determining Parameter and Establishing Model

#### 77.3.2.1 Select Variable

Incidence age was dependent variable, dust sort, exposure time; exposure year and age were independent variables.

#### 77.3.2.2 Output Result

Establish BP neural network model and parameter, by setting up independent and Automatic Adjustment software system, the main parameter of the optimum BP neural network model, see Table 77.3.

Accuracy Test and the model efficiency estimate



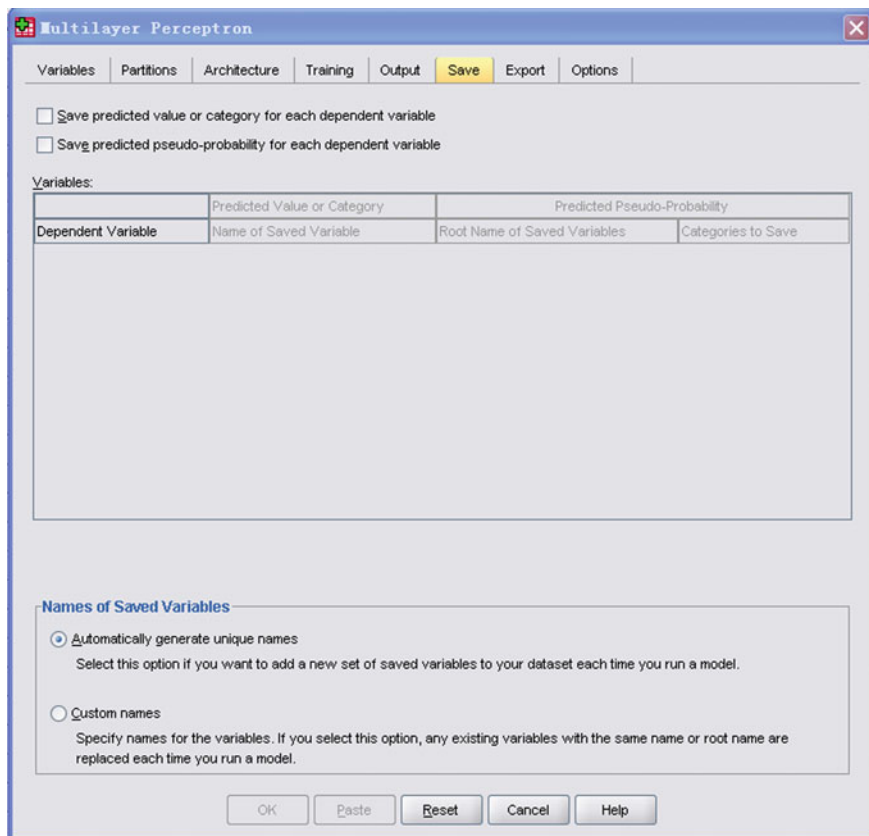


Fig. 77.4 Multilayer perceptron

Table 77.1 The distribution analysis of dust exposure time and dust sort ( $n = 949$ )

Input variable	Group	Patient number	Constituent ratio(%)
Type of work	Coal dust	425	43.7
	Coal and rock dust	25	2.6
	Rock dust	521	53.7
Exposure year(year)	1930-	144	14.8
	1950-	298	30.7
	1960-	230	23.7
	1970-	284	29.3
	1980-	11	1.1
	1990-	3	0.3

**Table 77.2** The distribution analysis of incidence age and dust exposure time( $n = 949$ )

Variable	min	max	$\bar{x} \pm s$
Age (year)	40	95	$67.6 \pm 10.4$
Exposure time (year)	3	55	$30.4 \pm 7.0$
Length of service (year)	3	55	$27.9 \pm 7.4$

**Table 77.3** The main parameter of the optimum bp neural network model

Network structural parameters	The train parameter of network
Hidden layer: 1	Training algorithm: gradient descent
The number of neuron in hidden layer: 8	Iterations when stop training: 25
The number of neuron in input layer: 4	Speed of study: 0.0169
The number of neuron in output layer: 1	Performance function: SSE
Active function in the implication layer: hyperbolic tangent	Training set when stop training SSE = 0.359
Active function in the output layer: identically equal	Inspection set when stop training SSE = 0.399

**Table 77.4** Analyze data by paired-sample t test ( $n = 949$ )

Group	$\bar{x} \pm s$	D-value( $\bar{x} \pm s$ )	T	P
Ture value	$27.97 \pm 7.432$	$0.095 \pm 2.399$	1.225	0.221
Predict value	$27.87 \pm 4.918$			

**Table 77.5** The important of each independent variable

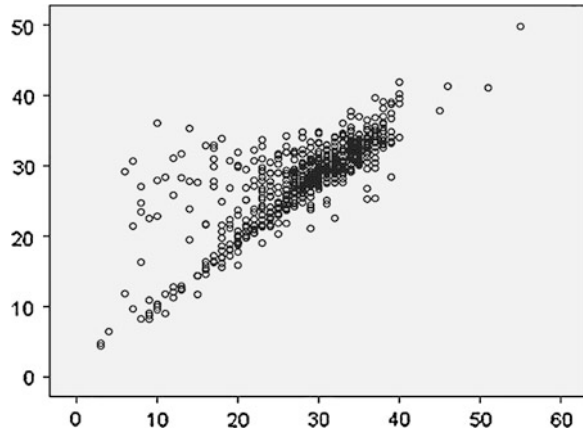
Value	Importance	Standardized importance(%)
Dust exposure time	0.632	100.0
Dust sort	0.247	39.1
Dust exposure year	0.061	9.6
Age	0.060	9.5

The scatter diagram was made by the output results and real value, besides fewer splashes, the model had global liner trend distribution with a slope for  $45^\circ$ . Thus under the circumstances, it is accurate that use BP neural network to predict coal workers' pneumoconiosis.

There was no statistical significance between true value and predict value, when analyzing data by paired-sample t Test. It explains that the prediction performance of BP neural network is good. See Table 77.4.

The degree of influence to incidence age among each input variable, see Table 77.5 and Fig. 77.5; from Table 77.5, it is known that the largest influence factor to incidence age was dust exposure time, in the next place was dust sort, exposure year, and age in turn.

**Fig. 77.5** The scatter diagram was made by the output results and real value



## 77.4 Result

It is accurate to use BP neural network to predict coal workers' pneumoconiosis by using suitable parameter, so we could use it to predict the incidence age of coal workers' pneumoconiosis. And the largest influence factor to incidence age was dust exposure time; in the next place were exposure year, dust sort, and age in turn.

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# Chapter 78

## Study on Tutor Team of Full-time Professional Degree Graduates

Huilan Li, Chunling Sun, Lei Zhou, Guobin Zhang and Weitao Su

**Abstract** The structure, academic quality, student/teacher ratio, practical experience, and management mechanism of the tutor team of full-time professional degree graduates were investigated to discuss and analyze the current situation and the existing problems in order to provide the basis for strengthening the construction of tutor teams. Tutors, full-time professional degree graduates, and practice base personnel were treated with sample surveys and interviews and the related literature were retrieved. All the data were dealt with statistical analysis. The tutor team construction of full-time professional degree graduates has just started, so there exist problems in terms of the structure type, quantity, quality, management mechanism, influencing the education quality of graduates, which need to be strengthened.

**Keywords** Full-time · Professional degree · Graduates · Tutor team

### 78.1 Introduction

In recent years, with the vigorous development of graduates' education, the construction of the tutor team had received great attention and made some achievements, yet relevant reforms focused on academic graduates. With the rapid rising of education of professional degree graduates with vocational background, some problems such as what the current situation of the tutor team of professional degree graduates was, whether the

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tutor team was right for training applied and creative talents emerged. Owing to the short time, the academic field had little research in this aspect. And some discussions lacked supporting data as well as sufficient statistical and quantitative analysis. Therefore, the structure, academic quality, student/teacher ratio, practical experience, and management mechanism of the tutor team of full-time professional degree graduates were investigated, and tutors, graduates practice base personnel were treated with sample surveys and interviews. All the data dealt with statistical analysis, expecting to assess the current situation of the tutor team of full-time professional degree graduates objectively, and providing the basis for strengthening the construction of the tutor team.

## **78.2 Materials and Methods**

### ***78.2.1 Subjects***

A questionnaire survey was distributed to full-time professional degree graduates in various disciplines of 11 universities in one province, and their tutors. Among them, tutors' questionnaires were 200 copies, 167 returned and the recovery rate was 83.5 %; graduates' questionnaires were 150 copies, 119 returned and the recovery rate was 73.9 %.The management personnel and practice base personnel were interviewed.

### ***78.2.2 Methods***

A questionnaire survey, interviews, access to management literature and training files, literature search on the CNKI were used.

### ***78.2.3 Contents***

The structure, academic quality, student/teacher ratio, practical experience, and management mechanism of the tutor team of full-time professional degree graduates were investigated; graduates, tutors, management personnel, and practice base personnel were interviewed and the construction plans of the tutor team in higher universities were retrieved.

### ***78.2.4 Data Processing***

Software such as EXCEL and SPSS was used to analyze the data of questionnaire results.

## 78.3 Results

### 78.3.1 *The Structure*

The structure of the tutor team of full-time professional degree graduates fell into five aspects, namely, age, degree, technical title, learning-origin and type.

According to the survey, the proportion of age and degree in the total number were calculated and the distribution trend. As can be seen, the proportion of tutors with the age from 56–60 decreased by an average of 6 % a year; while the proportion of tutors with the age from 36–40 increased by an average of 6 % a year [1].

In the top 10 list of universities issued by “The USA News and World Report” in 2000, the proportion of teachers with doctorate degrees was above 93 %. In general, having associate professor title was the entrance condition for graduates’ tutor. Yet in recent years, a few lecturers with doctorate degrees who had plentiful academic achievements had become tutors by waiving conventional constraints. In this survey, the proportion of professors accounted for 47.76 %; associate professors 51.03 %; lecturers 1.21 %. The survey found that 62.5 % of tutors had no change in their discipline since their university period, and 59.7 % of tutors with master’s degree had no change in their learning-origin structure. Interviews showed that the existing professional degree tutors were tutors of academic-typed tutors concurrently. Therefore, most of the tutors belonged to the type of academic ones. The proportion of full-time applied tutors with practical experience was low (only 13.3 %).

### 78.3.2 *The Academic Quality*

The assessment of academic quality to tutors was made up of two parts: academic level and professional skills. Investigations found that in the recent 5 years, 5.7 % of tutors published no paper since they got their mentorships; 27.7 % of tutor’s published 1–5 pieces of paper; and 34.9 % of tutors published about 10 pieces of paper. In addition, 38.1 % of tutors did not compile academic monographs as the main or the associate editor; 23.4 % of tutors compiled one academic monograph as the main or the associate editor; Investigations also found that the research fund obtained by the tutors younger than 30-years old was only 13,000 yuan per capita; while the research fund obtained by the tutors older than 61-years old was 184,000 yuan per capita. Interviews found that most of the research projects of tutors were of provincial and university levels, while there were less national and international cooperation projects.

The investigation of graduates found that as for the aspect of “the influence of the tutors to the improvement of graduates’ innovation ability”, 68.33 % of graduates thought there was large influence, while 23.88 % thought there was little

influence. One survey to graduates found that the academic moral quality of tutors decreased. “17.5 % of graduates thought that some tutors copied or plagiarized other’s achievements, 33.1 % thought that some tutors conducted scientific research carelessly, not rigorously” [2].

### ***78.3.3 The Student–Teacher Ratio***

The survey found that there existed significant difference of disciplines in student–teacher ratio. The average student–teacher ratio of applied disciplines was 9.5, 2.3 times more than that of academic disciplines. The highest student–teacher ratio was found in Law school (14.7), followed by the business school (11.4), and engineering school (7.3). The lowest student–teacher ratio was found in humanities and social science institute (3.5). The student–teacher ratios of medical, science, and liberal arts colleges were 3.8, 4.6, and 4.4 respectively. The student–teacher ratio of different disciplines. Retrievals found the student–teacher ratio of America and Britain which had advanced higher education was low, while the average student–teacher ratio of China’s famous universities was 8.4, 2.1 times more than that of Canada, 1.9 times of Japan, higher than that of America. Guan Yingjun’s statistics to some key universities showed that from 2000 to 2003, the average number of college graduates increased 27 % every year, while the average number of tutors increased only 9.2 % [3].

Different guidance methods of tutors influenced guidance effects. Investigations of graduates showed that most graduates preferred to make communication with their tutors by face-to-face interview; 10 % by “written guidance”; 8.6 % by “internet communication”; 3.8 % by “telephone communication”. 26.2 % of the investigated graduates thought that the communication between them and their tutors was more and irregular; 9.8 % thought it was less and irregular.

### ***78.3.4 The Practical Experience***

Tutors in different disciplines had different practical experience. Interviews found that there were no quantitative requirements of whether tutors participated in practice or whether they were full-time or not in all universities. The reality was that full-time professional degree tutors in applied disciplines were the original academic-typed tutors concurrently. Among them, 1/4 of tutors had practical experience, while for their professional activities, practice only accounted for 2/3 to 1/5, 13.7 % of the professional degree tutors never guided their graduates to participate in applied practice. Whereas, the United States had specific requirements in practical experience to tutors; Japan required the ratio of practice to professional activities was more than 30 %, the ratio of full-time and part-time tutors and the student–teacher ratio were 1.5/1 respectively [4, 5].

### ***78.3.5 Management Mechanism***

The survey found that only 30.2 % of tutors were satisfied with the current selection system of tutors; 23.6 % thought that there existed some other influencing factors in the process of selection of tutors. Interviews found that there existed a seniority system. The survey also found that 30.9 % of tutors thought that there were insufficient training systems to tutors; 14.1 % of tutors were not satisfied with the current assessing system. Interviews to management personnel from 11 universities revealed that the current assessing system turned out to be a formalized and elimination system of tutors, not very often implemented.

## **78.4 Discussion**

### ***78.4.1 The Structure Type***

Statistical results showed that there was normal distribution in the age composition of full-time profession degree tutors' team, among which, the amount of tutors from 41–50-years old accounted for the largest proportion, indicating that the age structure of tutors' team was basically rational. At the same time, we also found that the number of tutors younger than 40-years old accounted for a considerable proportion, while the amount of tutors older than 55-years old accounted for low proportion, indicating that with the rapid expansion of the scale of graduates, there appeared the tendency that the ages of tutors turned out to be younger, whose developing momentum made the tutor team system not to make an appropriate buffer and adjustment.

As for the structure of tutor's degree, the proportion of full-time professional degree tutors with doctorate degree was low, which had a great gap with that of America. The tutors with younger ages have such low degree, which was worth pondering. In a sense, this situation could affect not only the construction of tutors' team, but also the training quality of professional degree graduates.

Investigations of technical titles and learning-origin of tutors showed that there were lower proportion of tutors with technical titles of professors, and learning in breeding was very serious, which not only blocked the improvement of the teaching and research levels, but also influenced academic exchanges and teaching experience's sharing. As the result, heterogeneous type of tutor team and lower talent flow were barriers to the formation of academic atmosphere with the academic property of absorbing and bold seeking.

The proportion of applied and vocational-based academic tutors of full-time professional degree was larger, while that of practical and applied full-time tutors was smaller, which influenced not only the realization of training goal to professional degree graduates, but also the whole healthy development of graduates' education.



### **78.4.2 *Quantity and Quality***

Investigations found that to the tutor team, the teacher-student ratio of the applied disciplines was too large, indicating that there were insufficient full-time or practice-experienced professional degree tutors so that the increasing number of tutors was far lower than that of graduates. In addition, the academic level and professional skills of tutors remained to be improved owing to their fewer academic achievements, narrower project sources, low-leveled research projects, inadequate funds, insufficient innovation, land-sliding academic morality and so on. The reasons were as follows: on the one hand, the selection and assessment systems of tutors were single, stressing the academic orientation, on the other hand, applied-typed tutors' training was not sufficient; practice bases were not enough; the learning-origins were near, and the honesty construction was weak. Therefore, the reform to tutors' selection should be strengthened; selection requirements should be assessed scientifically, and assessment to practical experience should be emphasized. What is more, the selection scope should be further developed, for example, appointing tutors from multiple channel, such as from academic tutors, classroom teachers, and from practice base with the aim of the diversity of full-time tutors' team. In addition, crossing and fusion of disciplines, academic innovation, honesty construction were still to be further strengthened.

### **78.4.3 *Management Mechanism***

Scientific and fair tutor's selection system and training and assessment system were the key to mobilize tutors' enthusiasm and creativity. The survey found that tutors were not satisfied with the current selection, training, and assessment systems, which was attributable to the current rigid management mode, with irrational innovative assessing system to tutors, and with imperfect mechanism in tutors' training and assessment. Therefore, scientific management mode should be constructed. On the one hand, dynamic appointment system and elimination system should be established and implemented, strengthening the management of the posts of tutors. On the other hand, perfect tutors' training systems should be established to stimulate the self-development of tutors. A good atmosphere of innovation should be created, the corresponding innovation mechanism should be improved, and then excellent innovative teams can be cultivated.

## **78.5 Conclusion**

Through the investigation and research, the conclusions were as follows:

The echelon of full-time professional degree tutors was reasonable basically, and it played a key role in promoting the training of applied and inter-disciplinary

talents. Yet the construction of applied full-time tutors' team had just started, and there were some problems not to be neglected in the aspects of the structure type, quality and quantity, management mechanism, which to some extent influenced the realization of training goal. So it must be improved urgently.

- (1) The tendency that the ages of tutors turned to be younger appeared, and fewer practical full-time professional degree tutors made the tutors' echelon imbalanced: The proportion of tutors with doctorate degree or with technical title of professors was small. So the structure of learning-origin system must be optimized.
- (2) The student-teacher ratio in applied disciplines was large and the number of applied-typed tutors and their academic level and practical experience remained to be improved. Crossing and fusion of disciplines, academic innovation, honesty construction were still to be further strengthened.
- (3) The current management mode was rigid, lacking proper innovative assessing mechanism to tutors, and the tutors' training and assessing mechanism were not perfect. Therefore, the construction of scientific management paradigm should be focused on.

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# Chapter 79

## Analysis of Graduates' Professional Maturity

Huilan Li, Chunling Sun, Lei Zhou and Guobin Zhang

**Abstract** Objective: Graduates' professional maturity was investigated to discuss and analyze the present situation and the influencing factors in order to provide the basis for counseling about graduates' professional career. Methods: Questionnaire survey was used with graduates from different grades and different disciplines in one university as subjects. All the data were treated with average data, *t* test and variance analysis. Results: Graduates' professional maturity as a whole was not high. There existed significant difference in discipline between graduates the factors, such as gender, family background, work experience, discipline satisfaction and education cost, could influence the development of professional maturity.

**Keywords** Graduate · Career · Professional maturity · Present situation · Influencing factors

### 79.1 Introduction

The dual economy of our society made orientation of graduates' employment imbalanced, and the asymmetry between job opportunities and graduate enrollment scale, quality and requirements, and so on made graduates' employment into the dilemma gradually. Employment of university students had been the research focus of the academic field, but more focuses were put on the influencing factors of college students' employment and less on graduate professional maturity. Questionnaire survey of graduates' professional maturity was used with graduates from

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different grades and different disciplines in one university as subjects to analyze its present situation and its influencing factors in order to provide the basis for counseling about graduates' professional career.

Professional maturity was first put forward in 1955 by Super, and then gradually replaced by more systematic and mature Crites' theory. Super divided career development into five stages, namely growth, exploration, establishment, maintenance, and recession and each stage had its own specific career development objectives and tasks and its realization showed the extent which the individuals' professional maturity achieved [1]. Crites explained individual professional behavior from the viewpoint of development, thinking professional maturity showed individual's development in his career [2].

## **79.2 Materials and Methods**

### ***79.2.1 Subjects***

Questionnaire survey was distributed to graduates from Grade 2010 (the first grade), Grade 2009 (the second grade), and Grade 2008 (the third grade) in different disciplines of one university. Questionnaires had 200 copies, 196 returned and the recovery rate was 98 %. Relevant personnel were interviewed.

### ***79.2.2 Methods***

Revised professional maturity questionnaire from Zhang Zhiyong [3] was used to investigate the subjects, followed by interviews and retrievals.

### ***79.2.3 Contents***

The present situation of graduates' professional maturity from different grades was surveyed, feedback and suggestions from related personnel was interviewed, and relevant professional mature literature was retrieved.

### ***79.2.4 Data Processing***

Software such as EXCEL and SPSS was used to analyze the data of questionnaire results.

### 79.3 Results

#### 79.3.1 General Situation of Professional Maturity

In this survey, the average value of the overall scores of graduates' professional maturity was 3.387, less than more mature level (4 points).

Indicating that graduates' overall professional maturity was not high. The overall score and its influencing factors' scores in graduates' professional maturity were shown in Chart 1.

Of the six structural factors, scores from high to low were professional independence (3.390) → reliance on friends or relatives (3.406) → professional understanding (3.575) → professional value (3.454) → professional confidence (3.324) → career goals (3.111) (Fig. 79.1).

#### 79.3.2 Analysis of Gender and Grade in Professional Maturity

Multivariate and single factor analysis of variance with gender and grade as the independent variable and professional maturity and each factor score as the dependent variable, found that there existed significant difference in gender from professional goal, professional confidence, and professional value. Yet Du Wensi's survey showed that there was no notable difference in this aspect [4]. In addition, there existed significant different in grades. Scores from high to low were Grade 3 (3.481); Grade 2 (3.449); Grade 1 (3.349). Multiple comparison results showed that there existed significant difference in the scores in career goal, professional value, and reliance on friends or relatives between Grade 3 and Grades 1 and 2

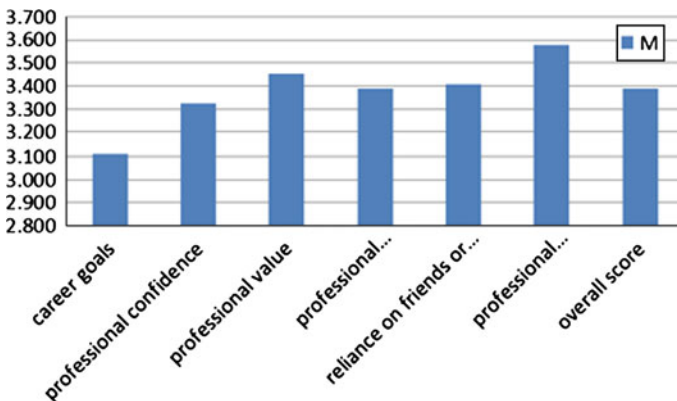


Fig. 79.1 General situation of professional maturity

respectively. There was no difference in the scores of professional confidence, professional independence, professional understanding between Grade 3 and Grades 1 and 2 respectively.

### 79.3.3 Analysis of Disciplines and Work Experience in Professional Maturity

Disciplines were divided into two categories: science and arts. Multivariate analysis of variance with disciplines as the independent variable and professional maturity and each factor score as the dependent variable showed that there existed significant differences in the factors such as professional value, professional confidence, professional understanding, reliance on friends and relatives, and professional independence (Table 79.1). Multiple comparison results further showed that there were significant differences in disciplines between science and arts except the factor of career goal.

Professional maturity of graduates without working experience and its influencing factors were treated with two independent *t* tests, indicating that as for professional maturity on the whole, there existed significant individual difference between graduates with and without working experience. Further multiple comparison results showed that the scores of individuals with working experience in terms of professional value, career goal, and professional confidence were significantly higher than those of individuals without working experience.

### 79.3.4 Analysis of Professional Satisfaction for Professional Maturity

Professional satisfaction was divided into satisfied, general satisfied, and not satisfied. Multivariate analysis of variance with professional satisfaction as the independent variable and professional maturity and scores in its influencing factors

**Table 79.1** Analysis to disciplines in professional maturity

	Science ( <i>n</i> = 129)		Arts ( <i>n</i> = 67)		F	Sig.
	M	SD	M	SD		
Professional value	3.477	0.027	3.503	0.053	3.221	**
Professional self-confidence	3.461	0.027	3.277	0.049	3.105	**
Professional independence	3.485	0.027	3.366	0.051	2.471	*
Professional understanding	3.718	0.029	3.527	0.054	3.011	**
Career goal	3.155	0.024	3.067	0.046	2.092	
Reliance on friends or relatives family	3.207	0.025	3.313	0.050		*
Professional maturity	3.477	0.027	3.365	0.051	3.254	**

Note \*\*  $P < 0.01$ , \*  $P < 0.05$

as the dependent variable, found that there existed significant difference in the professional satisfaction of professional maturity and its influencing factors. The overall scores in professional maturity from high to low were satisfied group (3.505); general satisfied group (3.343); not satisfied group (3.185).

### ***79.3.5 Analysis of Other Factors in Professional Maturity***

As for other variables, the professional maturity scores of only children, the self-employed from large or medium-sized cities in totality and in professional self-confidence, professional value, and professional independence were higher than those of not only children and the self-employed from rural towns. Parents' education also influenced the overall scores in professional maturity, that was, the higher education their parents had, the higher professional self-confidence the self-employed had. Further analysis found that there existed significant difference in professional self-confidence, professional independence, and career goal of graduates whose fathers were different in their education background; while there existed significant difference in professional independence, professional understanding and the overall professional maturity of graduates whose mothers were different in their education background.

## **79.4 Discussion and Conclusion**

### ***79.4.1 The Overall Characteristics of Professional Maturity***

The overall professional maturity of graduates had become mature, yet the overall scores of professional maturity and those of its influencing factors were low. There existed significant restriction and influence between the influencing factors, leading to imbalanced development. Among the influencing factors, the score of professional independence was the highest, while the scores of career goal and professional self-confidence were significantly lower than those of other factors, indicating that although they had stronger self-consciousness and independence in their career choice, graduates were confused about their goal and value orientation, showing their imbalanced psychological factors of professional maturity.

### ***79.4.2 Characteristics of Gender and Grade Development in Professional Maturity***

Data showed that there existed significant difference in gender in graduate's professional maturity. The scores of males were higher than those of females in professional maturity, whose result was different from that of Du Wenxin. Perhaps

this result might have some relation with dominant male subjects in this survey. In addition, there existed significant difference in grade in graduates' professional maturity, presenting "U" type development. There appeared declining professional maturity from Grade 1 to Grade 2, and till Grade 3, increasing professional maturity appeared, which was even beyond that in Grade 1, indicating the period of Grade 2 was the key stage of developing their professional maturity.

#### ***79.4.3 The Development Characteristics of Disciplines and Professional Experience in Professional Maturity***

There existed significant difference in disciplines in graduates' professional maturity, which was, the overall professional maturity in science was greater than that in arts. This difference might have some relation with different discipline characteristics, or with different social practice or professional guidance of disciplines. There existed significant influence of professional experience on individual professional maturity, which might be due to their previous professional experience helpful for their applying for jobs later.

#### ***79.4.4 The Development Characteristics of Professional Satisfaction and Other Factors in Professional Maturity***

Research found that there existed significant difference in professional satisfaction of graduates' professional maturity. Perhaps it was because individuals satisfied with their disciplines were not only interested in their discipline, but also satisfied with their universities' attention to discipline, material and technical conditions, professional development, and job prospects, which led to their greater self-confidence in facing career choice, so their professional maturity was higher.

As for other factors, there existed some homogeneous features in the aspects of only children, the self-employed in large and medium-sized cities and parents' education background. Rich social quality resources usually led to stronger self-consciousness and personality in individuals, and more attention to their own professional design and development. So their professional maturity was higher.

#### ***79.4.5 Summary***

- (1) Although the overall scores of professional maturity and those of its influencing factors were not high, graduates' professional maturity had become to the level of maturity.



- (2) There existed significant difference in gender, grade, discipline, professional experience, and discipline satisfaction of graduates' professional maturity.
- (3) Professional maturity directly influenced the attitude of career choice and the ability of career choice. There existed close relation between the attitude of career choice and the situation of employment; while the ability of career choice directly influenced the employment purpose and subjective feelings in graduates' employment.
- (4) Imbalanced psychological factors appeared in graduates' professional psychological development, such as graduates lacked skills in professional planning implementation and they had lower anti-frustration ability [5].

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**Part IX**  
**Computer Graphics and Image Processing**

# Chapter 80

## A Forward and Reverse Wrapping Depth Image-Based Rendering (FR-DIBR) Method for Arbitrary View Generation

Haitian Gui, Zhiyong Pang, Dihu Chen, Min Chen and Hongzhou Tan

**Abstract** Double-sided DIBR can generate a perfect virtual view image. However, most of the data are the same in the two candidates. It is a waste cost. This paper proposed a simpler and more effective method to reduce the cost called forward and reverse wrapping DIBR (FR-DIBR). The FR-DIBR utilizes a main color image with associated depth map and an assistant color image. First, it wraps the main reference image to the virtual plane, and then reversely wraps the region of the disocclusion in the virtual view to the assistant reference image to get the lost information of the holes. The efficiency is improved by only wrapping one image and the disocclusion region. A depth map inpainting method called BBWF is also proposed. The experimental results show that the FR-DIBR can reduce the computation cost by 33 % and generate a clearer virtual image compared with the double-sided DIBR.

**Keywords** 3DTV · 3D display · B-DIBR · FR-DIBR · Virtual view

### 80.1 Introduction

Arbitrary view generation method can be classified into geometry-based information called GBR and image-based information called IBR. The GBR renders a virtual view by building a 3D geometry model. However, it is hard even impossible to construct all the models of the objects in the scene because of the high

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complex to reconstruct a model of an object, especially there are many objects in the scene with some unexpected modes. Contrast to GBR, the IBR method does not need the 3D details, since it renders the virtual views only by using the reference images. By doing so, naturalness of the virtual view image is preserved. Another advantage is that it can render virtual image in real time. It is more important for the 3D display with huge data to visit.

Depth Image-Based Rendering (DIBR) [1] is the most important and latest method in many IBR methods which has several attractive features. DIBR can theoretically render arbitrary view using a reference color image and the associated depth map. However, there are some problems like visibility, re-sampling, and disocclusion which make it hard to create a high quality virtual image [1]. Among those problems, disocclusion is considered as the most important and difficult one. Several approaches have been proposed to solve the problem.

One method is to fill the holes by using the information of the remainder part of the reference image. Simple way is to fill the holes with the background of the image [2]. Complex way is to do that using image-inpainting [3] [4–6]. Layered-depth-image (LDI) is another approach [7]. Recently, depth map pre-processing [8, 9] and bi-warping methods [10–14] are proposed to fill the holes.

However, most of the methods above cannot achieve the best result between image quality and low algorithm cost. The approach utilizing the information from the remainder part will cause artificial impairments and might involve some time-consuming schemes like inpainting. As to LDI, it needs to store the multi-layer depth value, it is a computationally complex and badly bandwidth consuming for transmission. Pre-processing methods would bring serious geometrical distortion. Bi-warping method needs two color image and two depth map and it also needs to wrap two reference images to the virtual plane.

Considering the image quality and the cost, we propose a simple and effective DIBR method. The method can get a better quality virtual image compared with the way using the data of the reminder of the reference image, depth map pre-processing, and inpainting. And the algorithm only costs 67 % compared with the double-sided DIBR. The virtual views generated with our approach have a more satisfying image quality at a low algorithm cost compared with other approaches.

We organize the reminder of the paper as follows. [Section 2](#) briefly describes traditional double-sided DIBR technique. [Section 3](#) is the details of our proposed method. [Section 4](#) is the results of experiment. And [Sect. 5](#) is the conclusion.

## 80.2 Double-Sided DIBR

Double-sided DIBR [12] can generate a better quality virtual image since it can use the information of both sides of the virtual view. So the virtual image has no apparent distortion and artificial noise without pre-processing the depth map and using inpainting approach. First, it uses two reference color images and two depth maps to get two candidate images. Second, it synthesizes the two candidate virtual

images to get the final virtual image after interpolation and inpainting for the cracks and other tiny holes. The best advantage of double-sided DIBR is the complementary of the information in the disocclusion region. Figure 80.1 is the main framework of the double-sided DIRB.

A warping function [1] can theoretically generate arbitrary view by projecting the reference image to the objective plane with the depth map corresponding. The warping function can be expressed as follows.

$$sm = A[R|t]M \tag{80.1}$$

$$M = R^{-1}A^{-1}(sm) \tag{80.2}$$

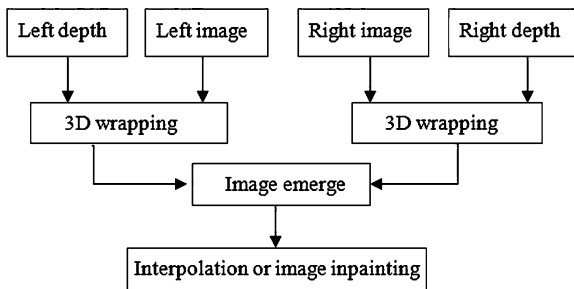
$$zm' = A'R'M + A'T \tag{80.3}$$

$$zm' = A'R'R^{-1}A^{-1}(sm - At) + A'T \tag{80.4}$$

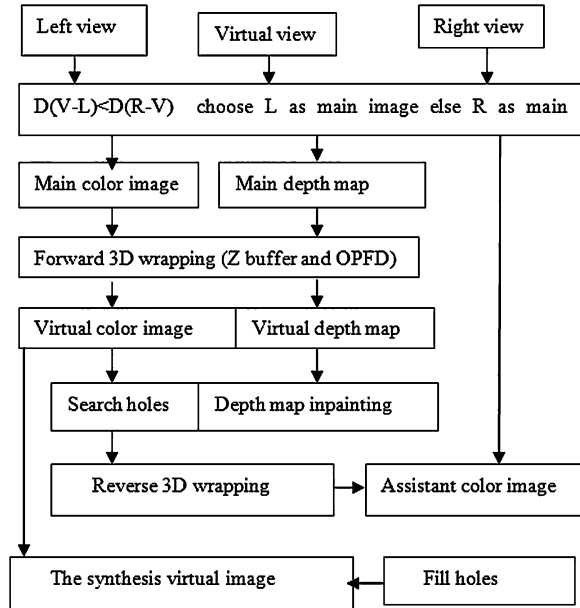
where  $s$  and  $z$  is a scale parameter equaled to the depth value in the world space,  $m$  and  $m'$  are coordinates of the reference image and the virtual image,  $M$  is the world coordinates.  $A$  and  $A'$  is the  $3 \times 3$  Matrix presents the intrinsic parameters,  $R$  and  $t$  are the external parameters of the reference camera.  $R$  is the rotation parameters,  $t$  is the translation parameters. The  $s$  is the depth map value.  $R'$  and  $T$  are the external parameters of the virtual camera. In this paper, we assume they are known.

3D wrapping can get the coarse virtual image. And image emerging can handle the big problem of the disocclusion. Figure 80.2 shows the results of the tradition double-sided DIBR. It must wrap the whole left and right reference image to the virtual view plane. But we can see that most of data between the left and the right candidate image are the same, while the holes need to fill is only a little proportion. And most of the cost is caused by the wrapping algorithm in the DIBR. So we can reduce the cost if we can reduce the wrapping data. Considering the cost, we proposed the FR-DIBR for the real time of two views to multi-view system.

Fig. 80.1 Double-sided DIBR



**Fig. 80.2** The framework of the FR-DIBR



### 80.3 FR-DIBR

Figure 80.2 illustrates the procedure of our approach FR-DIBR. The input files are two color images as the reference image and one depth map corresponding to one of the reference image. The output file is the arbitrary virtual view image in the middle of the two reference image: the color image with the depth map is considered as the main color image, another image as the assistant image.

Step 1. Forward Wrapping. Wrap the main color image to the objective plane to get the coarse virtual image and the depth map in the virtual view using the wrapping function with the depth map corresponding to the reference image.

Step 2. Use the OPFD and Z-BUFFER [11] algorithm to handle the overlap, visibility, and re-sampling problems.

Step 3. Virtual depth map processing: after 3D wrapping of the main color image, we get the virtual view color image. The virtual view depth map is obtained at the same time. We named the depth map as the virtual depth map. From Eq. (80.4), we can know that when project the  $M$  to the  $m'$ , we get the  $u'$ ,  $v'$  as the coordinate and the depth map value  $z$  at the same time in the virtual plane. It does not cause another cost in the whole algorithm. And then a method called block-based water filled (BBWF) is used to fill the holes of the depth map, a block as  $8 \times 8$ , only use the depth with the lower value to fill the hole like the water stream. Figure 80.3 shows the BBWF algorithm, and Fig. 80.4 shows the results (Fig. 80.5).

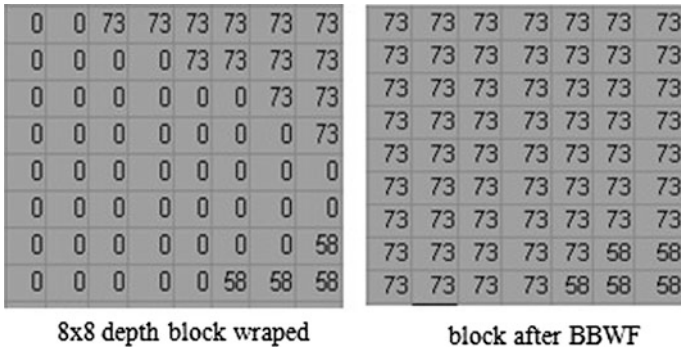


Fig. 80.3 BBWF algorithm process



Fig. 80.4 The result of the virtual depth map inpainting

Step 4. Reverse wrapping: find the holes in the virtual image and wrap the position to the assistant reference image with the virtual depth map. The procedure follows:

Search the holes used in the block  $8 \times 8$ . Sum the holes in the block.

Wrap the coordinate  $(u', v')$  to the assistant image, get the corresponding  $(u1, v1)$  in the assistant reference image when the sum of the holes is more than 50.

Use block  $4 \times 4$  pixels to search the best match block in the assistant image, and get the pixels in the block to fill the holes in the block of the virtual image.

At this moment, we have handled the disocclusion problem in the virtual image, but there are still some little holes and cracks in the virtual image. We use the simple interpolate to handle them. At last we get the final virtual color image.

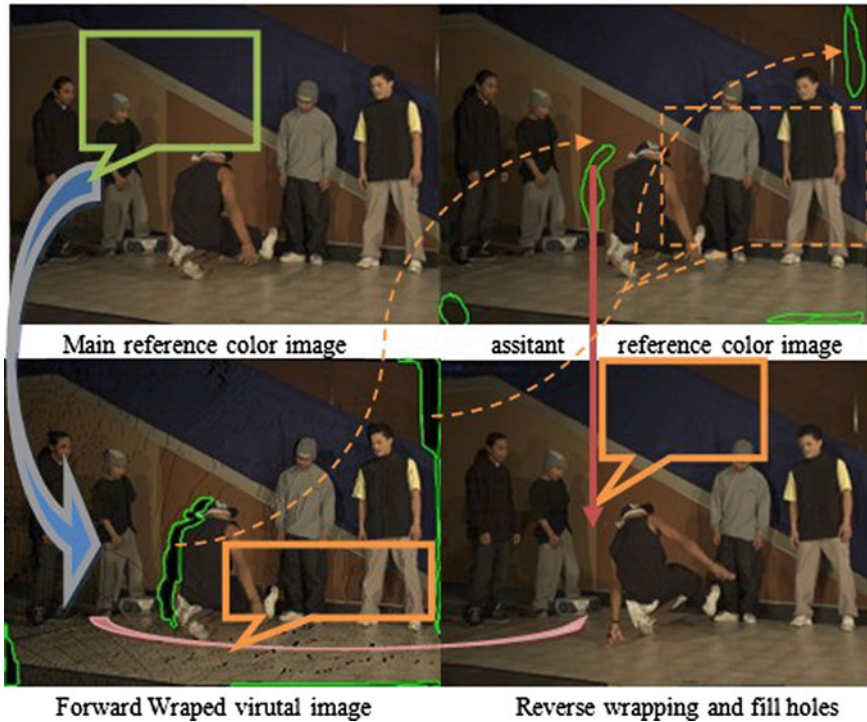


Fig. 80.5 The procedure of the FR-DIBR

### 80.4 Experimental Results

We used the MSR standard test sequence and breakdancing sequence to test our proposed view synthesis approach. In our experiments, camera 2 is chosen as the main reference viewpoint, camera 4 as the assistant viewpoint to get the virtual viewpoint at the position of camera 3. The virtual image quality of the proposed algorithm and other algorithms is compared in Fig. 80.6, and the computational complexity is analyzed in Table 80.1. We can see that the virtual image is clearer and the cost is reduced by 33 %.





**Fig. 80.6** Results of different algorithm without holes filling **a** Real image **b** Classic Gaussian filter **c** Traditional bi-directional DIBR algorithm **d** Proposed algorithm

**Table 80.1** The computational complexity

Algorithm	Artificial defects	Distortion	Cost
Depth map pre-processing	Acceptable	Badly	2,900 s/6
Double DIBR	Acceptable	Acceptable	4,500 s/6
Proposed method	Acceptable	Acceptable	3,000 s/6

### 80.5 Conclusion

We have proposed a new double-sided DIBR. It is simpler and effective. In our algorithm we choose two viewpoints as the reference viewpoints to generate the intermediate viewpoint.

We can generate a good quality view image. Overlap problem is handled by OPFD method [11]. The disocclusion is filled by getting the information in the assistant image. The cracks and tiny holes have been removed completely but simple interpolation. The most important, we reduce the algorithm cost by 33 % through introducing the reverse wrapping which wraps the virtual point to the reference viewpoint. And it is important for the real time DIBR system.

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# Chapter 81

## An Improved Low-Cost Adaptive Bilinear Image Interpolation Algorithm

Zhiyong Pang, Huimin Dai, Hongzhou Tan and Dihu Chen

**Abstract** Image scaling is a very important technique and has been widely used in many image and video processing applications. To achieve the goal of low cost and real time, a novel scaling algorithm is proposed which consists of a bilinear interpolation and an adaptive sharpening filter. The proposed sharpening filter is added to perfect the blurring effects existing in traditional bilinear interpolation methods. Simultaneously, we also verify the scaling quality by taking into account the adaptive technology. Compared with the previous bilinear techniques, our method performs better in terms of both quantitative evaluation and visual quality.

**Keywords** Adaptive technology · Scaling · Sharpening filter

### 81.1 Introduction

Image scaling is the process of resizing a digital image. Scaling is a nontrivial process that involves a trade-off between efficiency, smoothness, and sharpness. In recent years, many efficient scaling methods have been proposed in the literature [1].

According to the memory and computational requirements, previous works on image scaling can be roughly categorized into two groups: lower complexity [2, 3] and higher complexity [4, 5] scaling techniques. In this paper, we consider the

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lower complexity scaling techniques only, especially traditional interpolation methods [6, 7].

The traditional interpolation methods includes nearest-neighbor algorithm, bilinear algorithm, 0061nd bicubic interpolation algorithm, among which the nearest-neighbor algorithm [8, 9], which demands the lowest operation complexity and few memory access time, is believed to be the simplest one. However, the undesirable blurring and block effects occur obviously under this circumstance, hence making the nearest-neighbor algorithm more unattractive. The bicubic interpolation [7] is a popular polynomial-based method as it exhibits higher performance accuracy. However, it entails a large computational burden due to the calculation complexity. Bilinear interpolation algorithm [6] provides a good compromise between the computational burden and quantitative accuracy. Accordingly, the bilinear algorithm is adopted in this paper for easier implementation at the expense of image scaling quality.

Considering the unwanted blurring and block effects caused by bilinear interpolation method, two assumed filters, including a combined sharpening filter [1] and a Laplacian sharpening filter, are added to the interpolation process separately. Simultaneously, we also verify the scaling quality by taking into account the adaptive technology [1]. Compared with previous bilinear techniques [1], our method performs better in terms of both quantitative evaluation and visual quality.

The rest of the paper is organized as follows. Sect. 81.2 elaborates the bilinear interpolation algorithm and Sect. 81.3 describes the assumed sharpening filters as well as the adaptive technology. In Sect. 81.4, the experimental results are presented with Peak Signal-to-Noise Ratio (PSNR) value measured and vivid sample images illustrated. The conclusion is provided in Sect. 81.5.

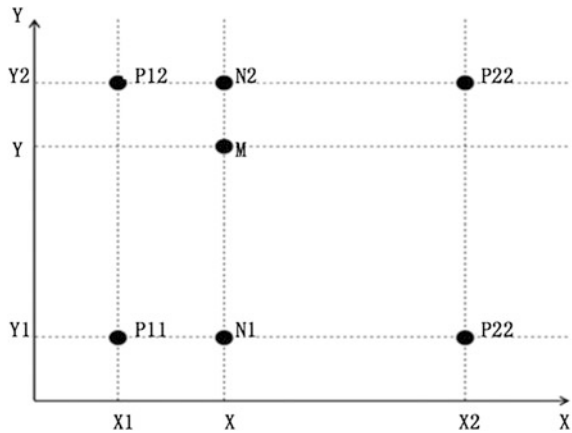
## 81.2 Bilinear Interpolation Algorithm

The bilinear interpolation is widely used in various applications due to its computational efficiency and compromising image quality among various interpolation methods.

According to the bilinear interpolation, it creates a new pixel by calculating the arithmetic average mean from four original pixels in a nearest-neighboring  $2 * 2$  block area. Bilinear interpolation is completed by two steps. A linear interpolation is processed in one direction, then the output pixels of the previous process are taken as input pixels and used to generate desirable pixel in another direction which is perpendicular to the former direction. As shown in Fig. 81.1, suppose  $P_{11}, P_{12}, P_{21}, P_{22}$  are the four original pixels, the intermediate pixels  $N_1$  and  $N_2$  are obtained first in the  $X$  direction using linear interpolation. The universal equations of generating  $N_1$  and  $N_2$  are listed as

$$f(N_1) \approx \frac{x_2 - x}{x_2 - x_1} f(P_{11}) + \frac{x - x_1}{x_2 - x_1} f(P_{21}) \quad (81.1)$$

**Fig. 81.1** Bilinear interpolation



$$f(N_2) \approx \frac{x_2 - x}{x_2 - x_1}f(P_{12}) + \frac{x - x_1}{x_2 - x_1}f(P_{22}) \tag{81.2}$$

where the coordinates  $N_1 = (x, y_1)$ ,  $N_2 = (x, y_2)$ , the values of  $f(N_1)$  and  $f(N_2)$  refer to the calculated pixel value, respectively. As mentioned above, the subsequent linear interpolation in the  $Y$  direction is executed based on the output value produced by interpolation process in the  $X$  direction. Hereby, a final desirable pixel  $M$  is generated and its pixel value is shown in Eq. (81.3) with new coordinate  $M = (x, y)$ .

$$f(M) \approx \frac{y_2 - y}{y_2 - y_1}f(N_1) + \frac{y - y_1}{y_2 - y_1}f(N_2) \tag{81.3}$$

The algorithm elaborated above is much easier for implementation in hardware since it needs very few resources compared with other computationally expensive algorithm such as bicubic interpolation. However, it involves the property of low-pass filter, consequently, the high frequency component is damaged and the blurring effect along the outline is caused as a result.

### 81.3 Sharpening Filter and Adaptive Technology

In order to reduce the blurring and block effect produced by bilinear interpolation method, the image processing procedure of sharpening, which could reinforce the contour between the dark and bright regions and also smooth discontinues edges, is taken into consideration. The combined sharpening filter described in this section refers to literature [1], which is to achieve the objective of enhancing image quality. The adaptive technology could further enhance the quality of scaled images [1].

### 81.3.1 Combined Sharpening Filter

The combined sharpening filter is combined by a 3 \* 3 clamp filter [8] and a 3 \* 3 sharpening spatial filter [9]. The clamp filter is a low-pass filter for the purpose of smoothing discontinuous edges and reducing block effect caused by interpolation method, whereas the sharpening filter is a high-pass filter provide for lessening blurring effect and providing certain objects. For conserving memory, the combined sharpening filter is a 5 \* 5 matrix which is calculated as follows:

$$\begin{aligned}
 P'_{(i,j)} &= \left[ P_{(i,j)} * \begin{bmatrix} 1 & 1 & 1 \\ 1 & C & 1 \\ 1 & 1 & 1 \end{bmatrix} / (C + 8) \right] * \begin{bmatrix} -1 & -1 & -1 \\ -1 & S & -1 \\ -1 & -1 & -1 \end{bmatrix} / (S - 8) \\
 &= P_{(i,j)} * \begin{bmatrix} -1 & -2 & -3 & -2 & -1 \\ -2 & -2 - C + S & -4 - C + S & -2 - C + S & -2 \\ -3 & -4 - C + S & -8 + SC & -4 - C + S & -3 \\ -2 & -2 - C + S & -4 - C + S & -2 - C + S & -2 \\ -1 & -2 & -3 & -2 & -1 \end{bmatrix} / [(C + 8) \times (S - 8)]
 \end{aligned}
 \tag{81.4}$$

where  $C$  represents the clamp parameter and  $S$  is the sharp parameter, respectively.

### 81.3.2 Laplacian Sharpening Filter

In the combined sharpening filter, the original image is filtered by a 3 \* 3 clamp filter smoothing and again by 3 \* 3 sharpening filter. Since the blurring effect occurs when adopting the bilinear interpolation, we assume that this phenomenon equals to the smooth process. In consequence, the filtering toward noise is accomplished in the process of bilinear interpolation. Accordingly, we propose the Laplacian sharpening filter, which only executes the process of sharpening the edges, to further enhance the image quality. Moreover, the implementation of above 5 \* 5 combined filter costs too much hardware resources. Laplacian sharpening filter can reduce the hardware consumption.

The Laplacian filter is a linear operator and it forms an isotropic filter. The Laplacian operator could effectively improve the edge delineation, whereas it is sensitive to the noise. This paper derives the Laplacian sharpening filter based on various Laplacian operators. The following array is considered as the best kernel after our experiment on different Laplacian sharpening filters including 3 \* 3 arrays and 5 \* 5 arrays. Our proposed Laplacian sharpening filter has the following array:

$$\text{kernel}_{\text{LAPLACIAN}} = \begin{bmatrix} 0 & -1 & 0 \\ -1 & S + 4 & -1 \\ 0 & -1 & 0 \end{bmatrix}
 \tag{81.5}$$

where  $S$  is a sharp parameter that can be set according to the characteristics of the image, the sharpening degree can be adjusted by changing the sharp parameter.

### 81.3.3 Adaptive Technology

The adaptive technology could enhance the effect of the sharpening filter [1]. We added to the interpolation procedure by offering feedback information after filtering to the input pixels. By this means, we can update the input data and ensure higher fidelity. Since this feedback technology is supplemented, the sharpening filter is no more an FIR filter. But instead, it is equal to an IIR filter. To prevent the IIR filter from exhibiting an unstable filter response, the parameters of the clamp and sharpening spatial filters are selected to ensure stability. We have proved the stability. The general adaptive block diagram is shown in Fig. 81.2.

### 81.4 Experimental Results

In this section, in order to verify the effect of our proposed interpolation method, we consider quantitative fidelity, as well as visual quality. MSE is used to measure and analyze the quantitative fidelity by quantifying the noise approximation between the original image and the interpolated image. Considering an image with size  $M*N$ , after the image processing, the MSE could be calculated as

$$MSE = \frac{1}{MN} \sum_{M=0}^{M-1} \sum_{N=0}^{N-1} [P(i,j) - P'(i,j)]^2 \tag{81.6}$$

In addition, the corresponding PSNR, which is used for quantitative performance assessment of scaling methods, is defined as

$$PSNR = 10 \times \log_{10} \frac{MAX^2}{MSE} \tag{81.7}$$

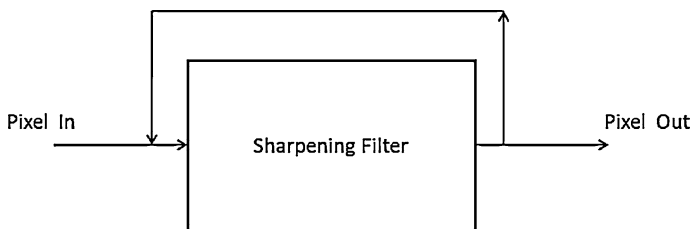


Fig. 81.2 Adaptive technology

Since each image pixel in this paper contains eight bits, the maximum value of each pixel is 255. Therefore, the value of MAX in (11) is 255.

Four gray images with size  $512 * 512$  are selected respectively as a sample group for interpolation methods simulation for the purpose of quantitative comparisons. Figure 81.3 lists the four sample images. The test method is that the sample image is interpolated back to the original size using the function of bilinear interpolation in MATLAB after the process of applying the proposed interpolation algorithm.

To achieve the highest fidelity, the combined sharpening filter [1] and the Laplacian sharpening filter that we propose are selected, respectively. Accordingly, three kinds of processing ways toward sample images, including (a) scaling up/down without filtering, (b) filtering before scaling up/down (nonadaptive algorithm), and (c) filtering before scaling up/down (adaptive algorithm). The four original images with size  $512 * 512$  are interpolated into refined images with size  $1024 * 1024$  and size  $256 * 256$  using the three kinds of processing methods mentioned above in the first step, then interpolated back to original size in the second step using the function of bilinear interpolation. Table 81.1 lists the values of PSNR of scaling up the size of sample images from  $512 * 512$  to  $1024 * 1024$  with various interpolation methods and also the values of PSNR of scaling down the size from  $512 * 512$  to  $256 * 256$ .



**Fig. 81.3** Four sample images **a** Lena; **b** Peppers; **c** Baboon; **d** Airplane



**Table 81.1** The values PSNR of image scaling up from size 512 \* 512 to size 1024 \* 1024 and scaling down from size 512 \* 512 to size 256 \* 256

Sample images		Scaling up		Sample images		Scaling down	
		512 * 512->1024 * 1024	PSNR			512 * 512->256 * 256	PSNR
LENA	METHOD						
	Direct scaling		37.82	BABOON			
	Combined	ad	39.93	METHOD			
	Filter[1]	nonad	39.74	Direct scaling			
	LAP	ad	40.34	Combined	ad	36.25	30.34
PEPPERS	Filter	nonad	39.24	Filter	nonad	38.46	30.74
				LAP	ad	38.38	30.78
				Filter	nonad	39.84	30.71
						39.24	30.85
						PSNR	
METHOD	Direct scaling		27.22	AIRPLANE			
	Combined	ad	29.81	METHOD			
	Filter	nonad	29.78	Direct scaling			
	LAP	ad	32.26	Combined	ad	38.95	29.40
	Filter	nonad	32.45	Filter	nonad	38.73	29.44
				LAP	ad	39.23	29.37
				Filter	nonad	38.59	29.48



**Fig. 81.4** **a** Original image. **b** Scaling up/down without filtering. **c** Filtering before scaling up/down (nonadaptive algorithm). **d** Filtering before scaling up/down (adaptive algorithm)

Taking the scaling up process for example, a list of sample images of Lena by adopting different methods is shown in Fig. 81.4. From Fig. 81.4 we can see that the image scaling quality is improved.

## 81.5 Conclusion

Based on the experimental results, an optimized bilinear interpolation solution is proposed. When scaling up/down an image, adding a Laplacian filter as a pre-filter and applying the adaptive technology to the interpolation method before scaling up can enhance the image quality to a large extent. In this paper, bilinear interpolation [6] is selected for their practicality and lower computational complexity. The Laplacian filter, which is simple structured, is added to solve the defect of blurring and block visual effect caused by bilinear interpolation method. Furthermore, the adaptive technology is applied for the purpose of facilitating the reinforcement of the proposed filter and helping to achieve the higher quality as expected.

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# Chapter 82

## EEG Correlation Analysis Under the Condition of +Gz Accelerations

Yifeng Li, Tao Zhang, Bei Wang, Lue Deng  
and Masatoshi Nakamura

**Abstract** In this research, Electroencephalogram (EEG) data under the condition of +Gz accelerations were recorded and its correlation analysis was done. The correlation change features were found for different loads through respective correlation analysis including auto-correlation and cross-correlation analysis for 16 derivation EEG data. The results show that, auto-correlation and cross-correlation are gradually decreased with time lag increasing. Correlation diagrams show that the first peak after zero lags appeared as main peak which responses to relatively stronger correlation. The relationship between correlation and different action of +Gz loads from analysis of a lot of EEG data indicates that EEG correlation is greatly affected by G loads.

**Keywords** EEG · Correlation analysis · Auto-correlation · Cross-correlation

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## 82.1 Introduction

Electroencephalogram (EEG) is the whole reflection of brain nerve cell electrophysiological activity in the cerebral cortex or scalp surface. The brain pattern formations induced by different types of sensory stimuli are different. EEG data refers to the data of tiny voltage value, the experimental time series and experimental event, information and so on, got through objective experimental recording, responding brain electrical activity which changes with time changes. EEG is mostly recorded and analyzed in the static state, dynamic condition less applied, much less applied under the +Gz accelerations. In the field of aerospace, more and more scholars begin to study EEG changes under the condition of centrifuge +Gz accelerations in order to have more comprehensive and in-depth understandings for the state of the subjects and search for the EEG change feathers [1]. In these researches, the correlation analysis of EEG data is an important part of EEG data analysis, and also is the base of other analysis. Although EEG changes under the condition of centrifuge +Gz accelerations have been studied and reported in China and abroad, but the reports specifically focused on its relevance study are rare. EEG data correlation analysis has important significance for correctly understanding the brain different locals' relationship, as well as the global and local relationship of human brain. And it can be used for reference for the follow-up features exploring and change mechanism research of EEG change under +Gz accelerations. This study focuses on the brain local auto-correlation and cross-correlation of brain left and right symmetrical parts through correlation analysis, also the correlation change situations with different G loadings.

## 82.2 Method

### 82.2.1 *Experimental Equipment*

The main experimental equipment is human centrifuge, with three axial degrees of freedom. Cockpit has a red central light and two white perimeter lights used to judge the subjects' visual changes. EEG signal is recorded by using portable electroencephalograph recorded for every test.

### 82.2.2 *Experimental Subjects*

Five subjects all are male. The age is of 20–22. All subjects are in good health. And before the test, all the subjects had a centrifuge experience. Subjects are clear to the test content, and volunteer to participate in the experiments.

### ***82.2.3 EEG Data Acquisition***

The five subjects experience different +Gz exposures on centrifuge according to the generating curve on different work days. The curve is set as: from 1G increasing to 1.4G with the growth rate of 1.4G/s, continuing for a few seconds, then getting to the set maximum G with growth rate of 3G/s, lasting 10 or 15 s, then reducing to 1G with growth rate of 3G/s. The max G value begins from 2.5G, according to the rate of increase, 0.5G/round, until the subject reaches his end of endurance. The time interval between every two times +Gz exposures is at least 5 min. The centrifuge recording system monitors in real time and records ear pulse signal for each time running. The judgment standard of endurance end is ear pulse level, surrounding light disappeared or central lights fuzzy according to the subjects' subjective narration, combined with subject's expression. The experiment is performed and the judgment is made by experienced physicians.

The EEG data of each running are recorded by using portable EEG recorder, and the data are converted to readable text format through specific software to facilitate the subsequent processing. The sampling frequency is 128 Hz. The 16 leads electrodes are placed according to the standard 10–20 system installation method made by International Federation of societies of EEG. All of the 16 leads electrodes take the ipsilateral earlobe electrode (A1 or A2) as the reference electrode [2]. The subject's head is fixed with mesh cap, and each electrode is affixed with the adhesive tape in order to strengthen the fixing and prevent the loosening in device running.

Considering that EEG may be affected by EMG, blink, body movement, rotation, power, and some other factors, EEG is needed to be filtered as far as possible for all kinds of disturbance. The current filtering methods are more, such as FIR filtering, wavelet filtering, wavelet package filtering, independent component analysis (ICA) filtering, and some new developed methods based on these theories [3, 4, 5]. Digital filter is used in this study, and a 35 Hz low-pass filter is first used to eliminate EMG, power, and high frequency noise interference. Then a 1 Hz high-pass filter is used to eliminate electrode noise, baseline drift, rotation, eye movements, and other low-frequency interference [6]. After filtering, the data is divided into continuous multiple segments, 1 s data for each segment. That is, EEG data are divided into multiple blocks, sampling points 128 for each block, a second record time for each block.

### ***82.2.4 Data Processing***

The correlation analysis involved in this study is designed on multiple channels and its basic principle is based on the fast Fourier transform (FFT) [7, 8]. Auto-correlation and cross-correlation in this study can be explained by the following mathematical formulas [9]. Auto-correlation refers to the dependency relationship

between signal instantaneous value at a certain moment and at another moment. And it is the time domain description for random signals. It indicates the available values which are got by computing the data sequence of some electrode and its own data sequence with time lag. It can be expressed with the following formulas:

$$r = \frac{(M - k) \sum_{i=1}^{M-k} X_i X_{i+k} - (\sum_{i=1}^{M-k} X_i) (\sum_{j=k+1}^M X_j)}{\sqrt{\left[ (M - k) \sum_{i=1}^{M-k} X_i^2 - (\sum_{i=1}^{M-k} X_i)^2 \right] \left[ (M - k) \sum_{j=k+1}^M X_j^2 - (\sum_{j=k+1}^M X_j)^2 \right]}} \quad (82.1)$$

$$discrete\ data(\tau) = \lim_{T \rightarrow \infty} \frac{1}{2T} \int_{-T}^T x(t)x(t + \tau) dt \text{ continuous data}$$

The cross-correlation describes the correlation degree of two random signals valuing in any of two different moments. It indicates the available values which are got by computing the data sequence of some electrode and another data sequence with time lag. It can be expressed with the following formulas:

$$r = \frac{(M - k) \sum_{i=1}^{M-k} X_i Y_{i+k} - (\sum_{i=1}^{M-k} X_i) (\sum_{j=k+1}^M Y_j)}{\sqrt{\left[ (M - k) \sum_{i=1}^{M-k} X_i^2 - (\sum_{i=1}^{M-k} X_i)^2 \right] \left[ (M - k) \sum_{j=k+1}^M Y_j^2 - (\sum_{j=k+1}^M Y_j)^2 \right]}} \quad (82.2)$$

$$discrete\ data(\tau) = \lim_{T \rightarrow \infty} \frac{1}{2T} \int_{-T}^T x(t)y(t + \tau) dt \text{ continuous data}$$

In the study, in order to reduce the unnecessary calculation, correlation analysis is made according to the 128 time delays, each delay of 0.0078 s. i.e., the total time lag is 1 s. EEG data auto-correlation and cross-correlation analysis are made for 16 leads, 27 person-time (each of the subjects experiencing 1 time +Gz exposure is called one person-time) data of different G loads.

### 82.2.5 Data Correlation Analysis

Each electrode auto-correlation analysis and asymmetrical electrodes cross-correlation analysis are made for five subjects and 27 person-time, and intuitive correlation diagram is made according to a series of correlation results. The auto-correlation and cross-correlation analysis of different loads data are made and the related graphs are obtained. Then the visual charts of correlation with the change of the load are made on the basis of this analysis. Result includes 128 time lags with each time lag of 0.0078 s, i.e., the total time lag is one second. We call that one block. Then the output results standardized, i.e., auto-correlation value is 1 at time zero lag. In order to facilitate to have a more intuitive reflect for in which EEG frequency band correlations are stronger, the abscissa of

intuitive graph will be converted from delay time to the corresponding brain wave frequency. The first wave (also the largest wave) peak point after the time delay is displayed in the graph. Data correlation values corresponding to different loads take the first positive extreme point, also the peak value point.

## 82.3 Results

### 82.3.1 Auto-Correlation Diagram in One Block

Auto-correlation diagram is drawn for 16 leads in a block, namely in one second. The following graph shows four lead results. Cross-correlation graph is drawn for left-right symmetry electrodes.

Here are two examples of subject 1, and the correlation diagrams of data in other blocks are similar to the two. The time lag is converted into corresponding brain wave frequency (Hz) for the transverse coordinates in diagrams; Vertical coordinate represents the correlation value, separately auto-correlation values of single electrode in auto-correlation diagram, and cross-correlation values of brain symmetry electrode in cross-correlation diagram. The time delay is 1 s, and a second correlation graphs are shown in diagram. The cycle of correlation is not very strong, and correlation values gradually decreased with time delay increasing from a large amount of data analysis. Auto-correlation value is 1 at zero delay, but cross-correlation value is not 1 at zero delay. The appeared first main peak, that is the first positive extreme point, generally is the largest peak point, and the frequency corresponding to the peak falls in 0–3 Hz (marking the correlation values and location with vertical lines in diagram). The brain wave band corresponds to the largest peak point which is delta wave, explaining that this wave has a stronger correlation relatively to the brain waves of other frequency bands under +Gz accelerations, Figs. 82.1, 82.2.

### 82.3.2 Correlation Analysis under Different Loads

First, through the correlation analysis of each subject EEG data under the influence of different loads, the correlation change curves of different loads is made, getting correlation diagrams of correlation with loads change. They are shown in Figs. 82.3 and 82.4. In the diagrams, subject 2 experienced separately the roles of static state, that is 1G,2.5G,3G,3.5G,4G,4.5G,5G,6G,7.5G.

The results show that different individuals perform differently with the increase of load, but the brain's correlations of local and total reduce overall. The local correlation of each lead is also different with others. The diagrams show that the correlations round 3G always presents maximum relatively, then decreases



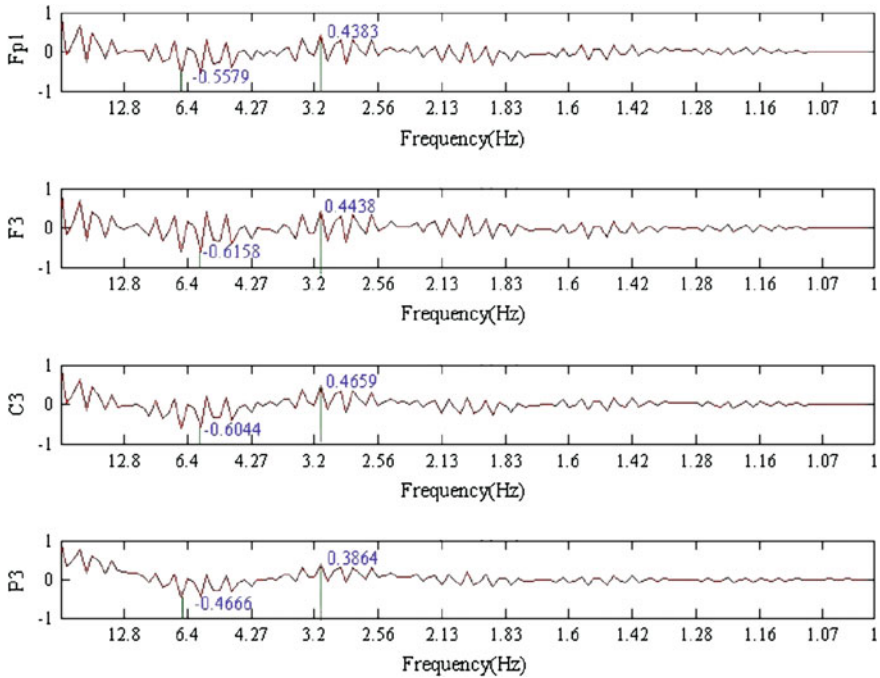


Fig. 82.1 Auto-correlation graph of EEG data of subject 1 in one block

gradually, and presents trough possible round 4.5G. Right-side leads of brain have more obvious changes than left-side relatively.

## 82.4 Discussions

From auto-correlation and cross-correlation analysis of the recorded data, the change waveform are close to EEG, but the periodic performance is not strong, which is not the same as mentioned in some previous studies about EEG. And the first correlated positive extreme (main peak) falls in the frequency band of 0–3 Hz, indicating that delta wave has a stronger correlation, also indicating that this wave occupies dominant advantage relatively to waves of other frequency bands. This is relevant to that, under the +Gz action, the large number of a person's blood transfers to the lower part of the body, and people is in different physiological state from normal state. Many studies show that, brain slow wave activity increases under the +Gz action, in the severe case fully slow wave; moreover slow wave such as delta wave energy percentage is higher relatively in that of all frequency bands [10, 11]. The result of analysis is consistent with this point. The cross-correlation of each local symmetrical parts of brain two hemispheres is overall less than the auto-correlation of local electrode. Local auto-correlation higher explains

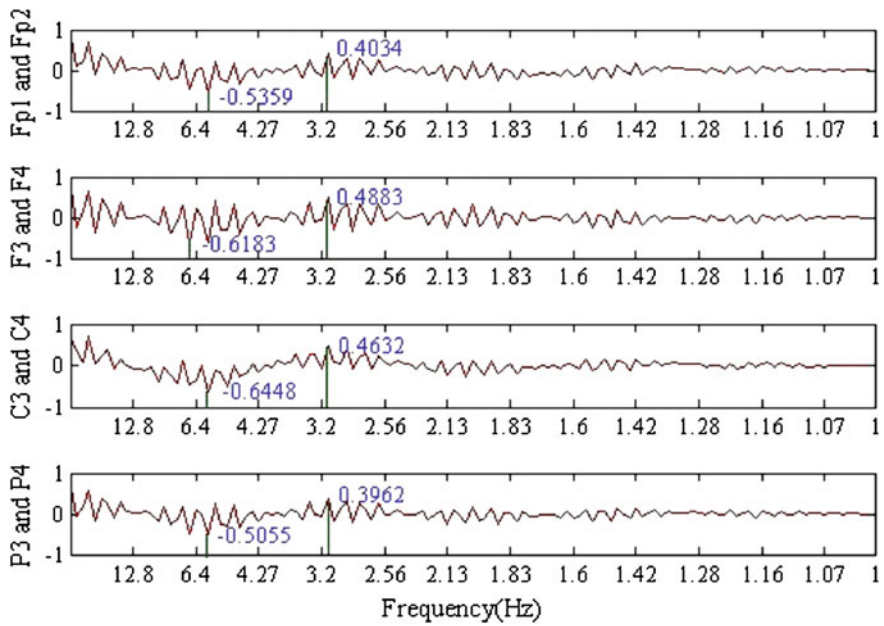


Fig. 82.2 Cross-correlation graph of EEG data of subject 1 in one block

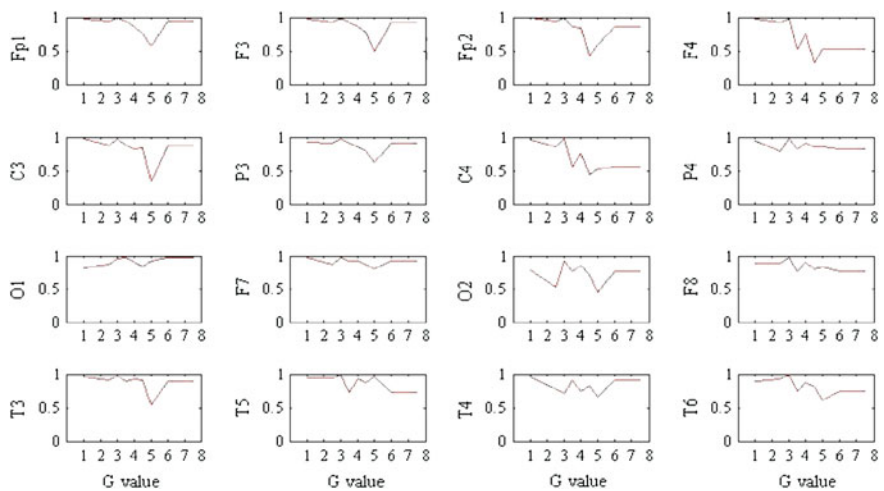


Fig. 82.3 Auto-correlation diagrams of 16 leads EEG data of subject 1 under different loads

EEG activity has certain stability; cross-correlation lower shows that there is immanent connection between symmetrical locals of left and right although they have own stability and independence.

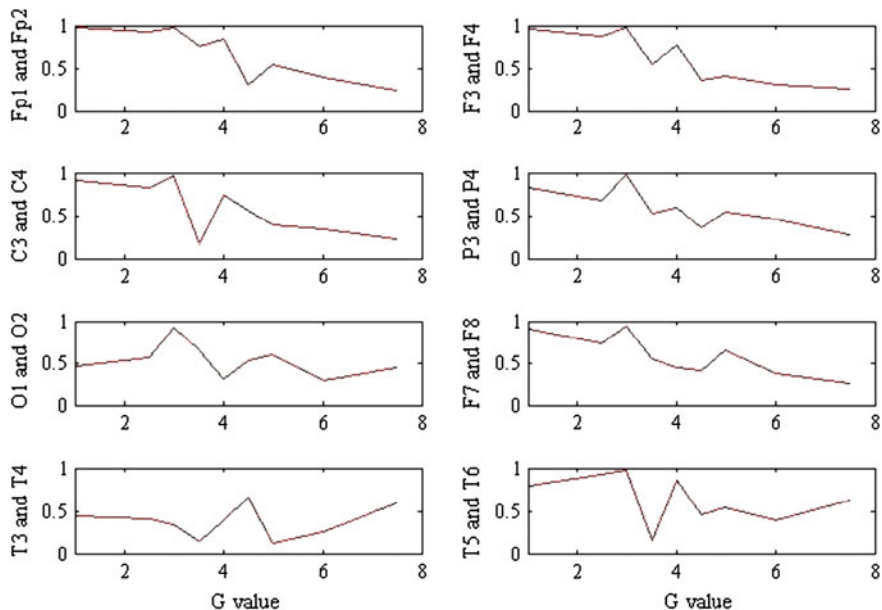


Fig. 82.4 Cross-correlation diagrams of 8 pair of leads EEG data of subject 1 under different loads

The research results of correlation change with load change show that: the brain local auto-correlation and cross-correlation of symmetrical lead electrodes varies with the load change, but the change trends are basically consistent, that is a decreasing trend, lower than the static correlation value. Each local variation has differences, such as auto-correlation changes of P3, P4 electrodes are small respectively, but lead pair change is larger. The +Gz role leads to brain ischemia and hypoxia, and brain inhibitory effect enhances, making brain bioelectrical change, EEG slowing, inducing lack and slow of wave. With G increases, the power of each frequency band of brain wave has increase or decrease of different degrees, complexity reducing, stability reducing, EEG specific performance enhancing. It performs as, decreasing trend is not smooth but having fluctuation, with G value increases. Correlation exhibits a maximum round 3G, and smaller round 4.5G. This may be related to systemic circulation and EEG signal delay property under +Gz role. Some scholars have done the dynamic observation and research about the effect of alcohol on EEG, and discover that alcohol has impact on the power percentage of each EEG frequency band, and do have a delayed effect on the brain function [12]. EEG stability reduces on the whole, so correlation reduces. The values when subject bears the highest G value-7G, auto-correlation value decrease 11.6825 % on average, while cross-correlation decrease 41.6988 % on average, compared to the static value. And it explains that, reduced degree of cross-correlation of two hemispheres left and right is greater than that of the local auto-correlation, and capability of coordinate work of brain two hemispheres

diminishes, so lead to the capability of coordinate work of body symmetric parts, such as the left and right hands, greatly abates, to which attention should be paid fully in actual centrifuge training and flight. In addition, right-side leads' correlation changes are greater in general than that of the left-side leads, which may be related to the person's special posture when +Gz acting. Under +Gz role, people is in the half lying position with the left arm down, experiencing centrifugal force role of from head to toe according to the generating principle of centrifugal force; EEG change of right-side leads are more significant than that of left-side leads affected by the blood circulation and systemic circulation, thus leads to that correlation changes of right-side leads are also more greater than that of right-side leads, reflecting that the brain electrical activity is a non-stationary random process.

## 82.5 Conclusions

In this research, some preliminary conclusions are drawn through auto-correlation analysis of 16 leads and cross-correlation analysis of left and right symmetrical electrodes of EEG data under +Gz accelerations. That is correlation value decreases gradually with time delay, and delta frequency band wave has a relatively strong correlation; Correlation changes with the load changes, and is influenced by the G load effect. The changes of brain local auto-correlation and cross-correlation of brain left and right two hemispheres, the overall trends are reduced with load increasing compared with static state, that is 1G state; And the reduced degree of cross-correlation is more obvious than that of auto-correlation; The decreasing trend of right-side leads is more obvious than that of left-side leads. EEG data correlation analysis is an important part of EEG data analysis, and it is also a basic analysis and research. Some conclusions obtained in this research can help thorough understand the relationships between the locals of brain and between global and local of brain, and also provide experimental basis and reference for the following research of EEG characteristics change and the related research under +Gz accelerations.

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# Chapter 83

## Research on the Lossless Image Compression Algorithm Based on Linux Embedded System

Liping Hao

**Abstract** Based on the ARM Linux operating system, this chapter studied the technology of image capturing and compression. It makes the JPG image have lossless compression, so it can reduce the transmission of data traffic and increases the channel utilization. Its concrete realization process is that to first extract useful coding information from the image, and then remove the redundant coding information. In this way, the system could increase the channel capacity and improve the information transferring rate.

**Keywords** ARM Linux · Information processing · Image compression · Lossless compression

### 83.1 Introduction

With the development of digital technology, a wide range of embedded system applications to the field of industrial, military, medical Introduction, and so on. Due to the large amount of data contained by the image information, the corresponding transmission with the increase, adding to the traffic load the quantity of data of the wide image information makes the transfer rate low, contradiction of the image information and channel capacity is the main bottleneck of information transmission in the modern information society. Along with the requirements of modern communication technology is growth, which makes use of the image

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acquisition and compression technology to become an inevitable trend in the channel transmission. The key of the image compression technology is to quantify the data and the use of information entropy coding of image data. As early as the 1920s, people began to image data compression by the line, then the research is based on the method of computer simulation to predict the encoding of the image information. Image processing technology is more and more the attention of the medical, industrial, and other fields. The image processing technology based on the embedded has strong processing power, and lightweight, flexible, and very popular with the people of the application and development [1]. Traditional image processing technology, processing too much data, another large amount of information, with a high degree of seasonal, so inconvenient in the field of medical and industrial applications.

The modern use of parallel image processing technology greatly improves the efficiency of computer data processing and provides a lot of use of space for the future development of image processing. The parallel image processing technology system consists of algorithms and hardware. In order to achieve higher performance, the embedded processor designers concentrated in well-designed clock frequency and this can be extracted from the sequential code instruction-level parallelism in the past few decades. However, this approach leads to diminishing returns and high power consumption. Therefore, the designers have placed their focus on multicourse multiple processors on single silicon chip architecture to improve system performance. This architecture is essentially a parallel structure. Trends suggest that this evolution will continue to develop and the massive parallel multicore architectures will become widely used in engineering fields. Parallel processors to increase the processor architecture are not limited to the high-performance systems. More and more to solve the interconnection network from the existing chip transistors resources of the system on a chip is a system architecture that allows multiple low-power processor core. Therefore, there is a need to explore parallel processing in embedded systems, the other in the design of parallel programs are facing new types of applications. Embedded systems exposed to different requirements and it is a new challenge to these high-performance computing systems. Such as interaction with the user's applications, rapid processing time is more important than the throughput to ensure the necessary response.

The basic process of image compression technology is the first to send image signal into PCM encoder by line linear PCM coding. After compression encoder in nonmaintained encoder and information to keep the encoder to compress the PCM coding of graphic information; thereby, eliminating redundant code word in the image information and realizing the image information compression technology. From the principle of image compression, we can see that the process of image compression is useful coding information extracted from the image coding information, and remove the redundant coding information. Thereby increasing the channel capacity and improving the information transfer rate.

## 83.2 The Architecture of the System Hardware

### 83.2.1 System Architecture

Due to the portability of Linux systems, plus high-level languages and open source code, it has become one of the operating systems that many designers commonly used. It is mainly composed of FLASH memory chip, USB interface, SDRAM, and network interface. It is shown in Fig. 83.1 [2].

### 83.2.2 Software Process

The software implementation of the image lossless compression technology based on embedded Linux system mainly consists of seven parts: network connectivity, network drive, RAM Linux operating system, USB drives, image data, the compressed image, hardware environment. The process is shown in Fig. 83.2 [3].

## 83.3 Analysis on Compression Algorithm

This paper uses a translation algorithm for image compression technology. First the layer is divided into base layer and residual layer based on the embedded system. The base layer is through the value of each pixel  $s$  in addition to an integer  $L$  ( $L$  to take any of the 2, 4, 8, 16,  $2n$ ) and then after rounding, it is recorded as:  $BL$  ( $S$ ) =  $[S/L]$ . The remaining level enhancement layer is also called by the pixel

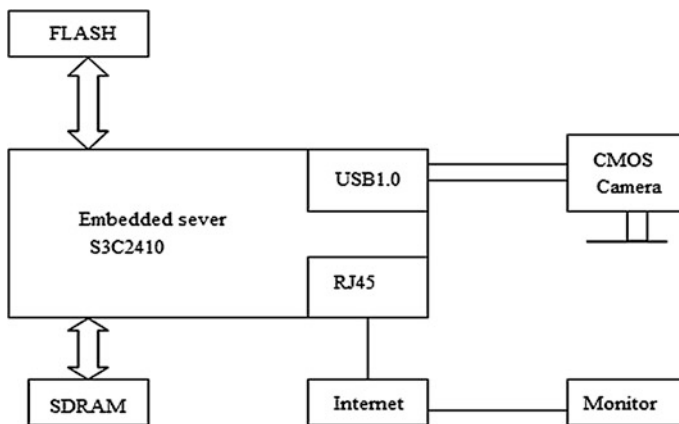
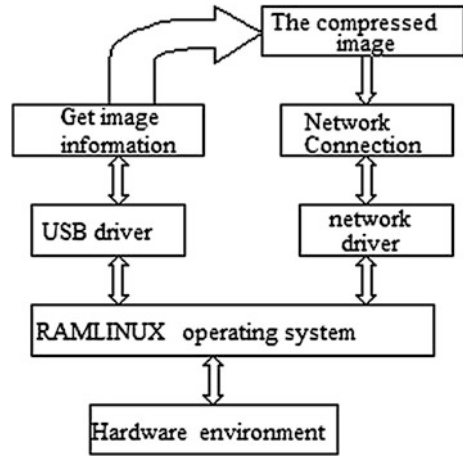


Fig. 83.1 System block diagram



Fig. 83.2 Software process



value of  $s$  and  $L = [s/L]$  subtraction, denoted by:  $r = s - L [S/L]$ .  $L [S/L]$  is called quantitative pixel  $QL (S)$ .

First, we can encode the image plane of the base layer, because the base layer is not related to the remaining layer, the image processing code on the base layer can be obtained with the layer structure is very similar to the original layer. The following will discuss the several important parts of the embedded system image compression algorithm. The embedded system mainly consists of three parts, one of the images the advanced nature of forecasting, by the line of mathematical modeling for predicting the structure and the model is quantified by the line, third is quantitative information entropy coding of the channel.

(1) Image prediction

First we have a pixel image representation, each pixel has eight adjacent pixels associated with it, we will from left to right, from top to bottom in the sequence of information encoding and decoding. Then we put the current pixel position denoted as O, and then the neighboring eight pixel location was W, NW, N, NE, E, SE, and S, SW. The pixel set graph is shown in Table 83.1 [4].

(2) Quantify the pixel geometry

First, we define the function  $f(S_k)$ , the pixel value of the W, NW, N, and NE location we express with  $S_k$ , E, the pixel value of the SE, S, SW location we use  $QL (S_k) + L/2$  to represent. We have quantified function formula as [5]:

Table 83.1 Pixel geometry

NW	N	NE
W	O	E
SW	S	SE

$$f(S_k) = \begin{cases} S_k & k \in (W, NW, N, NE) \\ Q_L(S_k) + \frac{L}{2} & otherwise \end{cases} \tag{83.1}$$

Based on the pixel calculation of the eight adjacent locations we can reach the pixel value of the center  $O$  is [6]:

$$\hat{S}_O = \frac{1}{4} \sum_{K \in (W, N, E, S)} f(S_k) \tag{83.2}$$

Due to the presence of errors, we calculate the nondestructive deviation  $S_o - \hat{S}_o$ , and get rehabilitated the prediction formula is [7]:

$$\xi = round(\hat{S}_O + \bar{\epsilon}(d, t)) \tag{83.3}$$

The prediction equation that we got is the nonlinear prediction, the content of the rounding function  $round()$  is the average of the prediction error.

We have a wavelet edge detection of the collected moral image, and its steps are as following [8]:

First we will have an image smoothing processing. It is denoted by  $f(x, y)$ ;

Then we should find the cross zero, the line cross recorded as  $wxf(x, y)$ , the column cross recorded as  $wyf(x, y)$ ;

Find the partial derivatives to get the modules and angles [9]

$$wf(x, y) = \sqrt{|wxf(x, y)|^2 + |wyf(x, y)|^2} \tag{83.4}$$

$$Af(x, y) = \arctan \left[ \frac{wyf(x, y)}{wxf(x, y)} \right] \tag{83.5}$$

Link the adjacent points in the vertical direction of the gradient to draw the edges of the image.

### 83.4 The Result Analysis

The method of the image compression that is based on embedded planar is the process that the encoding processing of the base layer and enhancement layer of the bit image [10, 11]. We can use the recursive compression method of decomposition to have the image compression. Figure 83.3 shows the three 8-bit grayscale images embedded compression for the plane. We can have the coding compression according to the embedded layer to the base layer and enhancement layer planar reconstruction. We can select  $L = 2$  in the layers of the experiment. The processed results of the grayscale are shown in Figs. 83.3, 83.4.



Fig. 83.3 The original image



Fig. 83.4 8-bit grayscale image compression results

We can see from the experimental results, you can clearly detect the edge of the image after image compression, reduce the image to extract information of the terminal redundancy, and at the same time increase the speed of transmission.

### 83.5 Conclusion

The image processing technology based on the embedded has strong processing power and lightweight, flexible; it is easy in the field of medical image processing and industrial control applications. This chapter according to the studies that based on embedded Linux system image lossless compression technology has shown that the embedded compressed image technology is an ideal image compression technology. It not only makes the values of the compression distortion is small, but also improves the speed of information dissemination.

**Acknowledgments** The work was supported by the “Twelfth Five-Year Plan” science and technology research projects of the Education Department of Jilin province, with the project number [2012] 438 and the name Research and implementation on general system platform of university excellent courses based on B/S model.

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# Chapter 84

## Image Processing System Based on the ARM Embedded System Architecture

Mingli Yang and Yihui Chen

**Abstract** With the development of information technology and the popularity of computer applications, ARM-based embedded operating systems become widely applied in the field of electronic technology. This paper mainly discussed the image processing system based on the design and implementation of ARM embedded system architecture, which included a series of problems in image acquisition, image storage, and image processing, and also provided a new research platform for image processing.

**Keywords** ARM · Embedded system · Image processing

### 84.1 Introduction

Embedded system has a professional system to streamline and speedup the operation of the system; it has been subject to the trust of professional designers. The embedded system is of strong inhibit nature because of the combination of hardware and software [1–3]. But the traditional system development often requires a self-designed circuit, the self-developed hardware expansion chip increases the costs, and is not conducive to the popularity of the system. Computer language C, C++ are widely used in embedded systems to write code.

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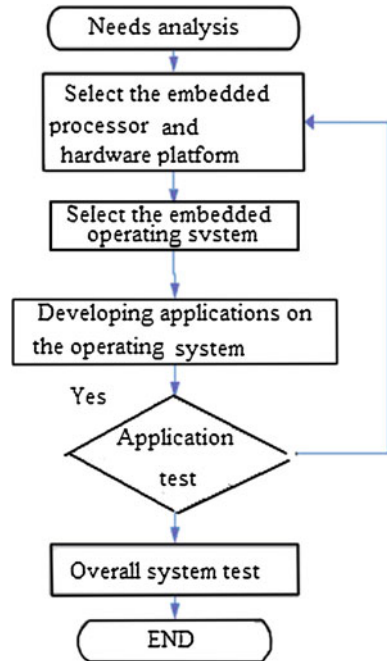
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**Fig. 84.1** Embedded systems development flowchart



The operation code written by these high-level languages is easy to transplant and cut. At the same time, this can also improve the code reusability, and reduce the burden on the programmer [4]. The complete embedded system development including the following series of steps: requirements analysis; selection of embedded processor and hardware platform; choice of embedded operating systems; developing applications; debug system; the overall performance of the test; and the end of the final development. A complete embedded systems development flowchart is shown in Fig. 84.1 [5].

In this paper, the design of systems mainly includes hardware and software platforms, the hardware platforms including three major modules: image acquisition module, display module, and storage module. The software design platform includes the preparation of the program, the transplantation of an embedded operating system, and configuration.

## 84.2 The Working Principle and Design

The embedded image processing system mainly consists of three parts: the hardware platform, the embedded operating systems, and the image processing algorithms. The hardware includes the embedded processor, image storage module, image acquisition module, display module, and so on. The processor is a

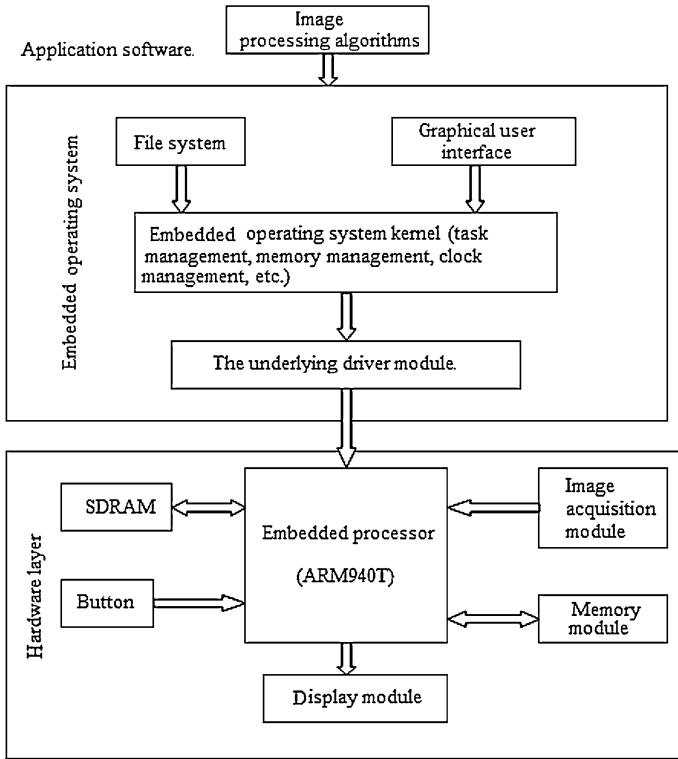


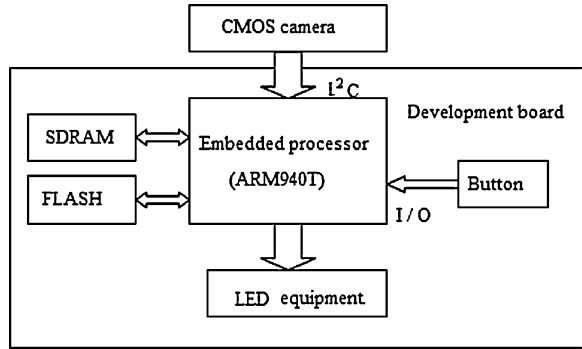
Fig. 84.2 The block diagram of embedded image processing system

core component of embedded systems, this design uses the ARM9 family processors which uses a Harvard architecture also has powerful processing and is of high cost. In image processing, the image acquisition module uses a CMOS camera, because it is the output signal directly from a digital signal and does not have to be converted as a whole system and it is convenient for us to collect and process images [6]. In addition, the speed and effectiveness of the low-cost CMOS camera acquisition meets our requirements and is cost-effective. The embedded operating system commonly used are mainly Linux, WinCE, and VxWorks. A typical embedded operating system has several components: the underlying driver module; task management module; task communication module; memory management module; clock management; file system. The specific content is shown in Fig. 84.2 [7].

(1) Hardware design

The hardware design of the system includes the CMOS camera, the embedded processor, and the LCD display device module, and in the embedded microprocessor (ARM940T) which contains the I/O port expansion button, SDRAM memory, and flash storage devices. Hardware block diagram is shown in Fig. 84.3.

Fig. 84.3 Hardware design diagram



(2) The design of the image acquisition module.

The image acquisition module of the system mainly uses the 0.18  $\mu\text{m}$  process of the CMOS camera OV2610 sensor, the effective pixels are 1.98 million, consume  $<90\text{ mW}$ , OV2610 has  $1618 \times 1204$  effective pixels and the ranks of the drive circuit, and also has a variety of output modes of adjustable size UXGA/SVG A/QVGA. Among them, the camera and the connection to the processor is mainly through the I<sup>2</sup>C bus control and clock signals, the chip selects signal and connected to the frame, the line syncs signal and eight data bus. Indirect block diagram is shown in Fig. 84.4.

(3) The design of the image information processing module.

The image information processing module includes the interception of image storage and image information, and we use the FLASH memory chips to store the image information. The system is first initialized and sets the register, then first uses the SVGA mode for real-time acquisition and displays the image stream, and then enters the waiting for key loop; if the button is pressed, the image storage

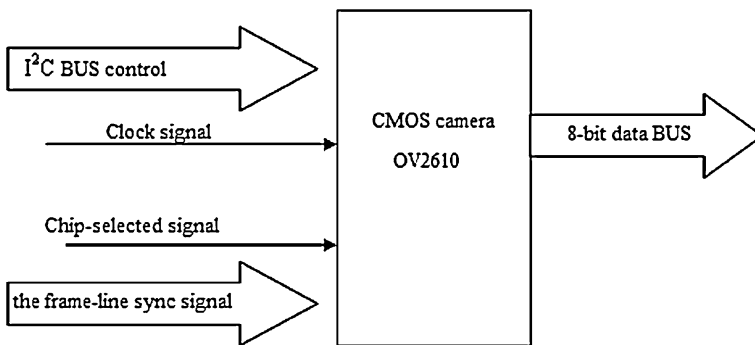


Fig. 84.4 The block diagram of image acquisition connection



process is entered. Finally, the scan image is encoded, outputs the encoded image information on the LCD monitor, and then the button to register, save the image, restart SVGA to continue to display images in real time.

### 84.3 The Design of Image Processing Algorithms

We can use the threshold segmentation method to have a segmentation of the image that CMOS camera acquisition. First, we need to determine the segmentation threshold, followed by division of the pixel area and pixel area classification to determine the segmentation threshold and the pixel value comparison.

First, we can define the segmented image [8]

$$g(x, y) = \begin{cases} 0, f(x, y) < T \\ 1, f(x, y) \geq T \end{cases} \quad (84.1)$$

Among them, we choose  $T$  as the gray threshold and turn the original grayscale image  $f(x, y)$  into a binary image  $g(x, y)$ . In the experiment, the final choice is based on measured 140 as a grayscale threshold.

Second, we should have image edge detection expressed as a continuous image function  $f(x, y)$ , with position vector gradient function [9]

$$\nabla f(x, y) = \left[ \frac{\partial f}{\partial x} \cdot \frac{\partial f}{\partial y} \right]^T \quad (84.2)$$

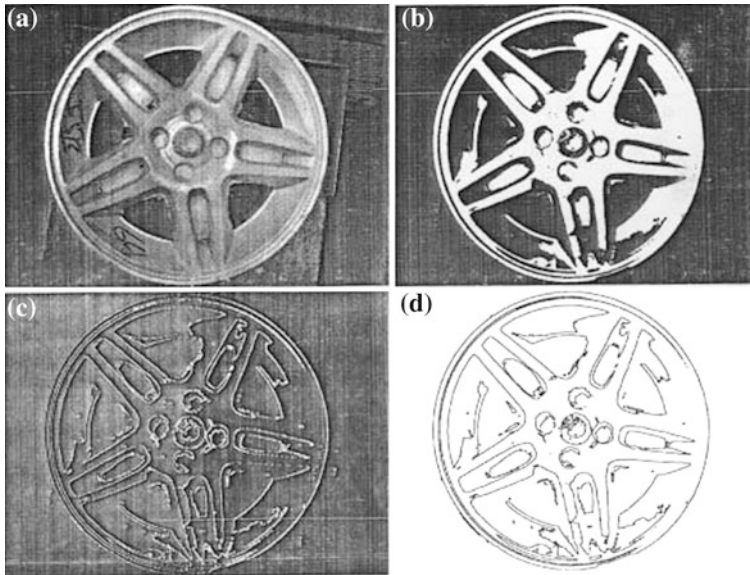
The magnitude of this vector is [10]:  $\text{mag}(\nabla f) = [G_x^2 + G_y^2]^{1/2}$

The direction of the vector angle is as follows [11]:  $\varphi(x, y) = \arctan(G_y/G_x)$ .

Gradient function to calculate the location information of the pixel is less than the values of noise that is calculated by the gradient operator in practice, and the difference between the final results and the actual effect is not obvious.

### 84.4 Results Processing

In this paper, taking car wheels as an example, a suitable model of the image information collection system is established, and then the wheels image has information collection, and are ultimately identified. First, it should create the image acquisition tasks, initialize the camera, image acquisition and real-time reality, then just click and load to save the image, digital image processing, save the current image and returns, and finally introduction of the system. Its handling of the structure is shown in Fig. 84.5.



**Fig. 84.5** The processed images

In the figures, Fig (a) is the image through the camera acquisition by Blip coding, Fig (b) is the image processed in accordance with the threshold value of 140, Fig (c) and (d) are the images processed through the algorithm.

## 84.5 Conclusion

The image processing system based on the embedded technology is the very rapid development of embedded applications in one direction. This paper based the automobile wheel hub as example, to establish the image acquisition system, thus completing the image recognition function. In addition to using the CMOS camera, in order to achieve the desired effect, the threshold segmentation method for CMOS camera collected image segmentation is used.

**Acknowledgments** This work was supported by the following three projects: One is the “Twelfth Five-Year Plan” science and technology research projects of the Education Department of Jilin province, with the project number [2012] 438 and the name Research and implementation on general system platform of university excellent courses based on B/S model. The second is the 2011 year item of the “Twelfth Five-Year Plan” of Jilin provincial education and science, with the project name The research and practice of professional setting and adjustment and optimization of industrial structure in universities and colleges and the project number GH11371. The third is the Natural Science Fund Project of Department of Jilin Province, with the name Research on logistics location selection based on bionic calculation and the project number 2011-05064.

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# Chapter 85

## Design and Implementation of MCU Control Module Based on H.323 Video Conference

Fang Wu, Yingying Shen and Zhihua Zhang

**Abstract** At present, the video conference control management system in the domestic market mostly can only handle some simple conference management, and it is unable to monitor the real-time meeting state. This chapter is based on independent research and development software for Polycom products and China Tobacco Zhejiang Industrial Co., Ltd., constitutes a practical design based on multimedia video conference terminal in the IP network, changes the original MCU control mode, and realizes the control operation of PC directly run software on the meeting process, the council for approval, meeting operating. It provides a hardware platform and software support to meet the requirements of H.323 standard video conference terminal.

**Keywords** Video conference · H.323 · Control mode · Multimedia terminal

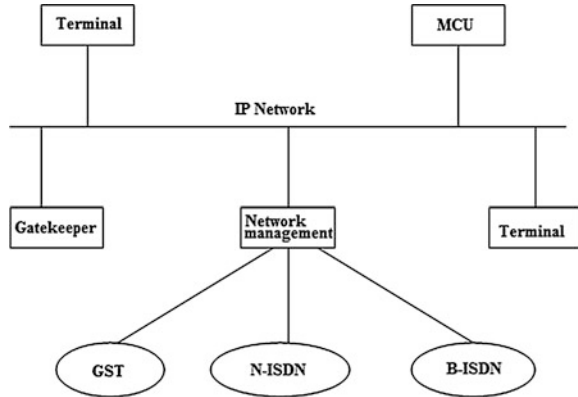
### 85.1 Introduction

Video conference is a product of the twenty-first century digital information age. Compared with the traditional form of face-to-face meetings and conference call mode, video conference has the incomparable advantage [1]. First of all, it broke the limitations of space, so that people in different regions of space can do with meetings to facilitate mutual exchanges and reduce unnecessary travel. In addition, the traditional conference call has noise impact, but the stability of the call quality of our video conference improves the quality of our work efficiency. There is no uniform protocol standards of the video conference in early days, each manufacturer uses its own

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**Fig. 85.1** H. 323 system diagram



criteria, which resulted in non-interconnection of the device. [2]. The first video protocol standard is the H.320 standard in 1990. It is the provisions on the information structure, coding combination, and networking principles. Along with the development of computer hardware technology, the H.320 protocol standards cannot meet the requirements of the video conference. In 1997, the Union's Committee on International Telecommunications announced new video conference protocol standards—H.323. H.323 has the characteristics of the bus network structure, and increases the stability. A complete H.323 system consists of a terminal, MCU, Gatekeeper, network management, and so on. It is shown in Fig. 85.1 [3].

## 85.2 The Overall Design of MCU System Structure

### 85.2.1 System-Level Model

The system solves the problem of device side through the “Device Manager Meeting’s separation” concept. The traditional video conference is used directly to face the way of professional video equipment, and at the same time the notice and meeting management and statistics of the meeting are done by people [4]. Therefore, the number of management and quality level management directly determines the architecture, business applications model is facing all human activities and the hardware directly, which is artificial subsequent and similar to the artificial continuation of the voice switch, bring the problems of slow and error-prone, small capacity, and the use of high cost. System is based on the design concept of “Device Manager and conference management separation”, uses the scientific three-tier system which contains a business application layer, software middle layer, and a variety of hardware devices. It is shown in Fig. 85.3. Frequency of the use of video conference and the results is shown in Fig. 85.2.

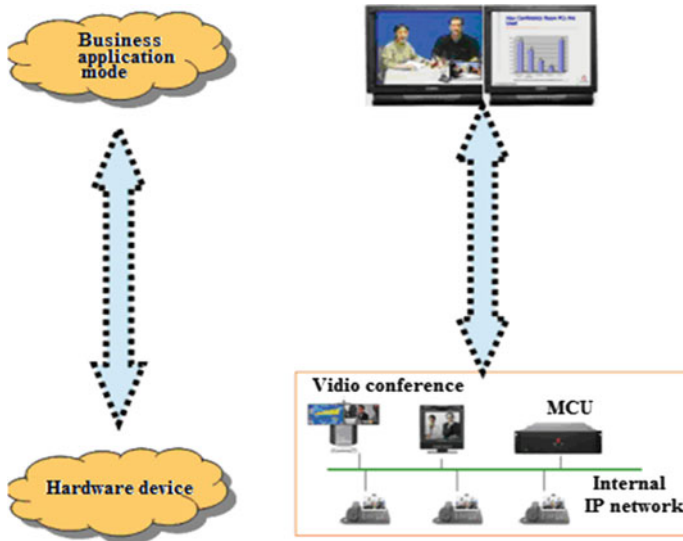


Fig. 85.2 The hierarchy analysis diagram of traditional system

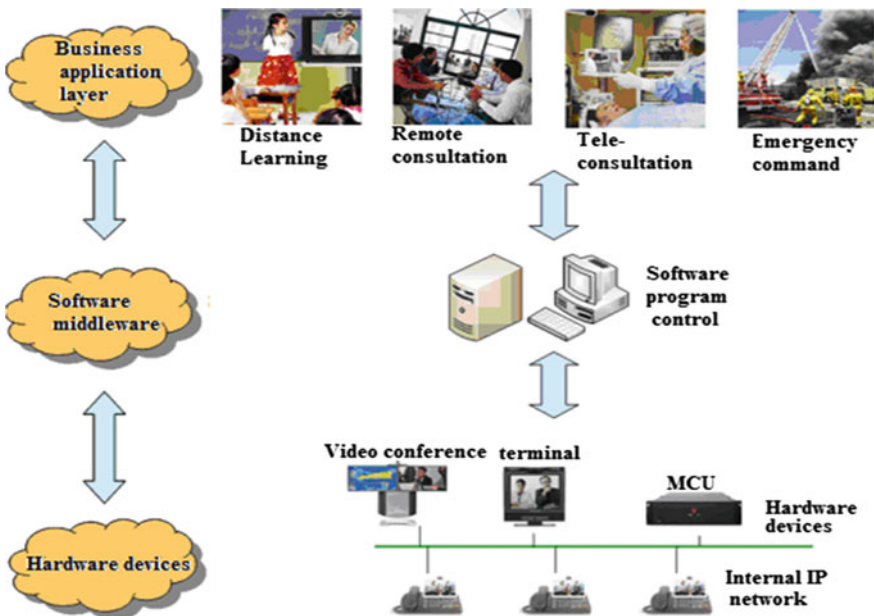


Fig. 85.3 Three-tier structure diagram of video conference

Among them, the business application layer includes distance education, remote consultation, remote consultation, and application command. Software intermediate layer is mainly controlled by the software program. Finally, a variety of video

terminals within the enterprise connect together to form a new type of video conference systems. Three-tier structure evolution of video conference technology separated people from the device. Equipment plays hardware support role; the layer of software operates as a layer of the technical staff, the software layer can be a simple input operation through the conference organization meeting and the information input, the hardware layer can display interface in reality [5]. In order to achieve the business application layer, the video conference system through the three layers structure reduces the conference staff workload and the cost but also improves the speed operation of the conference.

### 85.2.2 Hardware Design Model

Figure 85.4 Multipoint Control Unit (MCU), in essence, is a multimedia information switch, used to achieve multi-point call and connection, meeting management and control functions, including video broadcasting, video selections, automatic polling, and data broadcasting, the completion signal of each terminal tandem with the switch [6].

The engine room of the core node in the system configuration uses a single MCU RMX 1000. Entire system supports 720P HD sessions and is based on the standard H.323 architecture, it is an open system. The video protocols use the industry's most common H.263 and H.264 encodings, H.264 highest coding rate can be achieved 4 M and provide 720P or 1080P high-definition image quality.

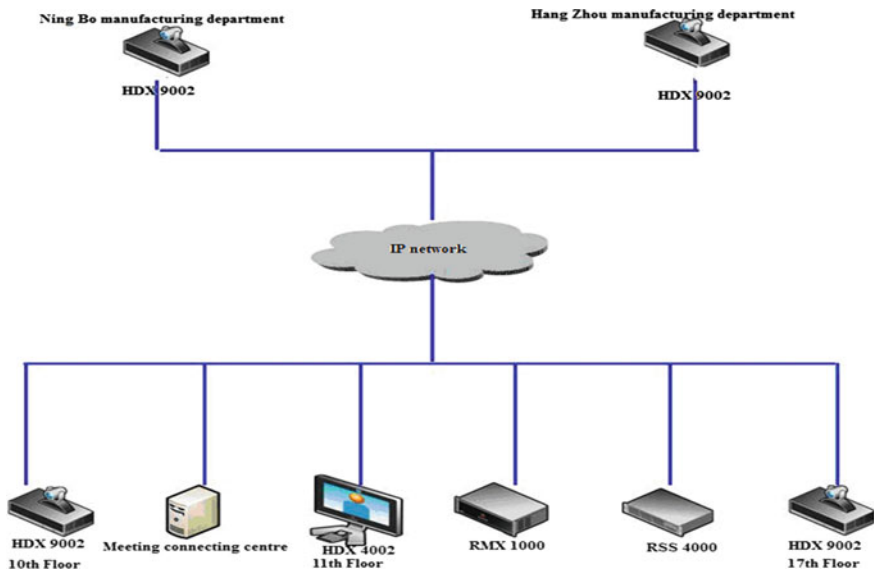


Fig. 85.4 Hardware design model

When bandwidth is  $<2$  M, it is recommended H.264 image coding, image effects better than ordinary H.261, H263, MPEG-4, MPEG-2 protocol in the same bandwidth. You can get the 720P of the image clarity. The system uses H.329 and SXGA to achieve panoramic view of the meeting. The complete video conference systems is in full compliance with the SNMP protocol, terminal, MCU management, configuration and maintenance can be achieved through SNMP. Users can have a large number of maintenance functions through a Web interface on the video device: dial-up control; parameter configuration; system log; incoming, outgoing state browsing; remote upgrade, web monitoring, and multi-screen. The system supports the standard ITU-T image coding protocol and G7XX series of voice coding protocol and AAC-LD wideband speech codec, can access the industry's leading manufacturers of video products, and use of LPR technology. When the packet's loss rate is in 5 % or less will not produce the mosaic, it can ensure the call quality.

### 85.2.3 Conference System Management Mode

First, users submit the meeting request by appointment meeting or instant conference interface, if the meeting requires approval, by a user who has permission to approve the meeting. If the approval is not adopted by the meeting, it will be returned and users need modify to re-apply; second, system will automatically reserve conference through the examination and approval, the system will automatically notify via SMS and e-mail before the meeting of participants; third, the convener of the conference control interface to preside over the meeting when having the appointment for successful meeting. If the meeting occurs exceptionally , the system can automatically activate contingency plans and maintain the normal convening of the meeting before the administrator solves the problem.

## 85.3 Test Programs and Results

We can connect the two video terminals to have the results of tests through the Ethernet integrated device; each video conference terminal has the status monitor to test the effect on the output. It is shown in Fig. 85.5.

In the hardware design, our audio mix formula is [7]

$$\text{Mix}b = \text{data}[i] = \sum_{j=0}^{N-1} |\text{Sourcedata}[j, i]| \quad (85.1)$$

The process includes the following aspects [8, 9]:

We have the audio sampling by mixing formula; send the sampling results to the MCU.



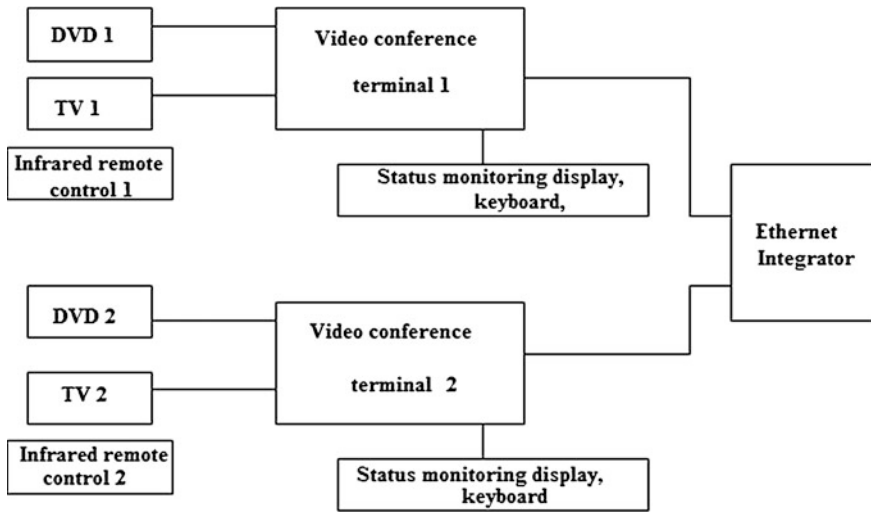


Fig. 85.5 Video terminal test schematic

Table 85.1 MCU acquisition utilization

	CPU utilization	Memory
0 terminal participation	0 %	114744 K, the MCU occupied 8568 K
1 terminal participation	0-1 %	Consumption of 1380 K
2 terminals participation	2-3 %	Consumption of 1380 K +1576 K
3 terminals participation	3-5 %	Consumption of 1380 K +1576 +1516 K,

The MCU receives information and data decompression after removing the noise value, and then compresses the data, sends the data to the video decoder.

The video decoder to receive the 4 frame  $W \times H$  size image synthesis for a  $W \times H$  picture size, the  $S$  practice image nested.

We can verify the results of the collected image information, its memory utilization, and CPU utilization are shown in Table 85.1.

From the data in the table, we can see that more video conferences and more video terminals to join the video conference do not consume CPU and memory usage. Therefore, H.323 video conference mode improves the transmission efficiency of the entire video network and increases the bandwidth utilization.

### 85.4 Conclusion

This chapter adopts the new MCU three layer video conference system to achieve a simple video conference operation process. It reduces the workload of the conference staff and the costs. At the same time it improves the speed of the

meeting. During the hardware design process, we use the mixing formula for audio sampling into the sampling results to the MCU. MCU received information and data decompression, decompression after removing the noise value, and then the data are compressed and fed into the video decoder and ultimately displayed on the screen of tire conference. The use of this process makes the loss on the CPU and memory very small, and increases the overall stability of the system screen, and then provides a new way of thinking to improve the video quality.

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# Chapter 86

## Study on Teachers Speech System in Three-Dimensional Perspective

Xiuli Xian and You Huang

**Abstract** In today's society, higher education is generally concerned about the topic, and universities also put forward a lot of methods and means for teaching reform. At home and abroad, the study of teacher discourse is more focused on the characteristics of the discourse properties, however, domestic research is also relatively small, teacher speech in today's academia is a relatively a new word. Three-dimensional system of teacher speech is built, to conduct field research to obtain data for specific universities' located class, then quantitative analysis is to obtain three kinds of ways and means that can enhance the effectiveness of the teachers discourse system. Practical results show that the methods are helpful for teaching reform and perfection, and at the same time have certain guiding significance for university teachers' teaching.

**Keywords** Dimension · Teacher speech · Practice · Validity

### 86.1 Introduction

With the development of society, college education has been paid more and more attention by all sectors of society, and the school also continually carries out reform and improves teaching; however, it is mostly in favor of teaching course and mode study. Teacher discourse is mainly embodied in the course of teachers to actively promote a pattern language of teaching activities organization. This is not

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only a method of teaching means, but also carries out an effective way of language input for students, and will play a prominent contribution and role of language teaching [1, 2].

In foreign countries, scholars' research on teacher discourse is language attribute characteristic analysis, such as voice, intonation, grammar, pause, and so on. In China, scholars mainly use the actual investigation in classroom; it shows that the teacher professor mainly uses the spoon-feeding teaching mode, basically is the way of the teachers and students to listen, to participate in the classroom, however, the classroom efficiency is not high, students' enthusiasm is not high. So, if the participation of students is not enough, it also contributed to the exchange of teachers and students in teaching is not enough, such as not enough to detect student's problem, to solve the problems of students, to answer questions for students, no way to achieve two-way communication, and so on [3, 4].

This chapter is mainly aimed at the literature knowledge analysis of teachers discourse and the constituent elements of teachers discourse, which are targeted to improve, effectively to increase students participation in the teaching process and to strengthen the exchange of students and teachers, to achieve the object and purpose is student-centered as the center and to realize the two-way communication and exchange, it is conducive to be effective outputted of students language in class, realizing the teaching methods to improve and perfect, in order to enhance the teaching quality [5, 6].

## **86.2 Using Three-dimensional Perspective to Analyze the Teacher Speech System Theory**

On the basis of combining teacher discourse theory, to build a three-dimensional analysis of the teacher speech system, there are three indicators factors to analyze, including the form of language genres, discourses time, and the text content [7].

### ***86.2.1 Text Content***

University teacher teaching should not only reflect the professional knowledge conservation, but also pay more attention to fuse between subject knowledge that must be combined with theoretical and practical; not only to pay attention to professional knowledge, but to combine modern social system and national condition, to fully understand social, and binding to the social reality to receive teaching knowledge, in order to hook with the times, to realize society to keep pace with the times. For subject knowledge, it only departures from the society and the status of the state that can be more scientific and practical in order to be more strategic vision; it also achieves the results of knowledge that can be effectively applied in actual social life and work, in order to better accepted by students, it can be more integrated into the social.

### ***86.2.2 Discourses Time***

To pay attention to time accounting for the distribution of teacher professors and students lectures, it not only want the time of teachers teaching and students discourse to carry out effectively divided, but also need the time reasonable allocation of mother tongue and target language, so as to time discourse language can be highly efficient absorbed and learned. At the same time, to expand the dissemination of language and discourse knowledge, making core values can be accepted by the students, the core values can be accepted by students, also can be more clearly guide us further improvement and teaching development.

### ***86.2.3 Language Style***

In the process of teaching, it should pay attention to ask questions, effective combining and unification the form of time and content. It not only should impart knowledge to students, but also need to give students some inspiration, making aware of the endless of knowledge, brainstorming, to give full play to their imagination and thinking, and to carry out efficient integration of knowledge, demonstrating the connotation and extension of knowledge, to achieve effective dissemination of knowledge.

## **86.3 Practice Investigation of the Three-dimensional Perspective for Teacher Speech System**

This paper is mainly aimed at three dimensions of teachers discourse system to carry out analysis, and analyzes the time scale of teacher discourse and student discourse, time scale of target language as well as the proportion of display questions and reference questions. This paper focuses on teaching discourse features, such as the use of teachers, and students' discourse, mother tongue case, etc., and the issues are raised by teachers and the results of feedback and so on. The article is mainly a teaching video, questionnaires, interviews, and several ways of combining to analyze. First of all, selected a few teachers college of class courses are publicly recorded, teaching videos use every class recording, and then are processed and converted into written information, the final to carry out effective statistical analysis. Questionnaires and interviews are mainly devoted to students of colleges' six classes to conduct research, to grasp discourses time analysis in the teaching process [8, 9].

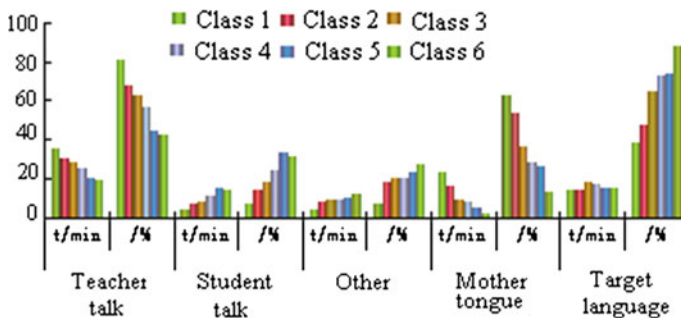
**Table 86.1** Discourses time proportion questionnaires

Grade classes	Teacher speech		Student speech		Mother tongue		Target language	
	t/min/	%	t/min/	%	t/min/	%	t/min/	%
Class 1	36	81	5	8	24	63	15	39
Class 2	31	68	8	15	17	54	15	48
Class 3	29	63	9	19	10	37	19	65
Class 4	26	57	12	25	9	29	18	73
Class 5	21	45	16	34	6	27	16	74
Class 6	20	43	15	32	3	14	16	88

### 86.4 Results and Discussion

According to comparative analyze the time of teacher discourses and student discourses in the classroom, the time of mother tongue, and target discourses will also be investigated, the discourses time proportion questionnaires is shown in Table 86.1 and Fig. 86.1. In class 1, class 2, and class 3, the proportion of three classes' teacher speeches are about 63, student discourses are less than the proportion of 20 %. However, the time proportion of teacher discourse in six classroom is 43–81 %, teacher speech maximum time is 36 min, and the shortest is 20 min; student speech maximum time is 5 min and the shortest is 16 min, the time proportion of student discourse in six classroom is 8–34 %; the time proportion of mother tongue is 14–63 %; the time proportion of target language is 39–88 %, this fully shows the degree of attention of teaching, teachers pay too much attention to teachers discourse, and it is not enough for the attention of student discourses.

In Fig. 86.1, it can be clearly shown that the percentage of teacher speech and target language is generally high, followed by mother tongue. In teacher speech, the six classes show a decreasing trend from class 1 to class 6, On the contrary mother tongue proportion shows a decreasing trend; student discourses basically show the increasing trend, except for class 6. According to class 5 proportion decreased, it also shows one correspondence relatively relationship.



**Fig. 86.1** Discourses time proportion chart

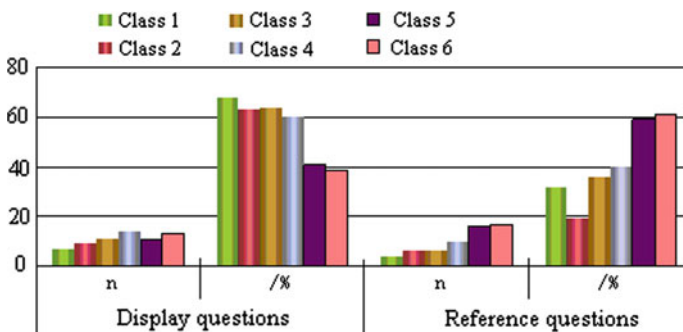
**Table 86.2** Scale of display and reference’s discourse questions in teaching classroom

Grade classes	The total number of questions n	Display questions n/ %		Reference questions n/ %	
Class 1	11	7	68	4	32
Class 2	15	9	63	6	19
Class 3	17	11	64	6	36
Class 4	24	14	60	10	40
Class 5	27	11	41	16	59
Class 6	30	13	39	17	61

Class professor is an interactive link, teachers impart knowledge, and the way of asking questions may include two problems that are display questions and reference questions. One is specific to a clear answer, such as display questions that aims at students to answer the standard answer; another is not a clear answer, students can fully play their own thinking, express their views.

In Table 86.2, it can be shown that the total number of problems show increasing trend from class 1 to class 6. Display questions show increasing trend, in addition to class 4; reference questions also show increasing trend. However, Display questions are accounting for 39–68 %, the largest proportion is class 1, it is followed by class 3, the smallest proportion is class 5; reference questions are accounting for 19–61 %, the largest proportion is class 6, it is followed by class 5, the smallest proportion is class 2.

From the Fig. 86.2, it can be shown that accounted for display questions and reference questions basically presents opposite trend; from class 1 to class 6, one is showed as increasing trend, another is showed as decreasing trend. However, the special circumstances also need to be excluded, such as reference questions proportion in class 2 is smallest; display questions is relatively greater than reference questions, it can be explained that Universities pay more attention to stimulate students dispersion thinking, students’ thinking is not confined to a particular answer to give students full of imagination and thinking space, it is able to achieve



**Fig. 86.2** Scale maps of display and reference’s discourse questions in teaching classroom

the correct transfer of information and effective communication, at the same time it also helps to develop students' thinking ability and verbal communication skills and practical abilities.

## 86.5 Validity of Teacher Speech System

Teacher discourse in the teaching process should pay attention to its effectiveness; it is mainly from the following three points to be improved.

(1) Teachers should effectively combine knowledge, so that students can more clearly understand the knowledge structure features, allowing students to really learn the professional knowledge. It not only speaks generally, no targeted or only theory, no binding to the practice, students can fully contact theory with practice and pay attention to knowledge.

(2) Teachers should make full use of all kinds of knowledge integration to enhance the interest of knowledge; students can easily participate in classroom, to inspire the students' enthusiasm and initiative, making it to change the learning state of passive acceptance and change passive to active. At the same time, the integration of interdisciplinary knowledge contributes to students' divergent thinking and stimulates thinking interest.

(3) Teachers should achieve the enlightening of the knowledge; students need to continuously think from learning knowledge, it can explore the deeper truth and mystery; teachers continue to inspire students' thinking in the professor process, enhance the students' thinking ability.

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# Chapter 87

## Analysis of Animation Art Design Based on 3Dmax Technology

Jing Wang and Ning Song

**Abstract** The birth of computer technology has originally no connection with art design, and the development of the times, it shows the computer technology to the modern animation art design which is particularly important. How to make not fluent “the beautiful” computer technology is better for the animation design services that is the focus of this paper. Using the theory of historical and modern esthetics and using the knowledge of symbol esthetics and system design, to carry on the in-depth analysis of classic animation design case from symbol characteristics and cultural connotation. On this basis, to create the game character archer Helena based on the 3Dmax technology, the role of modeling element is symbolic that describes the design elements in the extraction of role modeling, using art symbol esthetics methodology. In the animation design, character design is abstracted into the symbol design, animation design theory analysis, and practice operation based on 3Dmax technology will be innovative and realistic significance.

**Keywords** 3Dmax · Animation design · Art symbol esthetics · Cultural connotation

### 87.1 Introduction

Computer technology and art belongs to different definitions; the computer is good at calculation, and once refers to irrational factors, abstract thinking, inspired performance, and other problems, the computer will lose its advantage; the art is

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the historical esthetic precipitation that is people's thinking, emotional, spiritual expression, these are difficult with quantitative methods to measure and describe. However, with the development of computer technology, the multimedia application is rich, the help of computer technology carries on art design that has made remarkable achievements, and the animation design is the most remarkable success stories [1, 2].

Twentieth century is the big development period of science and art, division of the limitations are gradually being broken, the computer workers must have a certain esthetic accomplishment, in order to develop animation design software to provide excellent design platform, such as 3Dmax, Artists take into account the title of computer application master that is not uncommon. In this era, along with the development of sensing technology, recording technology, playback technology, storage and dissemination technology, even to appear "multimedia artist" to describe contemporary animation designer [3, 4].

At present, the animation design as creative cultural industry has an important force of market vitality and potential value, in the context of the global economic and cultural integration, the animation design has got more attention, especially developed countries, but also has made tremendous development and the actual benefit. Animated character design is the soul of the animation that is animation powerhouse to selling their animation and products' the important means. However, China's animation design is elegant without their artistic characteristics and theoretical framework, it is more common. With the advent of the digital age, the advanced computer software technology for the angle of animation designers observing creative way to provide a great convenience, the fusion of 3D technology and animation has gradually become the animation design's mainstream. In animation design, facing the theory and technical advantages of the developed countries to improve the design theory to guide the creation and design of 3D animation character is the purpose of this article [5].

## **87.2 The Theoretical Basis of the Three-Dimensional Animation Design**

Art and design activities at any time are based on the social economy and culture condition as the background, and along with the social conditions change and production change. The human society in twentieth century has occurred one of the biggest changes, which is from the traditional economy to the knowledge economy, science technology advances, computer applications rapidly changing, multimedia implementation change rapidly evolving, these changes will inevitably influence the design of animation art, at the same time, these effects in twenty-first century today is increasingly remarkable [6, 7].

### ***87.2.1 Three-Dimensional Animation Model Definition***

Three-dimensional (3D) animation is referred as 3D animation that is based on the new animation mode of computer hardware and software technology. Animation design is one of many art designs; it is the integrated use of exaggeration, personification, deformation, and other techniques, which will be the animated character design for visual image, its purpose is to every animation characters to give the appeal and vitality. 3D animation design in 3D space carries on character creation and motion design. 3D animation software, such as 3Dmax, designers in the computer first set up a virtual world, then in which according to the object shape size model and scene, and then to set the object trajectories, the virtual camera movement and other parameters, finally, to attach a specific material, and to cooperate with the lights. The current period of preparation is completed, it can automatically animate by the 3Dmax [8, 9].

### ***87.2.2 Development and Characteristics of the Three-Dimensional Animation***

3D animation design needs the arts as guide, technical as support. In the design process, on one hand, the contents should be fully realized creative requirements, the full performance of the script connotation; on the other hand, the contents should carry on artistic recreation and processing in color, composition, lighting design, and other details. The development of the course so far, it can be divided into three stages. The first stage is from 1994 to 2000, this stage is started and the initial development period, Disney and Picks is this stage's two main characters on 3D animation market. The second stage is from 2001 to 2003, this stage is a period of rapid development. At this stage, 3D animation is from polarization into the dream factory and the Picks' bipolar confrontation. The third stage is from the beginning of 2004, 3D animation has entered the diversification period of its development, and 3D animation has begun when all flowers bloom together. The main company has Warner Brothers film, Fawkes, dream factory and so on, these company has promoted the development of 3D animation, their logo are shown in Fig. 87.1 [10].

## **87.3 Esthetic Analysis of Classic Three-Dimensional Animation Art Symbol**

Since ancient times, the human has never stop for the beauty pursuit, the human pursuit beauty is inseparable from the fusion of art and technology, the intertwining of emotional and irrational, after several thousand years of sedimentation,



Fig. 87.1 All major animation company logo

the computer-based digital era has achieved unprecedented prosperity, this is the esthetic ideal of virtual reality technology and art symbolic esthetics [11].

### 87.3.1 Art Symbol Esthetics Definition

Sym biologists Roland Bat has pointed out that “means” and “referred” is a symbol consisting of two parts, “means” can refer to for the external manifestations of the substance; “referred” refers to the mental representation, the combination process of the two is called “means”, its product is the symbol. People on the outside of the consciousness reaction process is actually a process of symbols that is the media of the human understanding of the outside world, the information abstract vector, and the important way of human thoughts and emotions.

The animation is an art form of the most symbolic feature; this abstract symbolic feature is prominently marked characteristic of the art animation. In the actual animation design, it mostly rely on appearance characteristics and movement to describe different character and personality characteristics of the characters, so in the design of the role model, it should be according to the script creation that will image symbols and action symbol as a key, and then the two symbolic elements to extend, continually mining role behavior, characteristics, cultural, commercial, and other aspects of the symbol concept.

### 87.3.2 Design Analysis of the Classical Three-Dimensional Animation

The animated cartoon “Toy Story” is published by the Walt Disney Company, and is produced first computer animated feature by the Pixar, box office record had achieved tremendous data, at the same time “Toy Story” also had received the sixty-eighth Oscar special achievement award, and was the best original screenplay and other numerous awards. “Toy Story” is the beginning marked of the animation era, the toy story film still is shown in Fig. 87.2, and the combination full 3D computer animation design with film art has created a good start of the animation age.

“Toy Story” can obtain such a great success, and animation technology pioneering exploration has an indispensable link. In order to complete the animation character design, it contains more than 100 young workers’ design team and time-consuming more than 80 million work hours, to create a grand data of cartoon “Toy Story” computer production: it has more than 4 million screen that takes 20 h for the average of per lattice screen production. The main characters in the film have a total of 76; the object has a total of 366. Each image in animation is carefully designed, such as the little boy Andy has 12,384 hairs, the dog has 15,977 hairs, each hair can independently be active, in order to make the realistic effects, at least using dozens of different material texture, in order to achieve small spots, rash and sweat hair, and other minor detail fine effect. Advanced computer software design ability not only plays an important role for the role of design, but also makes a groundbreaking achievement in athletic performance. In the scene of Buzz catching Andy, the movement’s space sense is excellent, the 3D new era of announcing the animation has arrived.



Fig. 87.2 Toy story stills

## 87.4 Design and Analysis Based on the 3Dmax Technology

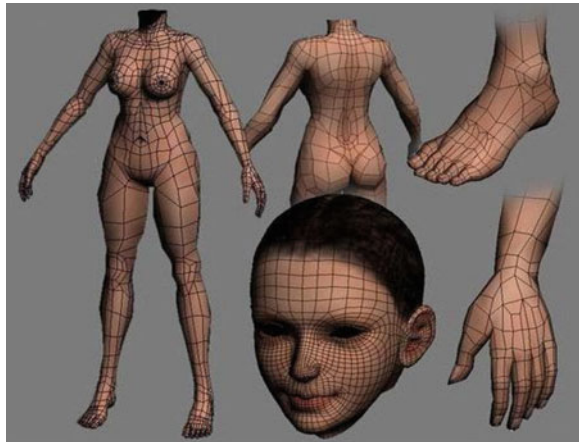
3D animation is art as guidance, technical as support. In the technology, the integrated use of computer software carries on modeling, texturing, lighting and other design, and in order to show the most perfect effect, only the each link is all realized and every detail is all expressed. The archer Helena is instance design based on the 3DMax 9, the inspiration is from a role of South Korean online game. In DEEPPAINT3D and Photoshop, making synthetic material, and using VR rendering.

### 87.4.1 Modeling Research

Modeling is the use of software to conceive a good role model for 3D realization, which is the first step of animation design. The role of the animation is in different scenes, the fine degree requirements of the model are different. However, in order to guarantee the fine animation, whether the role of vision or close-range, the model must complete the naked eye that can see details. Archer Helena design modeling can be seen in Fig. 87.3. Role model routing is based on the ductility of the role of action, using dense lines represent the range of motion, including joints, and expression significantly muscles and so on. Wiring adjustments in accordance with regularity changes slowly in smooth, then to gradually speed up, and to get the highest speed and then to gradually slow down until the wiring endpoint. This process can use the S curve fitting; (87.1) is the wiring's relative width with the function of position change  $t$ , the calculation formula of the wiring width is as follows:

$$x(t) = -2 \frac{x_{\max} - x_{\min}}{T^3} t^3 + 3 \frac{x_{\max} - x_{\min}}{T^2} t^2 + x_{\min} \quad (87.1)$$

**Fig. 87.3** Archer Helena modeling design



where  $x_{\max}$  and  $x_{\min}$  is respectively on behalf of the maximum and minimum of the width;  $T$  is  $x$  from  $x_{\max}$  to  $x_{\min}$  required extension distance. Usually using S curve function is the estimated basis of wiring width and wiring location.

Model topology correctness and the work effectiveness of UV division has a direct link, if the wiring structure is incorrect or inaccurate, UV development will face many troubles, even lead to map drawing are very serious, materials distribution is obviously uneven.

The face set segmentation algorithm of UV division that is the key step of the curvature surface calculation. Setting two adjacent surfaces  $f1$  and  $f2$ 's unit vectors are respectively  $n1$  and  $n2$ , their shared boundary is the AC, then to estimate the two UV surface relatively structure line bending degree function is defined as

$$H(f1,f2) = H(f2,f1) = n1 \cdot n2 \quad (87.2)$$

$H(f1,f2)$  is a rough reflecting of model topology structure line curvature? In the surface set of UV division, it needs to be slightly adjusted according to the characteristics of the various part models.

### 87.4.2 Material Art Symbol Esthetics

Material art symbols in esthetic embodiment are simply to achieve the perfect combination, a complete graph image of archer Helena can be seen in Fig. 87.4. In the rendering process, for example, to create the ideal role of skin texture that requires careful consideration with the column, the composition, construction, as well as various parts of the nature and texture, etc. Map includes not only the ordinary color processing; good map is perfect performance of main area and highlight area. The lighting system of 3D design software 3DMax9 is very important; the designer's grasp of reality optical principle is the key. In lighting design, the designers have to through different techniques of light and the color

**Fig. 87.4** Archer Helena image map





transition changes, to express different feelings theme. For example, the soft effect is no obvious projection, clear fine screen, realistic effect, stressed quiet in fine, trace harmony clear; on the other hand, light effect is opposite, its expression emotion should be strong, through the different levels to give people great power.

## 87.5 Conclusion

In this paper, the integrated use of the historical and modern aesthetics' theory, using the aesthetics and design knowledge, from the in-depth analyses classic animation design case of symbol characteristics and cultural connotation. On this basis, to create the game character based on the 3Dmax technology that is archer Helena, to undertake an analysis of the role of modeling wiring and material performance, and to elaborate design elements in the role of modeling, using art symbol aesthetics methodology, the character design abstraction in animation design is transformed into symbol design. The use of computer carries on art design that does not surpass materialism philosophy and aesthetics; however, it will possess interactive, continuity and systematic, and other advantage characteristics, which are combined with traditional art design forms. Through the complementary advantages, animation design will enter a new era.

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# Chapter 88

## Research on Art Teaching Methods Modern of Multimedia Technology Based on SPSS

Ning Song and Jing Wang

**Abstract** Modern art teaching pays most attention to art students' art creative thinking and their thinking development, promoting an innovative art teaching method. Modern multimedia technology to art teaching courseware design is the use of modern computer digital processing technology and sound image audio-visual technology, and multimedia computer technology platform as the center will teach art professional teaching design, art language, art graphics, art color, and other computer media information that are all combined, forming modern art teaching tools of having modern multimedia techniques. Aiming at the higher art education teacher research, the data statistical analysis derives that in the art of teaching ways, using modern multimedia art teaching is a way to obtain teaching effect obviously improved.

**Keywords** Modern multimedia technology · Art teaching · Teaching methods · SPSS · Mathematical statistics

### 88.1 Introduction

Art is the human use of their feelings and thoughts imagination as a tool to describe and express the special way for world. Art education is a very creative teaching task, with the rapid development of computer and information age, the teaching communication of art education and art majors' learning are not only limited to the art museum and other narrow regions, however, multimedia

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technology will be widely introduced to art teaching [1, 2]. Modern art teaching pays more attention to art students' creative thinking and art students' thinking development and promoting an innovative art teaching method. At present, the art professional teaching in Higher Professional Colleges make full use of modern multimedia technology to carry on art teaching mode's optimal result which is very important [3, 4].

## **88.2 Effect Analyses on the Modern Multimedia Technology for Art Teaching Mode**

Modern multimedia technology to art teaching courseware design is the use of modern computer digital processing technology and sound image audio-visual technology. Multimedia computer technology platform as the center will art professional teaching teacher's teaching design, art language, art graphics, art color, and other computer media information are all combined, forming modern art teaching tools of modern multimedia the techniques. Therefore, the modern multimedia technology in the art teaching has the prominent characteristic [5, 6].

(1) Modern multimedia technology to optimize the traditional art teaching mode. Application of modern multimedia technology in the teaching of modern art design has broken many limitations of traditional art teaching way, and its universality, art teaching convenient, art expression intuitive, artistic teaching flexibility, multimedia art teaching interactive, and other features. Art teaching knowledge and art expression information image will convey to the art major students, not only increasing the art teaching classroom's art design expression and the amount of information, but also expanding the art students awareness for the intrinsic meaning of the art, to make art students in art design ideas and thinking can get the art design and learning's breakthrough in the modern multimedia technology teaching.

(2) Modern multimedia technology for art students thinking in the application of art teaching has edificatory effect.

The use of modern multimedia technology to teaching will be rich and colorful, real art image and artistic information are conveyed to the student, which have the perception and the full range of artistic image, thinking, and language. Through the consciousness teaching of modern multimedia technology can improve the art teacher's working efficiency, the use of multimedia technology can collect a large amount of information, which will have the artistic features' video, voice, images, multimedia networks, and other advanced multimedia tools, the means to introduce the art teaching classroom, demonstrating the art design dynamic of latest domestic and foreign that will broaden the students vision.

(3) Use of multimedia teaching to stimulate students’ interest.

As art students must have a flexible design mind, the students could use the modern multimedia technology resources, they can see more, know more, broaden their knowledge, opening own design thinking. Second, for more practice, they can actively participate in some activities, to enrich their experience. At the same time, the use of spare time, the students can conditionally design their works, to put the campus network and other teachers and other students to exchange, which can cultivate the students to acquire knowledge and the ability of creativity.

Thus, the multimedia auxiliary teaching can not only enrich the art education resources, but also make students to carry more on independent learning, self discovery, and independent exploration, letting them put forward more innovative ideas and trying more new techniques, so as to cultivate innovative ability.

### 88.3 Researches on the Art Teaching Methods Based on Modern Multimedia Technology

Aiming at the higher art education teacher to research, selecting 135 art teaching teachers in the use of modern multimedia technology method is each art teaching teachers is to play a specific role, such as making courseware, content selection, and colors, which are art teaching teachers’ choice based on modern multimedia technology.

The independent variable is to study the teaching method of modern multimedia technology, and the dependent variable is the application score of modern multimedia technology teaching before and after test. The multimedia technology testing index factors for the application of art teacher teaching is mainly from the multimedia courseware, teaching efficiency, teaching mode, graphics, student satisfaction, to carry out analysis for this several dimensions, and then to get each art teacher’s teaching performance overall situation, the index case is shown in Table 88.1.

From Table 88.1 and Fig. 88.1, the modern multimedia technology’s indicators in the art teaching application are all greater than 75 %, indicating that this modern

**Table 88.1** Availability of modern multimedia technology to apply art teaching interactive

Aspect	Percentage
Multimedia courseware	85
Teaching efficiency	76
Teaching mode	77
Graphical	78
Student satisfaction	79
Overall performance	86

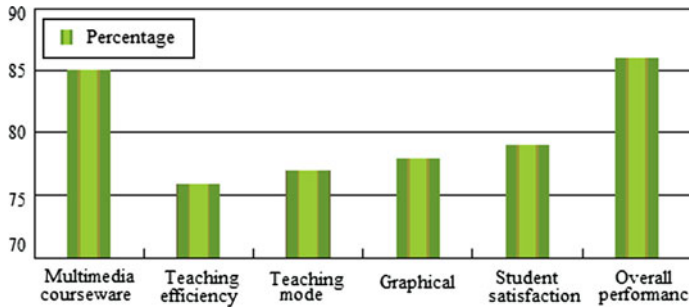


Fig. 88.1 Availability percentage of modern multimedia technology in the art teaching

multimedia technology in college is art students' acceptable categories level. The various aspects availability of modern multimedia technology in the arts teaching application analyzes art teachers in the multimedia technology application ability is accounted for 85 %, the rest of teaching efficiency, teaching mode, graphics, and student satisfaction are about 76 %, however, is also in the acceptable range, the overall performance is also satisfactory that is accounted for 86 %.

In the art teaching of modern multimedia technology, its application content and connection design development are mainly built on the basis of Herman theory model. Modern multimedia technology courseware design uses art education master's personal spiritual exercise, cognitive, and emotional elements. In addition, the main role of multimedia technology reduces the overload of art major students' memory. Notes is mainly each art teachers' teaching ability to carry on grade classification from 0 (no) to 10 (highest), and art teaching way of interaction, training the relationship, and exchange between art teachers and art students.

Before and after test in the teaching method of modern multimedia art, each test has 11 problems that cover the sound, image, animation, text, image, color and artistic sensory, and other problems. At the same time also combining art circles evaluation's form, audio, video recording, and semi-structured interviews to carry on triangulation, and the use of SPSS carries on quantitative analysis of results.

Because the modern multimedia technology mainly includes the senses of sound, image text, animation association, and the arts teaching effect, its most important parameter is the artistic teaching effect, namely the modern multimedia technology's relationship between effect and satisfaction in the art teaching reflects the action degree of modern multimedia technology, the expression of art teaching effect  $T$  is shown in type1.

$$T = \frac{B}{R_s + R_w} \quad (88.1)$$

Among them,  $B$  is the total effect of art teaching;  $R_s$  is to explore time for art teaching effectiveness,  $R_w$  is the art teaching effect time. After using average formula for the expression of art teaching effect to convert, it can use average for art teaching effect to carry on calibration that can be more convenient for art

teaching effect to carry on calculation. After conversion, the expression is shown in formula 88.2. The formula 88.2 carries on appropriate simplification that can be obtained by the type 3.

$$T = \frac{\alpha t_s k}{t_s + \alpha t_s t_w} \tag{88.2}$$

$$T = \frac{\alpha k}{1 + \alpha t_w} \tag{88.3}$$

Among them,  $k$  is the art teaching effect income,  $t_s$  is to explore time for art teaching effect,  $t_w$  is the art teaching effect time,  $\alpha$  is the art teaching effect coefficient.

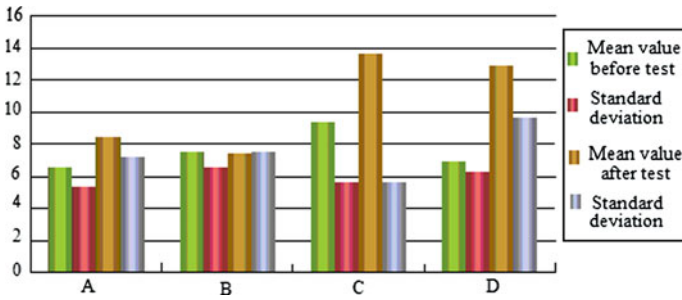
### 88.4 Survey the Data Results of the Art Teaching Method Based on Modern Multimedia Technology

Using the combination methods of qualitative and quantitative carry on the art teaching mode analysis based on the modern multimedia technology, to multimedia technology application scores of each art teaching teacher carry on descriptive statistical analysis, then to in-depth data analysis according to SPSS software.

From Table 88.2 and Fig. 88.2, they can be clearly drawn, before and after test, the mean values of each art teaching teachers are all increasing, and art teaching teacher D is the highest increase, followed by art teachers are C, A, the last is the art teacher B. However, before the test, the mean value maximum is the art teacher B, the second is the art teacher D, the third is the art teacher C, and the last is the art teacher A. During a test, the mean value maximum is the art teacher C, the arts teacher teaching D is increased one, row second, the third is the art teacher A, and the last is still art teacher A. These shows that in the teaching activities, the use of modern multimedia art teaching way has finally greatly improved.

**Table 88.2** Score descriptive statistical analyses of each art teaching teacher’s multimedia technology application

Teachers	Before test		After test	
	Mean value	Standard deviation	Mean value	Standard deviation
A	6.57	5.4	8.47	7.2
B	7.48	6.6	7.42	7.5
C	9.41	5.7	13.65	5.7
D	6.95	6.3	12.94	9.7



**Fig. 88.2** Scoring descriptive statistical analysis control chart of each art teaching teachers' multimedia technology application

## 88.5 Conclusion

Modern multimedia technology carry on art teaching that can combine with art sound, artistic image, animation art, and art media, finally through the forms of art sound pattern to teach the rich forms in diversity. Art teaching method is very flexible, the use of simple effect is also very good. After applying modern multimedia technology to the art teaching design, this is very convenient as well as very favorable for students' art teaching ways, thereby improving the teaching quality of universities in the art of teaching methods, which will serve as an important development direction of multimedia teaching methods and teaching means. The use of modern multimedia technology carries out the art teaching research, which need more in-depth study and exploration, this is a very long way, it will be accompanied by art education career development, to further mature and perfect.

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# Chapter 89

## Art Design Based on Digital Image Processing Software

Ning Song and Jing Wang

**Abstract** Digital image processing software refers to the use of a computer or other digital equipment to carry on a variety of processing and treatment for image information, and to meet people's visual and application requirements' application software. Through the digital process principle of digital processing software and the number of objects to indicate digital processing software in the application of art design, and to further explain the digital image processing software that is used in art design advantages, it will be artistic inspiration of the human and the combination of rational thinking and digital image processing software, to create a form more, effect more distinct, esthetic sense more independent art works.

**Keywords** Digital image · Art design · Gray-scale transformation · Sharpening

### 89.1 Introduction

Art design is inseparable from the graphics, in today's information age, with the development of computer technology, computer digital image processing software technology has been widely applied in art design, and using computer software converts the image signal into digital format to deal with digital image processing also known as computer image processing [1]. Digital image processing software is penetrating art design aspects, along with the application of the digital image processing software in art design, making design concepts of the majority of artists have a greater change, and the works of art design is more rich and colorful. With

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the ceaseless progress of science technology, people’s thought idea is liberated ceaselessly, horizons are constantly broadened. Digital processing in art design is a wide range of applications making digital image processing software in the application of art design which has more vast development space, and shows the vigor [2, 3].

## 89.2 Image Processing Main Content of Digital Image Processing Software

### 89.2.1 Digital Image Processing Technology

With the development of digital image technology in the decades, although image understanding has some progress in theory, it is more technical fusion’s technology that has the characteristics of complexity, diversity. Therefore, its wide coverage, the technology is more complex. It can also be said that digital image processing software is computer interactive integrated processing image information (text, graphics, image), making multiple information digital and establishing a connection, integrated into a system and each part has interactive, so digital image processing software is the technology of computer software integrated processing paper, shape, figure, has the certain integrated, interactive and real-time [4, 5].

Digital image processing through computer image carry on removal noise, enhancement, restoration, segmentation, feature extraction, and other processing methods and techniques. The common image processing methods has image enhancement, restoration, coding, compression, and so on. Overall image technology content is very rich; Fig. 89.1 shows the main digital image processing technology [6].

In Fig. 89.1, it introduces the key of digital image processing technology, image acquisition is the analog images to carry on digital in digital image processing, such as common photo, graphics, art works; digital image transformation

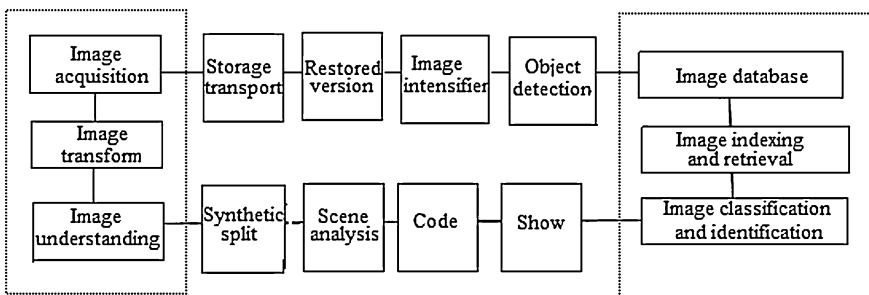


Fig. 89.1 Digital image processing technology

is the feature of the image through a kind of orthogonal transformation to be shown by transform domain in order to the convenience of digital images to carry on related to image processing in the transform domain, it has been well reflected, however, space does not complete the special treatment; digital image enhancement uses the histogram, airspace, frequency domain and color enhancement, or attenuation unwanted information, so as to achieve the purpose of requirement; image restoration is by the inverse filter, Wiener filter, homomorphism filtering, and other method, to remove noise interference and blur to restore the image of the original. Image coding is mainly through transform, wavelet transform, neural network, and other coding that carry on compression efficiency for image signal, thereby reducing the amount of stored data, to reduce the quantity of data in order to reduce the transmission bandwidth, compresses the amount of information for image analysis and image recognition; image analysis is by edge detection, region segmentation, feature extraction, and other method. Image data base retrieval type is further convenient for image processing; the image classification identification is commonly used classical model, statistical classification model, structure model to carry on image segmentation feature extraction, and classification [7, 8].

### ***89.2.2 Common Digital Image Processing Method***

Digital image processing methods can be broadly divided into two categories, namely spatial domain processing method (or spatial domain method) and transform domain processing method (or frequency domain method) [9].

(1) Spatial domain method

Spatial domain method regarded as the image is the collection of each pixel in the plane, and then directly its corresponding processing. It mainly has neighborhood processing method that relates to the gradient operator, Laplace operator, smoothing operator, and convolution operation. Point treatment methods involve the gray processing, area, perimeter, volume, weight calculation, etc.

(2) Transform domain method

Transform domain method first carries on the image orthogonal transform to get an array of transform coefficients, and then to carry on a variety of treatment. After treatment, the inverse transform to the spatial domain to get processing results. The process includes filtering, data compression, feature extraction, etc.

### 89.2.3 Digital Image Processing Software System Model

Digital image processing system includes the system of hardware and software, the system is mainly composed of image input/output, access/transmission, storage control and image processing. The main image processing software is composed of five parts; the functional model is shown in Fig. 89.2.

In Fig. 89.2, the image input is a input unit of digital image processing software system, by means of the common image input equipment acquired image information from input to image processing software, to undertake corresponding image processing; the image output is a output unit of digital image processing software system, it usually connects with the common image output equipment to carry on image output after system processing; the image's storage and control is responsible for executing the stored and control function of digital image processing software system, it is mainly controlled by completed engineering computer external devices, to carry on the control of quality and quantity in image processing, however the main function of the storage is through a variety of storage device to store related information storage of the image processing process; access and transmission equipment is referred to the local operating, and the distant terminal image information will be stored by the network to carry on image transmission, then to enter to the image unit for further processing; the main image processing software is the core of a digital image processing system, which is composed of a variety of different hardware and image processing software.

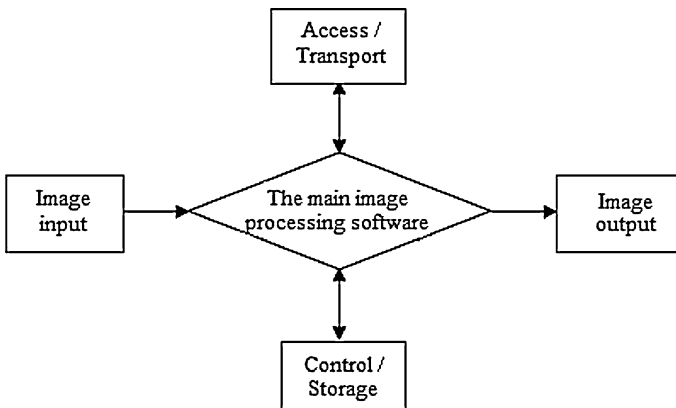


Fig. 89.2 Digital image processing software system model

### 89.3 Case Analysis of Common Digital Image Processing Software in Art Design

#### 89.3.1 Case Analysis of MATLAB Digital Image Processing Environment in Art Design

##### 89.3.1.1 MATLAB Digital Image Processing Environment Introduction

America Math work company in 1967 has launched the “Matrix Laboratory” software package that is a strong function, efficiency high in order to facilitate interactive software package of scientific and engineering computing. Matlab greatly reduces the user’s mathematics foundations and computer language knowledge requirements, and the programming efficiency and computation efficiency are not only very high, but also can directly output results and beautiful graphics copy in the computer, so it is an efficient art design assistant, and can complete the image preprocessing, image segmentation, image feature extraction, and other image processing functions.

##### 89.3.1.2 Gray-Scale Transformation Analysis of MATLAB Digital Image Processing Environment

In MATLAB, the digital image processing environment carries on color image gray transform, gray level contains only brightness information, and does not contain color information image. Gray-scale processing is to contain brightness and color image that transforms into the process of gray-scale image. In the gray level correction process, it does not change the pixel location, however by changing the pixel gray value, we can understand this is a point of operation. Assume that the input image is  $f(x, y)$ , the output image is  $G(x, y)$  after the output transformed. If using the corresponding mapping, the mapping transformation function is  $T[ ]$  then  $(x, y) = T[f(x, y)]$ , so as to the contrast of image to enhance gray.

The linear transformation is introduced as example. The gray value range of known image is 0 to  $M_f$ , most of which are located in the interval of  $[a, b]$ , then through the transformation, the gray range of image  $g(x, y)$  is  $[c, d]$ , the transform relationship between them is

$$g(x, y) = \begin{cases} \frac{d-c}{b-a}[f(x, y) - a] + c & a \leq f(x, y) \leq b \\ f(x, y) & \text{other} \end{cases} \quad (89.1)$$

In formula (89.1),  $a, b, c, d$  are constants that may be according to need to set out, such as  $a = 45, b = 75, c = 15, d-c = 90$ , to obtain the linear variation function:

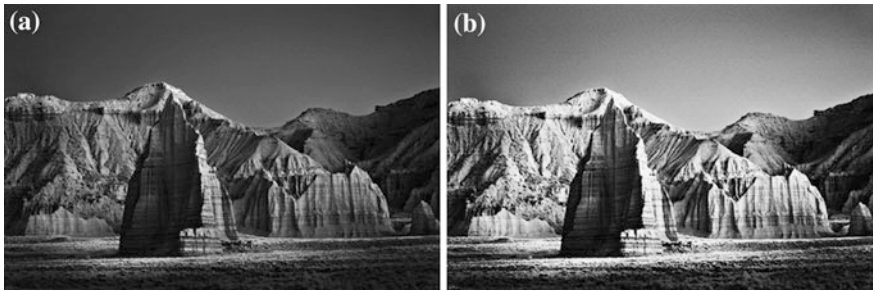


Fig. 89.3 Gray scale transformation art design image contrast of MATLAB digital image processing environment

$$g(x,y) = \begin{cases} 3[f(x,y) - 45] + 15 & 45 \leq f(x,y) \leq 75 \\ f(x,y) & \text{other} \end{cases} \quad (89.2)$$

Using the linear transformation, in the MATLAB digital image processing environment, to carry on linear transformation for the art image of Fig. 89.3, and then to obtain the art image processing results of Fig. 89.3b.

### 89.3.2 Case Analysis of Digital Image Processing Software Photoshop in the Art Design

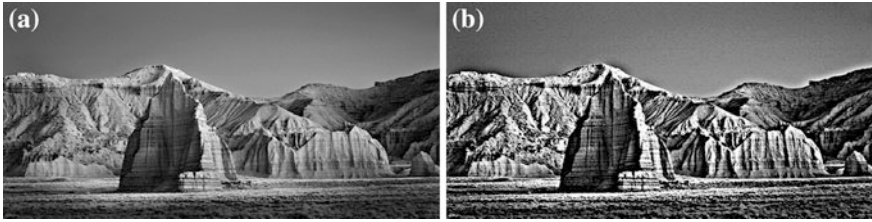
#### 89.3.2.1 Adobe Photoshop Introduction

Adobe Photoshop (PS) is the image processing software’s patriarch; it is also one of the most popular powerful image processing software; it belongs to Adobe Company that is one of the most famous image processing software that; it is the graphic image processing software of a set of image scanning, editing, image production, advertising, image input, and output.

#### 89.3.2.2 Image Sharpening of PS Software in the Art and Design

Image sharpening effect is by means of digital image processing, making the fuzzy image to become clear; it is different from the technology of image restoration that take appropriate means to restore image definition method based on the reason of image blur. Using the gradient method to explain sharpening principle of digital image processing, and then it can get sharpening image contrast through digital image processing software Photoshop.

Based on the gradient definition, the image function  $f(x,y)$  at the point  $(x,y)$  of gradient is



**Fig. 89.4** Art image contrast after digital image processing software PS sharpening

$$\nabla f = \frac{\partial f}{\partial x} \hat{e}_x + \frac{\partial f}{\partial y} \hat{e}_y \tag{89.3}$$

In type (89.3),  $\nabla$  is a Laplace operator,  $f$  is a gradient vector. For a picture, the area of gradient change values is the image gray change larger edge, and the changes of small area is a flat area of gray scale change in the image, therefore, it can get the Fig. 89.4b effect chart. According to the above algorithm, the acquired image sharpening effect is only shown in gray change sharp edge, the flat area of gray scale change shows a black, so sometimes adopting the operation mode, calculation is as follows:

$$g(x, y) = \begin{cases} |\nabla f| & |\nabla f| \geq T \\ f(x, y) & \text{Other} \end{cases} \tag{89.4}$$

In type (89.4),  $T$  is a nonnegative threshold. It not only has highlighted the image restoration larger variation contour, but also change the image gray flat background effect. From the spectrum analysis, fuzzy image is actually a high resolution's high frequency components that are caused by the attenuation, so it can be used to high-frequency heavier filtering to improve image clarity.

Through the contrast of Fig. 89.4a, b, these can be found that through digital image processing software PS processing, not a clear image is sharpened in the two picture that have become more clear. Using PS to make art design rich, concise. It also shows that the digital processing software in the application of art design is very convenient, and is conducive to the creation.

### 89.4 Application Prospect of Digital Image Processing Software in Art Design

With the development of computer science and technology, the digital image technology profoundly affects and changes the people traditional awareness of visual language, and effectively has promoted the continuous progress of art and design field. By digital image processing software in the art design with repeatedly modification function, it can not only improve the quality of design, but also

shorten the design cycle. Through a long period of development, it obtains the widespread application and the unprecedented development. At the same time, digital image processing software in the application of art design has good tolerance, complementary and originality, and produces a powerful copy, refinement, integration, processing shaping ability; all of these characteristics inject strong momentum for the sustainable development of digital art in itself.

For example, the above case PS in the application of art design is very extensive. The use of PS to the development process of art design also accompanies image graphics programming technology, printing technology, electronic scanning technology and other technology, making the art design of the graphic image to become digital, simplicity. From the PS to new model graphic art design, it has acquired a unique visual impact force and artistic connotation, so the bonding of technique and imagination reach predecessors do not have height. At the same time, the design has played a convenient role, to shorten the design and creative the revision process, reducing repetitive work processes, and enhance the interactive nature of the art designer, and it can also help the creators to create new content, to raise the level of creativity.

Digital image processing software will continue the development in the application of art design, the influence depth of art design and the breadth of participation will be more and more thorough, more profound. The combination of science technology computer software's progress and the human art design will be more harmonious, it is our inescapable fact, the new technology will be applied for the art design, which is the application of new technology's random stress degeneration and omnipresent; it also bring unbelievable change for art creators that need new concepts and technical means to engage in art design, so the digital image processing software is used in art design with unlimited development potential.

## 89.5 Conclusion

Digital image processing software uses its unique time characteristics and technology characteristics into the field of art design, making the art creators to carry on artistic conception. At the same time, through digital image processing software to carry on the creation of documentary, the performance form of traditional art design has a sense of mystery, technology and system, using specific performance means and creation form of digital image processing software that is free to modify the already completed art images works, making the work more novel and more diversified in the creative form. Then, the use of new scientific techniques creates dynamic and static combination, interactive art design forms in digital image processing software. Finally, by means of digital image processing software timely to feedback their creative ideas of achievement, it can be more flexible use of creative thinking and play, to create more excellent art works.

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# Chapter 90

## Acoustic Durational Properties of Sonorant as Syllable Boundaries in Text-to-Speech Synthesis

Tian Fang

**Abstract** Understanding the acoustic properties of phonetic unit is the key for concatenating natural speech in text-to-speech synthesis. In this paper, two sonorant, /n/ and /l/, are chosen as the target phonemes to learn their acoustic durational behaviors in CV and VC phonetic sequences. The results show that both share similarities and differences in durational behaviors with two variables of stress and position. Moreover, /n/ behaves more stable than /l/ both as onsets and codas. Their segmental application in TTS system (Text-to-Speech system) is discussed finally.

**Keywords** /N/ · /L/ · CV · VC · Duration · Stress · Position · Boundary · Text-to-speech synthesis

### 90.1 Introduction

To produce high quality synthesis, a concatenation-based text-to-speech (TTS) system usually requires a large number of segmental units to cover various acoustic–phonetic contexts [1]. For English, phoneme as the phonetic unit is often the segmental unit for concatenation. However, phonemes, the consonants for instance, in connected speech undergo variations caused by the articulation of adjacent vowels and a range of other factors [2], such as the consonant’s role in the CV or VC sequences, namely, the onset or the coda. This poses a difficult problem

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when the program is designed to select different consonants under different phonetic contexts. For example, /l/ has two variations: the dark /l/ in the coda position and the light /l/ in the onset position [2]. Selecting dark /l/ as the onset /l/ will definitely reduce the naturalness of the output speech because two variations of /l/ show durational differences, such as onset /l/ being longer before voiced than voiceless codas [2, 3]. Besides /l/, the variations of other sonorant consonants as syllable boundaries are seldom studied while their duration may be a practical cue in TTS than place or manner of articulation. Taking /n/ as an example, with most researches focusing on its place of articulation and formants transitions [4, 5], its durational behaviors as syllable boundaries are still not quite clear. Therefore, the durational properties of /n/ and /l/, both as sonorant, are the main concern in this paper. Their durational properties of /l/ and /n/ both as onsets in LV, NV sequences and codas in VL, VN sequences will be fully investigated in speech corpus.

Traditionally, there are two types of speech corpus, one which is a carefully designed set of sentences with the factor confounding minimized, such as controlling the vowel type and the stress pattern. However, its drawback is obvious in that the repetitive carrier phrases may seriously undermine the naturalness of speech [6], and the result may not be applied into speech synthesis. The other type of corpus, the naturally meaningful sentences, is good at maintaining the naturalness, but with the disadvantage of confounding the influencing factors [6]. In this paper, to obtain the authentic durational changes in natural speech contexts, the second type of speech corpus is chosen as long as the influencing factors as variables are under control.

Stress and position are two variables in this experiment. First, there are only two stress levels, stressed or unstressed. The secondary stress is still considered as stressed. Second, the relative positions of CV and VC sequences in multisyllabic words are classified into the initial, the middle, and the final positions. Meanwhile, three aspects should be excluded. First, VCV sequences are not included for the ambiguous role of *C* in the VCV phoneme sequences, such as /n/ in *anesthesia*. Second, consonant clusters as CCV or CCCV are excluded since the duration of target consonant will be strongly affected by adjacent consonants, which will not reflect the overall durational tendency by its minor numbers. Third, after we gave a gross calculation of the target phonetic sequences with five monophthongs /æ/, /ɪ/, /ɔ/, /ɛ/ and /ʊ/, we find that the four target phonetic sequences distribute quite unevenly, which means a strict control of the vowel type will not guarantee enough quantity in the experiment. In fact, the influence on consonant duration by vowels will be balanced out if all vowel types appear almost evenly over the target phonetic sequences.

Finally, with the variables controlled and the excluding factors removed, the research question is proposed: by observing the acoustic durational features of /l/ and /n/, can we find out their durational properties as the syllable boundaries under different phonetic contexts.

## 90.2 Experiment

In this experiment, the naturally connected speech from the MSRA speech corpus is used. It includes 6,000 meaningful and connected sentences from a Native American female. A program is applied to pick out all the legal phonetic sequences from it. All the durational results are first tagged by SFS software and then refined by a phonetician while listening to the original sound and watching the corresponding spectrograms. Finally, all the quantity of LV, NV, VL, and VN sequences are counted out and the durations for each type are calculated out and exhibited in the EXCEL.

## 90.3 The Analysis of Results

All the counts of legal phonetic sequences are illustrated in Table 90.1. In the following analysis, One-way ANOVA is applied to check how much both stress and position as variables affect the durations of // and /n/ in CV and VC sequences.

## 90.4 The Durational Analysis of /N/

Table 90.2 demonstrates the count, mean duration, and SD for /n/ as onsets and codas with different stress levels in the initial, middle, and final positions, respectively. First, the durations of onset /n/ are found to be almost the same in three positions with the general mean value. Then the one-way ANOVA in Table 90.3 proves this result, which is to say that onset /n/ is insensitive to position with the same stress level.

In contrast, with the same position, the mean duration is remarkably longer when /n/ is stressed. Correspondingly, in Table 90.3, the one-way ANOVA proves this result, which is to say that onset /n/ is sensitive to stress with the same position.

**Table 90.1** The syllable count for CV and VC sequences

Conso-nant	CV sequence	count	VC sequence	count
/n/	$N_L^0 V_R^0$	40	$V_L^0 N_R^0$	271
	$N_L^0 V_R^1$	154	$V_L^1 N_R^0$	240
//	$V_R^0 V_R^0$	5	$V_L^0 L_R^0$	154
	$V_R^0 V_R^1$	225	$V_L^1 L_R^0$	70

V vowels; L //, N /n/; 0 no stress, 1 stressed; L on the left position in the CV or VC sequences; R on the right position in the CV or VC sequences

**Table 90.2** The count, mean duration and Sd of /n/ with different stress and position

$N_L$ and $N_R$	$N_L^0$	$N_R^0$	$N_L^1$	$N_R^1$
Count	40	271	154	240
Mean	53.89	67.95	75.47	62.41
SD	19.90	26.43	21.11	27.68
$N_L$ and $N_R - i$	$N_L^0 - i$	$N_R^0 - i$	$N_L^1 - i$	$N_R^1 - i$
count	22	48	104	90
mean	55.07	79.76	76.81	61.03
SD	18.57	18.43	20.15	19.62
$N_L$ and $N_R - m$	$N_L^0 - m$	$N_R^0 - m$	$N_L^1 - m$	$N_R^1 - m$
count	16	107	42	62
mean	50.64	48.80	73.87	43.96
SD	22.50	16.38	24.62	15.36
$N_L$ and $N_R - f$	$N_L^0 - f$	$N_R^0 - f$	$N_L^1 - f$	$N_R^1 - f$
count	2	116	8	88
mean	66.9	77.59	66.37	76.83
SD	8.50	24.00	9.09	33.03

*i* the initial position in the multi-syllabic word; *m* the middle position in the multisyllabic word; *f* the final position in the multisyllabic word

**Table 90.3** The one-way analysis of stress as the variable in nv in the same position

$N_L^0$ and $N_L^1$	Initial versus middle	Initial versus final	Middle versus final
$N_L^0$	F0.05 (1,36) = 0.44 ( $p < 1$ )	F0.05 (1,22) = 0.77 ( $p < 1$ )	F0.05 (1,16) = 0.98 ( $p < 1$ )
$N_L^1$	F0.05 (1,144) = 0.56 ( $p < 1$ )	F0.05 (1,110) = 2.1 ( $p < 1$ )	F0.05 (1,48) = 0.71 ( $p < 1$ )
$N_L^0$ and $N_L^1$	General	Initial	Medial
F	F0.05 (1,192) = 33.94 ( $p < 0.001$ )	F0.05 (1,124) = 21.7 ( $p < 0.001$ )	F0.05 (1,56) = 21.29 ( $p < 0.001$ )

Differently, the mean durations of coda /n/ in general and three positions vary with the shortest in the middle position and rather longer in both initial and final positions. In Table 90.4, the one-way ANOVA proves this result, which is to say that coda /n/ is sensitive to position with the same stress level.

However, with the same position, the mean duration for coda /n/ is not remarkably longer when it obtains the stress. In Table 90.5, the one-way ANOVA proves this result, which is to say that coda /n/'s sensitivity to stress is not as sharp as onset /n/ with the same position.

**Table 90.4** The one-way analysis of position as the variable in vn with the same stress level

$N_R^0$ and $N_R^1$	Initial versus Middle	Initial versus Final	Middle versus Final
$N_R^0$	F0.05 (1,153) = 109.43 (p < 0.001)	F0.05 (1,162) = 0.32 (p < 1)	F0.05 (1,221) = 107.7 (p < 0.001)
$N_R^1$	F0.05 (1,150) = 33.02 (p < 0.001)	F0.05 (1,176) = 15.13 (p < 0.001)	F0.05 (1,148) = 53.23 (p < 0.001)

**Table 90.5** The one-way analysis of position as the variable in vn with the same stress level

$N_R^0$ and $N_R^1$	Initial versus middle	Initial versus final	Middle versus final
$N_R^0$	F0.05 (1,153) = 109.43 (p < 0.001)	F0.05 (1,162) = 0.32 (p < 1)	F0.05 (1,221) = 107.7 (p < 0.001)
$N_R^1$	F0.05 (1,150) = 33.02 (p < 0.001)	F0.05 (1,176) = 15.13 (p < 0.001)	F0.05 (1,148) = 53.23 (p < 0.001)

### 90.5 The Durational Analysis of /L/

Table 90.6 demonstrates the count, mean duration, and SD for /l/ as onsets and codas with different stress levels in three positions, respectively.

With the same stress pattern, onset /l/ is still sensitive to position with the longest duration in the initial position. This is especially true when LV is the real first syllable of a multisyllabic word as in *loudly* or *luxurious*. Although the one-way ANOVA cannot check all the three positions because of the small number for  $L_L^1 - i$  and  $L_L^1 - f$ , the results in Table 90.7 show that onset /l/ is sensitive to position with the same stress level.

Moreover, stress is the other variable to influence its duration, which is proved by the one-way ANOVA in Table 90.8.

Likewise, the duration of coda /l/ is sensitive to position with the longest in the initial position and shortest in the middle position. In Table 90.9, the one-way ANOVA proves this result, which is to say that coda /l/ is almost sensitive to position with the same stress level. With the same position, coda /l/ lengthens when it is stressed.

However, the result of one-way ANOVA in Table 90.10 shows that sensitivity of coda /l/ decreases comparing with onset /l/.

**Table 90.6** The count, mean duration, and sd of /l/ with different stress and position

$L_L$ and $L_R$	$L_L^0$	$L_L^0$	$L_L^1$	$L_R^1$
count	59	154	225	70
mean	48.51	80.15	69.97	92.64
SD	18.08	34.90	26.13	34.09
$L_L$ and $L_R - i$	$L_L^0 - i$	$L_L^0 - i$	$L_L^1 - i$	$L_R^1 - i$
count	5	44	160	17
mean	68.44	74.68	81.53	83.38
SD	15.18	20.09	18.59	16.98
$L_L$ and $L_R - m$	$L_L^0 - m$	$L_L^0 - m$	$L_L^1 - m$	$L_R^1 - m$
count	18	24	58	17
mean	30.10	56.98	39.60	70.22
SD	13.72	15.64	18.38	17.64
$L_L$ and $L_R - f$	$L_L^0 - f$	$L_L^0 - f$	$L_L^1 - f$	$L_R^1 - f$
count	36	86	7	36
mean	54.94	89.42	57.23	107.60
SD	12.27	40.842	21.382	38.74

**Table 90.7** The one-way anova analysis of position as the variable in lv with the same stress level

$L_L^0$ and $L_L^1$	Initial versus middle	Middle versus final
$L_L^0$	None	F0.05 (1,52) = 26.76(p < 0.001)
$L_L^1$	F0.05 (1,216) = 217.92(p < 0.001)	None

**Table 90.8** The one-way analysis of stress as the variable in lv

$L_L^0$ and $L_L^1$	General
F	F0.05 (1,211) = 132.29(p < 0.001)

**Table 90.9** The one-way analysis of position as the variable in vl with the same stress level

$L_R^0$ and $L_R^1$	Initial versus Middle	Initial versus Final	Middle versus Final
$L_R^0$	F0.05 (1,66) = 13.97 (p < 0.001)	F0.05 (1,128) = 5.09 (p < 0.05)	F0.05 (1,108) = 14.17 (p < 0.001)

**Table 90.10** The one-way analysis of stress as the variable in vl in the same position

$L_R^0$ and $L_R^1$	General
F	F0.05 (1,222) = 6.25 (p < 0.02)

## 90.6 Conclusions and Discussions

This paper is to explore the durational behaviors of /n/ and /l/ between onsets and codas with different variables of stress and position. Although both are sonorant, they behave differently in CV and VC sequences. On one hand, onset /n/ is sensitive to the stress, but not the position while coda /n/ is sensitive to the position but not to the stress so much. Therefore, in speech synthesis, the constraint of stress will be set to select onset /n/, but not the position while the constraint of position will be set to select coda /n/, but not the stress. On the other hand, /l/ bears more variations from /n/ under the same condition. For /l/, both onset and coda are influenced by stress and position. That is to say, /l/ is found to be more complicated and unstable than /n/ as both onsets and codas. In speech synthesis, besides duration, other stable attribute of /l/ should be found to help to select the suitable segment. Moreover, with the durational behaviors of /l/ and /n/ in the CV and VC sequences, we may decide the role of /l/ or /n/ in the VCV phoneme sequences, namely the onset or the coda, by comparing its durational behaviors with those in the CV and VC sequences.

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**Part X**  
**Multimedia Technology and Applications**



# Chapter 91

## Research on Language Ability for English Teaching in Primary and Middle School under Multimedia Network Environment

Junying Liu

**Abstract** With the deepening reform of China, English language skills are nowadays required more and more highly. How to improve students' language ability is not only the core content of the new curriculum reform and the fundamental measures to improve students' comprehensive English quality, but also the demand for international exchange and cooperation in future. Information technology, as the core of Multimedia and network technology, has become creative tools to expand the human's capacity to promote economic development. And its wide application in education field is bound to have an enormous influence on the reform and development of education. Based on many years of English teaching experience, the author put forward the corresponding measures to cultivate students' language ability in English teaching process of middle school, which has certain practical significance to the cultivation of student language ability.

**Keywords** Primary and middle school · Multimedia · Mathematics statics · Network environment · Information technology

### 91.1 Introduction

As a discipline of China's middle school and one of the three important subjects of college entrance examination, English attracts the unprecedented attention. If the students lack English skills, their future education, development, employment occupation choice, and even life design will be limited. Because the present

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situation of English Teaching is in non English teaching environment, the teaching form is in a big classroom, and teaching result is “taking much time but with low effectiveness”. With low English level and poor English application ability, quite a part of students have weariness emotion and quit to study English. In English teaching of middle school, the main task is to develop students’ ability of reading, listening, speaking, rather than to write mainly. Its main purpose is to cultivate student’s communicative expression ability. Students would like to communicate in English in order to learn English well, which is also the requirements of teaching plan [1]. As to learning English, students of primary and middle school are often afraid of losing face and dignity when they have difficulty in communicating and learning English. If they failed in talking with foreigner and other partners, they would lack confidence, then he first defeated himself, which would influence English learning ability into full play. Day after day, they will increasingly feel that it is difficult to learn English well, although they enjoy the performance, but the English made them step back and feel depressed. As we know, the English learning process in primary and secondary school is the most important content of teaching that can train the students to speak that we call the language expression ability. In the classroom, a lot of students fully grasp the rhythm of the classroom, and be good to express their ideas. However, by their own psychological characteristics and other factors, some students still think learning English is very difficult, which indirectly affect their learning confidence and make them being afraid of making mistakes and being laughed at. Therefore, we should focus on the problem of curriculum design and help students to regain confidence in the process of English teaching.

Twenty-first century is the era based on digital and information, as the core of information technology, computer technology and network communication technology are widely used in all social fields [2]. The abilities to get, analyze, card, release, and apply information will become the important symbol of modern basic competence and cultural level. The cultivation of students’ information accomplishment and improvement on the ability of processing and applying the information becomes the important content and task of the new century’s education. In order to make students actively learn English, stimulate their enthusiasm increasing and show their English ability confidence, in the innovation practice of teaching form, teaching content optimization, let students dare to “open mouse”, enjoy “open mouse”, in order to promote students’ English expression ability, and improve the quality of language communication.

## 91.2 Research System Analysis

This paper used the multimedia tutorial system to analyze the English teaching and multimedia teaching model is composed of three links: language input, output language, and language stored.

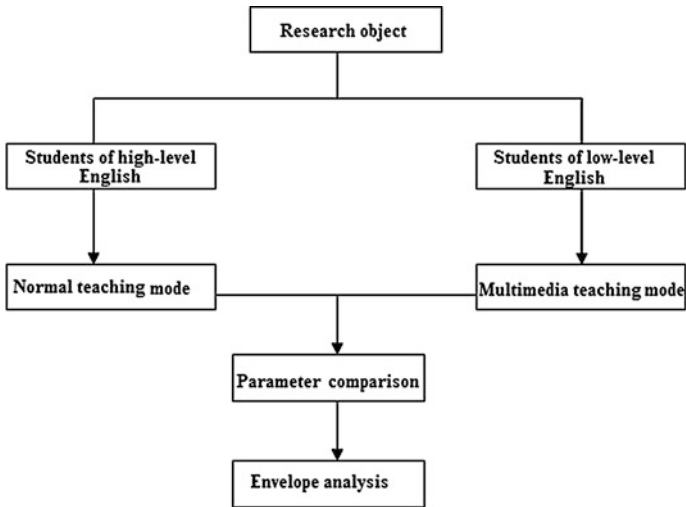


Fig. 91.1 The system structure model of multimedia teaching

(1) The model assumptions

According to our research object we can divide students into the English level of high and low English proficiency students. These two types of students have separate teaching, high English proficiency level of students are using the normal mode of teaching, low English proficiency students are using multimedia teaching course system. After a period of time their performance will have a data envelopment system analysis. Its structure model is shown in Fig. 91.1.

(2) Model introduction

There are three critical aspects of its teaching activities in the English multimedia tutorial system, namely, language input, language output, language memory; they are also known as three-dimensional circulation models. Language learning in three dimensions can be transformed into each other and restrict each other, in order to achieve the transformation - constraints - conversion - in the constraint process. The model is shown in Fig. 91.2.

### 91.3 The Establishment of Multimedia Teaching

We used data envelopment analysis to establish the model of the multimedia tutorial system. Data envelopment analysis is a new method of system analysis and mainly based on indicators input and indicator output analysis of the effectiveness evaluation.



**Table 91.1** The input, output index of all classes

DMUj		Class1	Class2	Class3	Class4	Class5
Input index	Xj	3.77	3.62	3.59	3.40	3.79
Output index	Y1j	3.79	3.72	3.75	3.45	3.64
	Y2j	3.85	3.78	3.65	3.56	3.78
	Y3j	3.95	3.72	3.55	3.64	3.57

**Table 91.2** Evaluation results

DMUj	Class1	Class2	Class3	Class4	Class5
$\theta_j^*$	1	1	0.974	1	0.932
$S_1^{-*}$	0	0	0	0	0
$S_1^{+*}$	0	0	0	0	0.005
$S_2^{+*}$	0	0	0.130	0	0
$S_3^{+*}$	0	0	0.375	0	0.330

tutorial system for teaching and research. After a half semester we can count student achievement. Its form is shown in Table 91.1.

After taking envelopment analysis to evaluate test data obtained, we get evaluation results as shown in Table 91.2 .

From the evaluation results, we can see  $\theta_j^*$ 's value of class one, class two, class four is  $\theta_j^* = 1$ , and  $s_1^{-*}, s_1^{+*}, s_2^{+*}, \dots, s_m^{+*} = 0$ , so the evaluation results are effective. English teaching through multimedia teaching system makes students' achievement increase significantly.

### 91.5 The Cultivation of Linguistic Ability

- (1) Emotions play an important role in the process of primary and secondary school students to understand things.

Cheerful and relaxed environment of learning is conducive to stimulating them to express their own desires. The teacher can encourage the students to enter the atmosphere of English learning through singing of English songs before the start of the program . In addition the teacher in class should be in Chinese with English, give a person a kind of cool feeling, which can help to stimulate students to have the fun of imitating and learning [6, 7]. Elementary and middle school students' ability of thinking in images is stronger, but the abstract thinking ability is weak, therefore in the teaching process to create visual learning effects is often better. Teachers can use actual objects or images to give students an intuitive understanding of the English-speaking environment, conducive to the memory of the students' knowledge and bridge the gap between students with learning English. We can also use the PPT production of courseware, presented to the vivid screen

and accompanied by music, to give students an immersive perception atmosphere of context. In addition we will layout the design the contents of learned English, carry out the performance of English melodrama, and strive to give everyone the opportunity to participate, so that students get a taste of the fun of learning English. Restricted as well as in the physical scene, the teacher can take advantage of the visual aids to help students clearly understand the content of the picture, stick figure, cartoon, and allow students to participate in painting, painting the color and other teaching activities. Students' emotions will be high all of a sudden, the classroom atmosphere will become active, and the memory of the word is no longer monotonous, the effect of teaching will be improved significantly. The use of multimedia technology to create a language environment for English language teaching is essential in the process of teaching; English teachers must be the language of instruction in English for flexible use, to create a favorable atmosphere for language. Extensive use of Chinese will have "dumb English" in the classroom, students also have high scores but low capacity. In order to have a breakthrough of "speak off", first we must cultivate the students' English listening, when teacher is in the English-medium instruction, the students create some simple English communication opportunities, combined with TRP teaching methods, training of students ability to hear.

- (2) The creation of scenarios, the ground to stimulate the desire of the students' performance.

The game play can effectively mobilize the students' interest in learning, in this way the content of the classroom is to review and consolidate, practice the knowledge of the student, and help students get a sense of accomplishment by the assessment of the game, thereby enabling students to improve confidence and motivation to learn. Through the game we can have assessment of student, resolve the students' psychological pressure, then the consciousness of everyone to participate in competition will be greatly enhanced, more active thinking, language learning will be faster. After the students' "desire" aroused, alleviate the psychological burden, and this is conducive to help the students' language expression in play. In the teaching process, teachers can allow students to perform various roles to fully mobilize the classroom atmosphere, conscious participation in the role of image, and emotional design so that the students had enough drama addiction knowledge of English of the classroom learning gains, while also improving the overall quality of students. English teaching for all students instigated the active participation of everyone in scene performance and that every student should be given the opportunity to participate. The seating arrangement in the classroom teaching should be appropriate to transform, so that it will help improve the teaching effect. For example, by the Subclass seat, division, take the form of the round table; we were sitting together, which helps the group face to face communication. The teacher set a scene, the panel may conduct its own role arrangements and carry out oral communication, this help some quiet, introverted child to improve their participation in the positive manner.

- (3) Extra-curricular expansion, fall in love with the exchange, develop students' communicative competence.

English-medium primary goal is to train students to use English communication ability. Only the classroom teaching is difficult to meet the requirements of the students' English language training, curricular learning is only the basic knowledge of grammar to the vast majority of students. The cultural quality of primary and higher secondary , the teacher can give students the job of English conversation with parents, and understand that the job is completed through the parents. Like low-grade age students, who are more afraid of "opening", So parents and teachers should pass with the way to praise the children, erase the pressure in their hearts. They should stimulate children's interest in learning English so that they can slowly develop the habit of expression in English. The parents whose English is not good can give their children layout recitation of homework, parents should listen carefully and make praise or make in recognition of gestures after the children recite [8]. Never say words that hurt children's self-esteem but influence them to learn positive. We can meet foreigners at more occasions in places such as shopping malls, parks, KFC, McDonald's, we want to encourage the children to take the initiative to strike up a conversation, the real exchange with foreigners. Just try, even if the other party is to understand an English of their own or understand the word of the foreigners, it will make the child to significantly increase in the guts of English, and their desire will be greatly enhanced, this inspires the students to communicate with foreigners in English and exchange interest by constantly chatting with the foreigner will make them learn English more confident.

- (4) Learn the combination of proactive and fully develop the students' comprehensive language competence.

Education is presented: Knowledge must be obtained by the student through practical exercises. This can guide his behavior, and the knowledge obtained from practice will be more profound cognition. So in English teaching we must pay attention to set up the practical situation and let students participate. For example, after the family member learning, we can organize students build their family tree, the English name, age, occupation, hobbies, and other fill. We can also learn to date, solar term in English made cards and calendars, the daily weather conditions in English records, do a weather collection book. Also we can collect some English stories learning, for example: Father's day, Christmas and other sources, in these activities and continuously improve their English culture. Through this experience, students' master the knowledge is relatively strong; students' learning initiative and enthusiasm will be greatly raised. The French educator brother Storey said: "education is a kind of ability is not transmitted, and is to inspire, awaken and encourage the teaching art". Absorption of his philosophy of education, English education is in the process of teaching, the mood and atmosphere will let the student in a happy way, and be full of the spirit of initiative in English learning.

We can enjoy every happy in learning English, also let the learned the English language knowledge applied to real life.

## 91.6 Conclusion

In the years of English teaching, the author deeply feels that the cultivation of students' language ability is not a thing that could be easily carried out, which includes the comprehensive training of English knowledge. In the training process, all the acquired knowledge reservation and the collected content are finally prepared to be used. Therefore, in the English teaching of primary and middle school, teachers should establish the concept of quality education, cultivate students' innovation spirit, and practice ability of using language. At the same time, we can not only develop the students' potential from the view of integrity, equality, but also provide students with a platform to show themselves, to constantly stimulate students' interest in learning, in order to improve English learning initiative of the students and promote students' practical English communication level, in further, to gradually improve the students' English quality.

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# Chapter 92

## Research on Application Model of Multimedia Database Based on Computer Network Technology

Boran He

**Abstract** With the advancement and rapid development of computer and network information technology, the application of multimedia database is more and more widely used, and multimedia database is widely used in academic circles, educational circles, and management to overcome the limitation of the traditional database and shortage situation and realize the effective application of multimedia database. This paper combine today's high-tech computer network technology, analyze, and study the basics and design of multimedia database. Thereby building a multimedia database application model makes it more convenient, fast, achieve rich content, various multimedia database, improve efficiency, at the same time to enhance the atmosphere of entertainment and relaxing, realize the efficient application.

**Keywords** Computer · Network technology · Multimedia database · Application model

### 92.1 Introduction

In modern society, computer information and network technology has been rapidly developed, and also makes the multimedia technology upgrade, realize the wide application of multimedia database [1]. Of course, the traditional database is based only on data storage and other functions, but at the present stage, multimedia database is a collection of text, pictures, video and audio, not only has large

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storage space, and the forms is diversified to achieve better results of visual and auditory. \Multimedia database can integrate different kinds of series of media and has unification supervision, integrate, process and apply the complex multimedia and maximize its advantage [2]. But at this stage, the application of network technology under the background of multimedia application is becoming more and more popular, but the progress and development of multimedia database technology supported these multimedia operation application system is relatively slow, and the traditional system at this stage also is directed specifically to the specific use and development. Therefore, the text is the research of application model of multimedia database based on computer network technology, so that people can guide the application for multimedia database, having practical significance [3].

At present, a large number of image information is the precondition of trades, like the e-commerce website and shopping mall site. In order to find a specific image, image database engines and webpage search engines are usually used. However, the retrieval ability of the engines is quite limited, especially on the web site [4]. With the rapid development of the Internet technology, the number of Internet users and the amount of the Internet multimedia information is growing. An intelligent network image retrieval system is proposed in the paper. The system architecture, the texture, and the color image classification and the retrieval technology is proposed based on the user usage model, and through the provision of the keywords, select one or more sample texture pattern, The keywords are the color values which designated by the position of the color, or are based on the factors in a combination of some keywords or combined all.

Based on the multimedia information technology, an intelligent network image retrieval system is built in the paper. Many image retrieval systems, such as safety, photo albums, can only dependent on keywords search and some support for contents search [5]. In the image retrieval based on content, they support the image retrieval based on the image features information, such as the average color, the histogram, the texture, and the shape of objects. However, most of them build up based on the application of the developed image databases.

## **92.2 The Foundation and Design of Multimedia Database**

Multimedia database can achieve the efficient and organic combination of network technology, the multimedia information processing technology and database technology undertook a variety of key technology and application. Because the multimedia database can involve the design of multiple angles and aspects, so we should fully integrate the characteristics of multimedia database, but also solve the problems of system architecture, data storage, information retrieval and database application of database system, and the solutions for these problems each other has data model structure [6].

### ***92.2.1 The Characteristics of Multimedia Database***

All of the most basic elements of the database is data, as for multimedia database is also the same, but relative to other database, multimedia database has a series of characteristics of the big data in store, a variety of data types, and the type of difference, complex data input and output. Compared with the present technology advances, the application of network information technology makes multimedia database more complicated, many are divided into two types of static and dynamic, static is a general text, data, character, image, and dynamic will contain video, audio, and animation effects.

In the data characters, simple is convenient to management; in the text, because of the use of specific semantic string to reflect the text data, so it is mainly the way of using text or keyword retrieval; in the graphics, image data, primarily using a decomposition method conduct hierarchical structure description for reasonable and effective data model, for the image with professional equipment extract, recognize and search the information of color, texture properties, in order to supervise and search view; in the audio, video data, it mainly take spatial and temporal characteristics on account to effective operation, efficient processing for the situation, methods and content, realize visual and auditory effective unity [7].

### ***92.2.2 The Hierarchy Structure Multimedia Database Design***

Multimedia database polymerizes a variety of techniques, so its design structure remains to be further improved and perfected, the text use the literature of multimedia database, The hierarchy structure multimedia database design is shown as in Fig. 92.1 below [8].

The striation concludes the following aspects [9]:

- (1) Physical storage layer it is a way of storing mainly the document, image, video, and audio to multimedia database, because the characteristics of multimedia database decide the store and read mode.
- (2) Data description layer as it is the core of multimedia database. It not only has the data model, data storage index, and temporal model simulation, mainly elaborate and interprets the original data information, data processing to achieve the function of rapid read and access.
- (3) Network layer It is based on the communication network technology, embodies the specific physical location of multimedia user. The multimedia information can be carried out different system storage, at the same time realize data access in communication network.

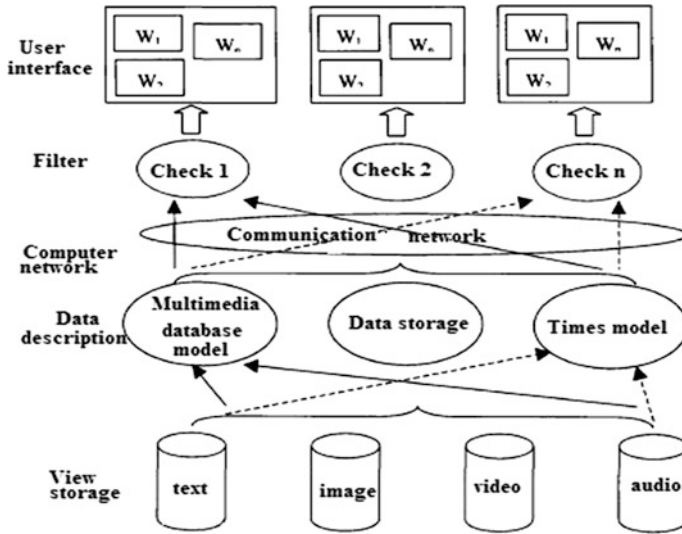


Fig. 92.1 The hierarchy structure of multimedia database design

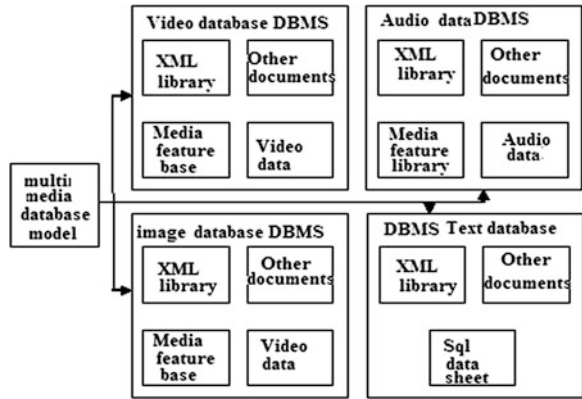
- (4) Filter layer. It has the function of realizing database query. Multimedia objects can take various types for query, which is mainly based on multimedia database view under the background of filter function.
- (5) User layer this realizes the application butt joint of user and multimedia database and realizes man-machine interactive function.

### 92.3 The Construction of Multimedia Database Model

Multimedia database is mainly based on the XML, thereby achieve the function of integration of database resources, sharing and mutual operation, and Web constructed and based on this also has the very strong practical benefits and value[10]. The paper is the model of multimedia database based on the XML technology to construct, the core technology facing in the multimedia database model construction process and how to realize the effect methods has fully research and analysis, which can be shown in Fig. 92.2.

Due to a variety of types of information data, the XML usually is flexible and simple, but it also need a concrete analysis for concrete problems. Database XML library based on the text, video, audio, and image is used for other management documents and the unified management of media feature library (except for the text database). Database application program accessing from the Web server will send to the Web browser through the HTTP (Hypertext Transfer Protocol) way, at the same time as the way of HTML to display, the user needs to send search in the

**Fig. 92.2** The diagram of multimedia database model



way of HTML form and other requests to a web server, and then the professional section in the server establish communication applications, users are convenient to search and query the database, then edit the HTML page, thereby realizing the effective allocation and regulation of multimedia database resource.

## 92.4 The Establishment of Multimedia Database Model in Computer Network Technology

By using MS SDL Servers software to install, and then the way of management menu graphical through the direct use of SDL En-97sterprise build multimedia database, documents, tables, and other database contained objects. At the same time, it can also use the tool command window to complete the work of data writing. After building multimedia data table, start the next task, the multimedia data will be stored in the database.

The access of experiment and time data by SDL Server is a set of specific procedure function, specific procedure function is as follows[11]:

- (1) The database table format: image and text (ptr-text) function is: because it is 16 bits binary, so return text and image pointer value,
- (2) Reading format: read [owner] column table-name. Image/text ptr-offset Lize read [owner] in text. The program features is: read the numerical value between the image and text columns.
- (3) Writing format: write [owner] column table-name image/text ptr-value in text. The program functions are: input between the number of image and text columns.

The application program for multimedia client connect the multimedia database through USB interface, the application of function complete the tasks of multimedia data access. As a kind of data application development tools for the study - VB, the

operation of using database tool is relatively simple and can be used as a good data development tools. At the same time, applying a common database call function in the process of using VB tool, namely Executes-SDL and Open-Database into calling function finish the task for connecting the data source.

When implement program statement of multimedia data at work, the key sentences of multimedia database operation is: Sets: SDL DB = Open Databases; If DNS = NTSFV; Database = mainly = sa; PRD = False”) connect to ODBC data source While NOT = EOF; read the image and document multimedia, and converting it into program code of multimedia text; Chara = hexs \$ (Asd(Input)) IdgSyr = IsgStr&Switchs (char = 1/2) SDLsyr = ”declares @ vall valvarbinary (17)” SDLsyr = sdlstrs &”selects @ vall = textptr (image call) from duomeitid” SDLsyr = sdlstrs &”where names = ‘ligiang’ SDLsyr = sdlstrs & “ write texts duo meitid.image coll @vall 0x”ImgStrt = SDL DB. Executes.

The algorithm will store multimedia teaching information in a multimedia database, finish the task of model establishment of multimedia database.

## 92.5 Conclusion

The application and the emergence of multimedia technology not only realize the expansion of the computer application category and field, but also promote the progress of computer network technique. But network technology in the current makes the construction of multimedia database have certain constraints, so the analysis and study of multimedia database application model in the background of computer network technology is conducive to further clarify the development direction of multimedia database and problems to be solved, unified storage search and management for the unformatted data information can develop the database model to appear personally to multiple users, which can be used to improve multimedia database technology, and have more technical content, but also develop database system of higher quality, higher levels, which is convenient for object to use,, reduce the waste of resources, achieve the most users to use multimedia database resources, fully achieve the sharing of resources and effective configuration, make resource utilization value maximum.

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# Chapter 93

## Study on Newspaper Group New Media Strategy

Xiaobin Ding

**Abstract** Recently, the new media constant emergency power newspaper form “double divided-flow”, together with the problems in the operation strategy, the industry overall recession has become a fact of life. With 2005 inflection point, in the home, the traditional newspapers began to witness large-scale “landslide” high-speed growth for the 20 years after; And in foreign countries, Brooks’s situation is not optimistic. Much famous newspaper, the New York Times and the San Francisco pioneer had to reduce our staff in a large profits arising as a result of shrinkage. Can think newspaper industry is facing a profound operational crisisbut how to deal with the crisis into a safe and get long-term development is a major theme of the newspaper industry.

**Keywords** Newspaper group · New media strategy · Digital times

### 93.1 From “News Paper” to “Multi-media”: To Realize the Transcendence of Development Orientation of Newspaper Industry

As known to all, the traditional newspaper industry adhere to the “disseminator-oriented” mode, generally speaking, the workers collect and edit news and provide the information service for readers through the wide of the actual carrier “newspaper”. Therefore, it is characteristic of the “single media are the only paper media; drab news text only two text is character and picture” [1]. This unilateral

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linear transmission only provides the reader what in the newspaper to meet you communicate and readers of receiving information requirements at any time anywhere; therefore, it features some delays and drab. Especially today, the rapid development of information technology on the shortcomings in the traditional newspaper industry has become more evident in the heat of the influence of the new media, the Internet, and mobile phone and make it suffer from history "winter" in advance, therefore, the whole newspaper industry needs a desolate appearance. First of all, in the circulation, global press association survey data provide that from 1995 to 2003, in the United States, the newspaper circulation of the rate of 5 % down, and in Europe and Japan is 3, 2 %, respectively. According to statistics, in the 1960s, in the average of every five American, four people read the newspaper; And now only half of the population retains the habit of reading newspapers, "readers have suffered great loss. In China, the data plan issued by the national bureau of statistics and financial according to the general administration of press and publication in 2005, said a total of 220 newspaper, the average number of printing of 2,74,54,900 pieces, a decrease in a 4.62 % interest rate, and the total printing number is 5504, the rate of 4.41 % decline [2]. Among them, the first ten newspapers in China began to appear in the first half of the 2005 negative, August this year in southern China sports daily and ball." stop circulation continuous if cycle decreases at this rate, it can be predicted in the near future, the traditional "newspaper" will disappear completely from the planet. Second, advertising revenue, the newspaper industry at home, and abroad have witnessed the weak economic growth, even fell sharply [3]. For example, the biggest newspaper chain gannet saw profits down three two consecutive quarters of 2005, among them, the third quarter profit decline rate is 4.3 %; The dow Jones company experienced net profit fell 54 %, the first quarter of 97 % in the second quarter compared respectively, the same cycle in the past several years. In two different advertising revenue source for the Wall Street journal, advertising revenue fell by 19 %, and financial advertising revenues shrank nearly 20 % [4]. By 2007, the American newspaper advertising revenues fell to lowest record. The environment is of the global recession newspaper advertising market, China newspaper ads also. Flat meet "cold current", in 2005, the growth rate fell 22.9 % in the same period than advertising a few years ago, and in 2007, the newspaper of the advertising revenue in China has suffered the industry actual low growth of more than 1 %, apparently in low ebb. In contrast, pessimistic traditional newspaper industry development, new media is emerging powerful. As an example to the Internet, "until February 2008, most of the Chinese Internet users (Internet citizens) has more than 221 million as the world's first, the number of the blog has exceeded 57 million years through, and online AD revenue growth has witnessed the 40 % [5]. "the fact vigilance newspaper operators emerging the impact of the media, keep the traditional" news newspaper "stubbornly can't adapt to the information the demand of readers, it is necessary to base on" readership-oriented "information transmission concept to absorb new technology has lofty goals, keep open thought in" multimedia "to promote beyond the traditional" newspaper "digital" multimedia. So, the authors believe that it is wise to reform two aspects: first, strengthen

the integration of media industry crisis. The newspaper is fierce competition all kinds of media and the division of the readers and advertising media clients. Paper the advent of the information age, the future of the newspaper industry determined to develop a response of change, make great efforts to realize the media mode and the interaction with a traditional media and new media and reasonable use of new media operator, because mobile phones, website, QQ, MSN and electronic mail, and other information in response to the spread of newspaper readership, and strengthen the different interaction and contact readers and therefore to build digital network and opened the paper operation mode with the media and the Internet, paper in multimedia video and audio media forms. Practice proves, by the use of the new technology, change report, provide more style background information and analysis and exploration in-depths report, the newspaper industry is not just broke the destruction of the prophecy, but also more and more and more development [6]. Second, to innovate the content of our newspaper. Content is the guarantee of our life newspaper the core competitiveness of the lies. Therefore, in the new era, the newspapers should make full use of it interview right and to the original news release unique and professional interview and editorial team for effective choice, processing and large information first task. At the same time, it is necessary to emphasize innovation of expression and space design news content, for example, the U.S. newspaper industry, in order to improve readability in the newspaper, Narrows the page through the half an inch of newspaper, the more pictures and form the stock market information and reduce the six to two pages and positive direct readers know the stock market the online version of the newspaper or mobile version. This practice not only reduces the cost, but also with the media and the network media paper more unique function, and will not be simple repetition. Therefore, only when the transition and outstanding direction from the traditional “news files” modern “multimedia” is the successful implementation, and different media integrated fully to form a whole newspaper industry operation link, can become the newspaper report real-time 24 h a day and efficiency newspaper advertising is to promote sustainable development of the maximization of the newspaper industry.

### **93.2 From “Newspaper Men” to “Business Men”: Facilitating the Transcendence of Newspaper Industry Talent Outlook**

Marxism believes that the theme of human society, only live in productivity and elements of the economic development of the basic driving force. The same, human resources should also be the theme of the newspaper industry and the essential force of newspaper industry development. Therefore, in order to realize the transformation from “traditional” to “modern” the newspaper industry, will adhere to the “people-oriented” concept and remedy the old man to prospect and

talent strategy realize switch from “journalist” to “business man”. Today, despite the newspaper at home and abroad being universally established offices respecting talented persons and prospects, the core of competition consciousness and the key lies in the newspaper industry talent. From the long-term practice of various major newspapers, the current talents prospects and talent strategy are without bold reform in response to new media technology, and still stay in accord with traditional newspaper development level that is, paying attention to the training and appointing human talents and male newspaper reporters and editors is closely related to the management of the traditional printing media. It neglects the selection and training of multimedia technology talent, operation, and management personnel and other comprehensive talent and therefore, cannot establish talent prospects that accommodate large emerging media mode [7]. In this case newspaper industry that lack of “business man” who knows how to arrange news page and how to manage the media and operation, know advertising and investment, and as a result, the paper is difficult to deal with the new media the impact of the media, is hard to adapt to the operation of the cross media and eventually made paper face the challenge of media crisis, facing the fate of destruction. In order to change above losses and adapt to conversion and beyond as soon as possible “digital newspaper industry” orientation combines “multimedia newspapers, periodicals, web and mobile phone”, the whole newspaper industry should establish new talent standard, achieve new talent prospects, adopting new talent strategy, fully present professionalism traditional newspapers and display the time the effectiveness of the new media, and promote the development of the newspaper industry environment, to achieve “keep pace to keep pace with The Times, the development, the innovation” the professionals in choice and planting. First, as major newspaper industry operators, in addition to know the news and know how to operate, it is more important to the deep understanding of the business operation [8]. A good combat talent newspaper industry should, on one hand, know “how to” port, broad vision, good legal market, and the development of the theory of the newspaper industry, host objective of the operation principle and policy advertising and the circulation, equipped with advanced management idea newspaper industry, can macro-development to provide guidance and making the front direction goal; On the other hand, should know “how to be a human being,” has a wide range of tolerance and arms to get along well with others, cogrow and rivals, learning the strengths of the others, to offset a person’s weaknesses, cultivate a constant, stay calm heart attitudes toward one another. The author thinks that the newspaper industry operators and the property requirements must be able to follow the principle of “people oriented get business success and honest and loyal action”, the great emphasis in each link of the media, so as to promote the role of transition from the newspaper chain reporter and editor of enterprise operators and as a newspaper industry “businessman” and “true knowledge”. Second, as the general practitioner of the newspaper industry, including reporters, editors and advertisers, etc., under the condition of market readers pay more and more attention to the depth of the report, it is necessary to highlight the characteristics and personality of the newspaper, therefore, in addition to good language

expression and writing ability, they must have a high degree of news sensitivity capture news fact careful, deep mining news value and have a certain command of foreign language, the computer operation and discipline knowledge law, Chinese literature, sociology, advertising and philosophy, and so on, especially on the economic management knowledge better judgment news or advertising can meet the demand of the market to provide and readership, no matter whether they can cope with the market exactly and whether they can bring the rich profit. Just like “businessman” plan can win the competition. Generally, in the development of the newspaper industry’s new era, must solve the problem of the “stress interview and editing, and ignore the operation” in the long term, therefore, we request practitioners should be “professional” professional, and “global talent” has a wide range of learning and knowledge, for example, in order to adapt to the orientation and beyond the newspaper industry transition for “operation media, multimedia,” Columbia University school of journalism, university, in the course of cultivation reporter, a multimedia competent reporters should be able to work different media newspapers, the Internet, television and radio station, and enjoy a variety of skills as driving some local language and talk, etc. [9]. In addition, communication ability, to plan the ability and the innovation ability will become very important ability and quality requirements of the general practitioner newspaper industry’s new era.

### **93.3 From “Newspaper Industry Group” to “Corporate Group”: Pursuing Transcendence of Newspaper Industry Operational Strategy**

To solve the problems in the development of the prospect of direction and talented person, the development of the newspaper still faces a dilemma in the new period of self-supporting. Overlap tiny-profit trend brings the homogeneous fierce competition and drab profitability mode and the influence of new media has increased the whole newspaper industrial crisis. Therefore, it is necessary to fulfill the newspaper industry transition “group” to “enterprise group”. In theory, the newspaper group, as a modern newspaper the main form of media operation organization, have apparent commercial properties consistent enterprise group. Either the newspaper industry organization or enterprise group is an organization to create value through some of the mode of cooperation and the core operation of the group can promote their profit come true. Based on the above two of the common, the author thinks that, from “the newspaper industry transition group” to “enterprise group” can not only promote the successful experience for reference before the latter, but also bring more development space before, so that Banks hope newspaper industry Mired in crisis. First of all, in the key period of reform and development of the newspaper industry, to promote the overall upgrade and the development of science, it is necessary to “realize the transformation of single

newspaper office transmission vector enterprise as soon as, newspapers office is no longer a simple units of publishing, printing, issue the newspaper, but a transmission vector enterprise cover multiple and joint media products" [10]. this change operation strategy not only conforms to the development of the orientation of "multimedia" digital and prospect of preferred operation management talent newspaper industry in this new era, but also can avoid the content repetition, wasting resources, brought about by the competing tradition newspaper industry, and to reduce internal friction of the newspaper industry in the field of circulation battle no matter the results, in addition, facilitate forging personal each big newspaper industry organization quality. Here, the author holds that the key to speed up the business strategy is to change the concepts and ideas transition enterprise management, and try to establish enterprise system and governance structure to improve the efficiency of the whole newspaper industry. Second, the newspaper industry group also should be actively will follow the market operation enterprise organization model, change a single profit model, development industrial diversification and the pursuit of economic interests to the biggest reasonable. In socialist market economy, at the same time, most of the economic foundation, the newspaper industry group will pursue the economic gains as the company group, that is, to create "income", to solve the "running" and the operation of the right. Now, the company profit source of the whole newspaper industry group is single, the most pure advertising revenue, part of the media by industry vulnerable to fluctuations. Statistics show that some of the main newspapers or media in China excessive rely on a single industry advertising real estate rate was over 30 %, and some even from 50 % to. In this method, only when the advertising market grows tired, the newspaper industry will be natural "involved" face the risk. Performance of steep declines like Jiangsu media and social media is the best illustrations. Therefore, in the future, the newspaper industry group should target to "create income" and behavior? The advantages of selection is based on, at the same time, promote the media industry economy, seek new economic growth point to develop industrial foreign news agency advertising company, conferences, and cultural. Exposition Company Transmission Company based on abundant information and social relationship to achieve diversity and stable profit source and formed a good development the whole newspaper industry status. Finally, it is important to note that the newspaper industry group has some political significance to adhere to correct the orientation of public opinion, consider its operating purposes, not blindly follow market economy and therefore, they are different from ordinary enterprise group. Therefore, the transformation in the process, must grasp the essence of "enterprise group", prevent the wrong doctrinarism, avoid blind imitation, avoid deflection, and trapped in mud pond.

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# Chapter 94

## Research on Traditional Newspaper Multimedia Fusion in the Digital Age

Xiao Bin Ding

**Abstract** In the digital age, the network and other digital media brought a lot of benefits and convenience to people's media life, but also may lead to the risk of social unrest in individual, group, and that level. Therefore, the ideal traditional newspaper should highlight the function of the social integration process, news product production, in order to rebuild integrated community. And the production and the impact on society of the integration function of the news product will be shown in two aspects: provide as choice news to share common experiences, said through the agenda set the mainstream values, and guide public opinion.

**Keywords** Digital age · Traditional newspaper · Multimedia fusion

### 94.1 Introduction

Since the late 1990s of last century, the Internet rapidly spread around the world as a whirlwind. The relationship of displacement and competition between the traditional media and digital media, the survival and development of traditional media, and the innovation of the traditional media's products, especially news products, in the digital age have been widely discussed by many scholars [1].

The theory of the gratification-utility niche gives a more in-depth analysis and hypothesis of the displacement and competition among different types of media. One assumption of the theory of the niche is "time displacement"; it predicts that a new medium will compete with established media for audiences' satisfaction or

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time, because the time budget of audiences is limited. But there is the second assumption of “functional displacement”, that is the competition occurred among the media which meet the same demands (have the same functions), and the media meet the different needs with non-reciprocal functions that have the complementary relations [1].

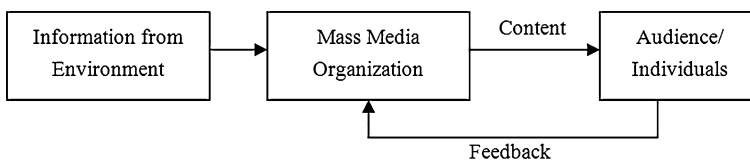
## 94.2 Risk of Social Disruption in the Digital Age

Today, as the most representative of the media in the digital age, the Internet has completely changed the traditional media information communication model and the modern human behavior and social life of the media to its unique digital features. Because of the characteristics of the Internet in the exchange of information such as two-way, timeliness, interactive, across-time, and across-space, so we often used the digital media positive evaluation, and neglected the negative effect of the modern society also causes these characteristics.

In individual level, the emergence of the Internet and other digital media have enhanced initiative choice function, the function is based on the interaction of the Internet properties. Based on this, we can even consider the Internet as a complete personal media, for the individual can transcend the limited information resources of traditional media and get rid of the old information communication mode, and people can choose and create their own interest and useful information from the subjective and positive. (See Figs. 94.1, 94.2).

From this price level started, the exchange of information, the Internet to respect individual socialist, there are some common experience or between individuals’ consciousness. Therefore, with the development of the Internet, the society will show more features of different, personal, and heterogeneous, integrated community can fall gradually.

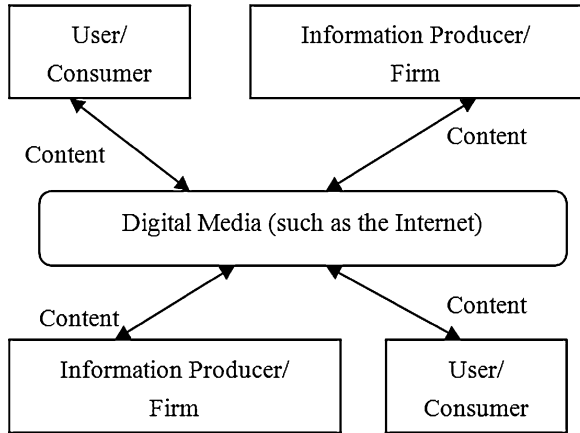
In the group level, digital technology can make communication realized in time and space, make the individual geographical restrictions and no longer subject to personal relationships bound in real life, but form various groups through the exchange symbols according to the individual’s wishes and preferences. But the Internet features, such as integration, anonymity, fragile social existence, and free access to the group polarization phenomenon more apparent in the discussion of the virtual organization, some data show that in the virtual social group polarization two more than in real life [1].



**Fig. 94.1** Information communication model of traditional media



**Fig. 94.2** Information communication model of the Internet



Mulberry Stan thinks, the development of the Internet brings huge growth option, this is a simple way to filter and a greater power to custom, so people may be more likely to find like-minded people or more inclined to choose point of view, they agreed to. Mulberry Stan and Wexler made a research in more than 60 political web sites in the United States in June of 2000 found that Internet users tend to circle in the discussion of like-minded people; they provide few links opposing views. (see Table 94.1) when a selected group of uniform point of view, rather than accept the heterogeneous view, mulberry Stan think, can appear “group polarization” phenomenon, that is, people may move to a more extreme o ‘clock the members first inclined.

This phenomenon of “group polarization” also confirmed in the study and by Martin lee and Russell a spear.

And “group polarization” will become an important incentive social conflict and social segregation. Mulberry Stan discussion, group polarization has undoubtedly happen on the Internet. “Obviously, Internet service, too many people, as a breeding extremism, and it is for like-minded people think about the more relaxed and in frequency, and often with a anther didn’t hear opposition point of view. Repeated exposure to extreme views, a hint, and many people think that position, can see those exposed, and move May tendency, to believe in it. One of

**Table 94.1** Links to allies and adversaries

Political orientation	Links to opposition	No links to opposition	Links to like-minded sites	No links to like-minded sites	Total number of sites
Republican	3	7	7	3	10
Democrats	1	11	7	5	12
Conservative	1	20	12	9	21
Liberal	4	13	9	8	17
Total	9	51	35	25	60

**Table 94.2** The situation of the Internet applications of rural users

Type	Application	Urban utilization rate (%)	Rural utilization rate (%)	Urban-rural gap
Business transactions	Internet stocks	16.9	8.5	-8.4
Business transactions	Online banking	27.7	15.2	-12.5
Business transactions	Online payment	27.7	15.1	-12.6
Business transactions	Travel booking	9.4	3.3	-6.1
Communication	BBS	32.9	23.3	-9.6
Network entertainment	Online Games	68.6	69.9	1.3
Communication	Blog application	58.4	55.5	-2.9
Business transactions	Online shopping	31.7	17.6	-14.1
Information acquisition	Search engine	75.9	66.5	-9.4
Information acquisition	Network news	82.8	72.4	-10.3
Information acquisition	Online music	83.8	82.7	-1
Communication	E-mail	61.0	44.6	-16.4
Communication	Instant messaging	71.9	88.2	-3.7
Network entertainment	Network video	64.5	57.3	-7.2
Communication	Social networking sites	47.9	41.0	-6.9
Network entertainment	Internet literature	47.7	41.2	-1.6

the results may be a high degree of debris, because different people, not the original point of view and maybe not so distant, finally in very different places, just because they are reading and watching [2]. Another the consequences could be a highly mistakes and confusion.”

In a more at this level, the phenomenon of the “digital divide” has become more obvious contact with the development of the Internet. There have been many studies that also reflects society level, social economic status of the inequality can also be copied in digital form, through the network can ascend. In addition, in many researchers agree, “digital divide”, it is a problem of the different levels of access or the use of digital technology on the surface, but in fact, it reflects the not equal opportunity in different populations in the digital age, and different levels of function to obtain knowledge and master the innovative thinking in individuals and groups in the Internet economy society [3].

Table 94.2 In the case of internet use the gap between the urban and rural users, we can achieve a more realistic understanding of the “digital divide” phenomenon

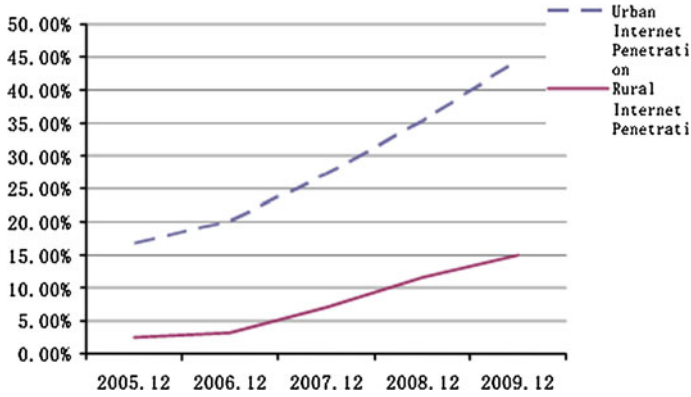


Fig. 94.3 Comparison of urban and rural Internet penetration

in china through the explanation “country internet development report” [4]. The “digital divide”, not only in the widening gap between rich and poor performance internet penetration rate in urban and rural areas (see Fig. 94.3), and there is a clear difference also show a between urban and rural areas in the Internet user application, especially in information retrieval and trading, network communication, city rate is much higher than in rural areas (See Table 94.2).

In the digital age, and the difference between the Internet users, the different use of parts have become a new dimension of social stratification, it has an overwhelming the influence of traditional social structure. Therefore, the “digital divide”, not only is a technical problem, has become a social problem. As a technology tools, the Internet has brought not equal to use information due to the geographical location, class, education, and other social differences, cause not equal distribution of resources in the real social interaction and lead to more divided [5].

Therefore, the technique characteristics of its inherent network and other digital media make personalized use to society as its division and the potential consequences. Especially in social transformation period, social stratification and social collapse largely triggered the Internet will lead to “worse” trends affect the transformation of social structure [6].

### 94.3 Integration Function Development of New Products

The characteristics of the Internet open, free, the interaction, the huge, traditional media cannot compete. But representative digital media, the Internet may lead to social chaos of the risk [7]. It enables us to think about, is it possible to reduce risk through the functional development of traditional media news provides products,

and provide a new development road of the traditional media challenge facing the digital media.

Usually, we conclude that the function of the traditional media to social supervision, interpretation, connecting rod, transmission of the values, and entertainment. But in the digital age, in response to the Internet brings social chaos, the ideal traditional media should highlight its social integration function besides above function and reconstruct integrated community in order to achieve a new social integration when they offer a new product [8].

Therefore to provide selected news is a very important traditional media means to realize their integrated function, adhesive in the digital age. The selected news is the news, people does not want to touch the initiative or had not thought of that. To provide such information we can make personal journey from their own narrow interests and hobbies, and no longer stay in imitating what the choice and create through filter information, but should be in with different levels of social information, promote individual socialization process [9].

On the other hand, news and information covers different areas to provide individual or group belong to different classes can be embedded in a common experience in different classes and groups, this common experience can make different groups in diverse society common background of communication, and maintain their different perception of society, it is important and necessary to strengthen social cohesion [10].

It also increases the demand in quality control of traditional media. According to the theory of man is a famous scholar of the communication Levine, in the traditional process of mass communication, information must be filtering and test the doorman sent to the audience and janitor people before they have great influence on all aspects of the collection of the production process, the information and the reporter, editor, and so on. Newspapers and other traditional media form information environment and influence the focus of attention, and then affect people's consciousness of environment through the door to maintain content. Therefore, the most important thing in providing the same experience is reporter and editor of conformity ability and judgment information. They should choose content can best reflect the region's core culture, national and state from massive and complex information, and to establish the common social cognitive between individuals [11].

An important way of traditional media guide the public is set agenda. Agenda setting describe public opinion formation, how it role in society. It can be said that, in a sense, the media agenda set agenda that open process, at this level, the mass media may have great influence on the people who want (audience agenda). It supports the agenda set of the assumptions that may play a huge role in guiding consensus [12].

But the agenda set affects not only the agenda in the media but can attract attention to certain facts or opinion (in the influence of cognitive level), also do not expel that may affect the personal attitudes, and behaviors. In 1993, the money of the agenda-setting theory, Macbeth and Shaw announced that tell us we should not only be media thinking, but can also tell us how to think, he called it the second

stage of the agenda set. In 2005, Mr. McCain is writing an article to look forward to the future of the agenda-setting theory research, and predicted the influence of the transfer from the cognitive agenda setting to attitude and behavior. Therefore, the media agenda may also influence personal attitudes or behavior [13].

So, as an important tool of public opinion guide, the traditional media can make group hold different opinions that have dialog in their contact and reading the news of the traditional media provide products, and then they can in some agenda reach a consensus. More important, the product can be integrated into the mainstream news media values agenda, and use the media agenda to influence the audience to form the individual agenda integration value under the guide of the mainstream values, in order to maintain the integrity of the society.

## 94.4 Conclusion

In the end of this paper, it needs to be confirmed, although this paper writing is a key point of view, there is no doubt of the value and the future of the digital technology. In fact, although digital technology will not bring optimistic optimists intended effect on the society, it is not a pessimist who think depressed. Therefore, we should realize digital technology revolution which may influence social and alarm attitude, we can own the thinking and make full use of the characteristics and the new digital the benefits of technology, so really see the future of the traditional media and digital media.

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# Chapter 95

## Study of the Unique Beauty of Product Forms

Jisheng Chen

**Abstract** Beauty exists in the minds of people at any time; different people have different esthetic standards. Therefore, with the purpose of realizing the esthetic pursuit of different people and getting a good control on the direction of product form design, it is necessary to fully research the creation of the unique beauty of product forms. Studying on the differences of esthetic subjects, grasping the characteristics of esthetic subjects and realizing the creation of the creation of the unique beauty of product form design are the main contents that are discussed by the author in this paper.

**Keywords** Unique beauty · Form · Difference · Subjects

### 95.1 Introduction

Along with the rapid development of society and the great progress of science and technology, product design has proven to be an indispensable part of the people's social life with each passing day. In the meantime, the social value and economic value of product design have become increasingly more obvious. The focal point of product design is to discover the potential functional demands of people, help solve the technical problems of practical functions, but simultaneously create the cultural value of products and meet the needs of users physiologically and psychologically [1].

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## 95.2 The Esthetic Demands of Different People

The esthetic demands of different people have common characteristics and their own characteristics. In general, the people from different countries and regions are different in the esthetic demands; the people of different ages and genders are also greatly different in the esthetic demands. For these reasons, it is necessary for product designers to attach high importance to the common characteristics and unique characteristics of the esthetic demands of different people [2].

Besides, the pursuits of people in beauty have laws to follow, and also are influenced by many factors.

Today, the society is diverse: there are different young and old people, and different men and women; different people can be classified into the poor and the rich according to their economic foundations. In addition, there are also different cultures, different nationalities, and different customs and so on. The differences of esthetic subjects play a direct role in the esthetic orientation.

There are a certain number of laws in beauty. However, to master the creation of beauty, it is also necessary to give consideration to the personal esthetic orientations of the esthetic subjects, meet the esthetic requirements of individual groups, and make a full study on the esthetic psychologies of different groups. All these are the important bases for the creation of the beauty in products. In fact, the esthetic demands of people with different genders, different ages, and different hobbies have their own characteristics.

For example, children own the esthetic demands on lovely things, bright colors, and cartoon images. For this reason, to make a design on the products of children, it is necessary for product designers to give consideration to the characteristics of children and hence help realize the esthetic demands. The products, which are designed only in such a way, can be loved by children [3] (Fig. 95.1).

**Fig. 95.1** Decorative coat and hat hooks for children





**Fig. 95.2** Mobile phone for women



In the design of the decorative coat and hat hooks (see the above image) of children, a full consideration is given to the gender demands of different children. That is, children can make a choice on the decorative coat and hat hooks according to their genders. The design makes the lovely and lively features and children's simplicity highlighted, and therefore meets the psychological characteristics of children. Generally speaking, children are always happy and simple in psychology, and this directly decides that the esthetic demands of children are oriented at happiness, liveliness, and freedom from care. The style of the above decorative coat and hat hooks intuitively gives a reflection to the psychological feeling and exaggerated happy expression of children. For this reason, children can be attracted by it immediately, and subsequently their desire of owning it will be increased so as to meet their happy feeling psychologically. In the meantime, this will also make the parents of children generate a feeling of owing it [4, 5].

For example, the differences, which are produced from different genders, will also make the esthetic demands of men and women greatly different. In product design, it is also necessary to give a full consideration to the different esthetic demands of men and women, respectively. Usually, women like small, exquisite, soft, delicate, and colorful visual feelings; men like modest, generous, and fashionable visual feeling (Fig. 95.2).

The appearance of the above mobile phone looks delicate and smart, and is mainly decorated with pink and also designed with curve patterns. This design keeps consistent with the beautiful appearance of the mobile phone, and also gives a vivid reflection to the characteristics of women (Fig. 95.3).

The above mobile phone is specially designed for men. It has a large size and looks heavy, generous, and rich in men's masculinity. In general, men yearn for moderateness and powerful masculine in their inner world. Therefore, the design

**Fig. 95.3** Mobile phone for men



of this mobile phone meets the esthetic demands of men, and also gives a full expression to the beauty in men (Fig. 95.4).

This mobile phone is designed very simply in appearance, and can be used easily. It has a small size and is very light. Therefore, it is very convenient to carry it anytime and anywhere. The elder can carry it with ease. In the meantime, the fonts on buttons are big, meeting the visual experience of the elder in clearly identifying them. As for the elder, the first demand is the clearness visually. Therefore, the beauty can be produced only if things can be clearly seen by the elder, because the fuzzy visual sense will make the elder painful greatly. However, the black body and white buttons of this mobile phone can generate a difference strongly in visual sense. Therefore, the elder can make a clear identification and also do the correct operations, and this will make them enjoy the communication by relying on a mobile phone happily and thus feel satisfactory and happy in the inner world.

**Fig. 95.4** Mobile phone for elder





Fig. 95.5 Dodge car

Fig. 95.6 Audi car



The living environments of people from different countries and regions are different and so are their esthetic orientations. Environment plays a certain role in the esthetic demands of people.

In the modern time, the spread of information technology is really fast, and therefore the results of some material civilizations can become the common wealth of human beings rapidly. However, the dividing line among the industrial products which are under the guidance of science and technology lies in design under the same technological conditions (this is possible).

The industrial products in the developed countries have their own characteristics. Therefore, the national spirits and characters contained in these products can give a vivid reflection to the cultural traditions of their countries [6] (Fig. 95.5).

For example, the body structure of the above “Dodge” car designed in the United States is oriented at spaciousness and comfort. Therefore, the car looks very grand. In the meantime, the high-power engine, low chassis, and high speed device reveal the richness and generousness of Americans and the attitude of Americans in pursuing an enjoyment of life and high-quality life. Besides, the design of this car keeps a consistent with the image that the United States own a vast territory, smooth and flat roads, and rich and generous life. Therefore, it is in line with the esthetic pursuits of Americans (Fig. 95.6).

**Fig. 95.7** The FIT car of Honda brand



The rationality, simplicity, conciseness, and integral style of the “Audi” car of Germany in design give a vivid reflection to the characteristics (attaching high importance to rationality, actual effect, and intellectual enquiries) of the Nordic. In appearance, the streamline design makes the multiple edges and corners eliminated, thus producing a very calm sense. However, the big car body also suggests its characteristics such as richness, generousness, and combination of inflexibility and yielding. In the meantime, the inside decoration is very luxury but soft in colors. Therefore, it looks delicate but does not lose moderateness, reaching high quality both inside and outside. The skillful design from multiple aspects makes the grade of the car increased, thus meeting the esthetic psychologies of many people and winning more users. As a result, the popularity of the car can be increased without a stop, and the automobile manufacturing standards of Germany are displayed all over the world (Fig. 95.7).

The exquisite and pragmatic characters of Japanese nation are reflected in the cost-effective, energy conservation, novelty, and smart design styles of cars. For example, the FIT car of Honda brand is more light and smarter than general cars in design, and realizes the highly-efficient energy conservation and high quality and inexpensive effects when the cost of manufacturing is reduced. In the exterior design, its liveliness is vividly reflected in the head lights or logo, which can give a good expression to the harmonious consistency of beautifulness, smartness, and exquisiteness. In the interior design, the width is kept moderately, pursuing no “big” but attaching high importance to the “fine” and “practical” effects. This gives a good explanation to the moderation thought that is a unique characteristic of the eastern world. Therefore, the careful idea and reasonable design lay a solid foundation for Japanese cars to survive in the world.

Regional environment also plays an influence on the esthetic psychologies of people. In the vast countryside of China, the life pace of people is slow, and the living environment is very quiet. Therefore, the vision of people is very broad generally, making them like bright colors. This is because that the living environment in rural areas is very gloomy and monotonous in color and also the luminous beams are insufficient at night. In the Spring Festival or major festivals, in order to increase the happy expression or atmosphere for the festival, bright and exaggerated colors will be primarily selected. The colorful scene will bring about a

**Fig. 95.8** The big-flower pattered cloth



**Fig. 95.9** The bedding supplies



bright and happy feeling for people visually. This is closer to the inner happy feeling of people and harmonious with happy expression or atmosphere, meeting the esthetic demands of people living in the rural areas. On the contrary, in China's cities, the life pace of people is very fast, and people often show a busy expression on face and are very noisy in the minds. Therefore, these people need to pursue quiet, easy, and comfortable environment and generate an esthetic demand on pursuing elegance, freshness, and quietness, and then choose the simple and concise colors for making up the feeling in their inner world.

There is a distinct contrast between the esthetic orientations of people in rural and urban areas, and this can be reflected from the important influences of living environments of different regions on the esthetic orientations of people (Fig. 95.8).

For example, the big-flower pattered cloth that is popular in China's rural areas is shown above. It is a specific expression to the rural people's enjoyment of life (Fig. 95.9).

In cities, the pure, fresh, and simple furniture meets the esthetic psychological demands of people. Therefore, the bedding supplies give top priority to clean and elegant colors, which have to the lighter colors, patterns, or dark flower in the same type of colors. The design and colors are very simple and gentle. In general, the simple, generous, and solemn visual experience can attract the people with the rapid life place in the urban areas, to allow them to be away from the busy life and seek a peaceful and serene esthetic psychological demand. The plain and neat bedding supplies design mirrors the whole room like a harbor, bringing people a comfortable, free, relaxed and free feeling, and reflecting people in urban areas to yearn for a sweet home. The design of this type of bedding supplies gives a full expression to the feeling of urban people in yearning for a home through the skillful collocation of light and elegant colors. Therefore, it is natural for this type of bedding supplies to be loved and pursued by the people in urban areas.

### 95.3 Conclusions

The design of product forms can become valuable only if it can meet the esthetic psychological demands of consumers. Therefore, in the design of product forms, it is necessary to give full consideration to the differences of consumers, but not to make any subjective judgment. In the meantime, it is necessary for the design to be based on full market research and investigations, and also have a clear target. Based on a target, the creation of the unique beauty of product forms and cultural quality of the design of product forms can be realized. Thus, the esthetic psychological demands of consumers can be satisfied, and the social value and market value of product design can be realized.

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# Chapter 96

## Study on Visual Arts Method Based on Music Rules

Yi Lu

**Abstract** In art and visual perception, grace, ham said, “design form will never be mechanical copy perception of the material, but a creative explain reality, and beautiful pictures have already explained is rich imagination, create and accuracy”. In the conversion of the art of design into visual music, it is necessary to focus on the new dynamic audio technology, expression and the way of forming the element, and new esthetic idea for the audience in the actual application.

**Keywords** Visual art · Music · Design form

### 96.1 Introduction

In a broad sense, the music is generally defined as a series of organization and the voice of the silence, including rhythm, melody and harmony, different scales. As a language exchange of information, visual arts use 2d and 3d sculpture and dynamic visual art film and television works of art image reflected. Music can let our hearing and visual art feeling sounds although main visual feast in pictures and we color. Since ancient times, artists and designers made many efforts for the transformation between them. This paper aims to analyze the music and the common features of visual art and trying to promote application rules of visual art employed by converted into music.

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## 96.2 A Statistical Dynamical Principle for the Evolution of Information System

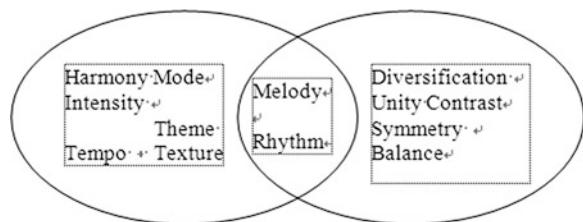
There is a close relationship between, the visual and auditory senses. It is said that the melody line outline of music is by the brush in different pitch time, this is a good metaphor of the relationship between the abstract melody line of music and concrete and vivid visual art line. Because “audio-visual” exists extensively, a bridge is established between art visual and auditory; therefore, visual stimulation can usually provide us with a similar feeling to enjoy music. Abstract form, such as sound, light, and color may directly reflect the twinkle of the audio-visual experience and internal feelings, as a result, more and better compatibility and the combination is found in music and visual art through the abstract and expressive art trend.

### 96.2.1 Music and Rules of Beautiful Form

In the creation of beauty, people are familiar gradually and master the characteristics of all kinds of formal elements, and the general abstract patterns of experience to the rules of the beautiful form. If we think that music is a kind of abstract art, and then create visual art under the rules of the beautiful form will enjoy music about the same infections. Music can regularly move up and down in the proper proportion, create a dynamic image rich rhythm. The beautiful music is human emotional language.

Music basically includes rhythm, melody, harmony, strength, mode, theme, texture, one of the most basic element yes rhythms and melodies, occurred just to rule the formal beauty. The so-called rhythm was originally known as the change and repeat frequency and intensity of sounds of music, and in the construction design of the terms of the time means that movement of strong form a continuous repetition of the same visual elements. Melody is also called the tune, representing the horizontal organization conventional high and low voice in particular rhythm. When reflected in visual arts, this means that the arithmetic and geometric lined the image or color and regular changes in order to create the melody of music and poetry which is full of vitality and charm (Fig. 96.1).

**Fig. 96.1** Music and rules of beautiful form





### 96.2.2 Music and Colors

American musicians Malio once said, “The voice sound color, and the color is visible voice”. Different colors can cause different feelings, so can sound.

From a physical point of view, they both sound and color is a wave, but different characteristics and frequency. In the 1500 s, Newton found that frequency between the first and the second overtone (two 8 degrees) is 1:2, the proportion between the minimum and maximum is about the optical frequency. He claimed that the seven note scale may be completely matched and seven color spectrum. Therefore, Newton demo use theory of physics, color and music has the same basis.

From the aspects of human emotion, bright color generally called the high definition, and deep color of the lower resolution. We know, high and low words usually used to describe sounds, but as long as we use their color there must be certain of letters and similar colors and voice, for example, green represents happy and happy song, red and yellow is warm and interesting melody, blue means sad and lonely sighed, black reflects the silent protest. The relationship between color and sound comes from the reality of life and art. Because these association and appreciation of music during created, we can create a more vivid and brilliant artistic appeal, get more extensive support point and theoretical basis of visual art expression (Table 96.1).

### 96.2.3 Audio-Visual Synesthesia

Germany hairdresser and Derek fisher said: “human perception is not independent, but a different branch of, so in a way they can change another one. Once an organ stimulation, another can be used as a memory, harmony, or the symbolism of the invisible, such as resonance”. Any sense organs stimulation can lead to other sensory system response. In psychology, the accidental feeling also is called “common sense” or “synesthesia”. In the art of “common sense” of the most active is the auditory and visual sense, this between is often called “audio-visual synesthesia”. According to science, our audio-visual feeling is the most effective memory. The application’s “audio-visual synesthesia” the design is to use the sensory system of visual, hearing, and psychological association explains to

**Table 96.1** Research of memory and sense

Items of research	Human sense		
	Visual (%)	Auditory (%)	Audio-visual
Absorption rate of information	83	11	/
Concentration degree	81.7	54.6	/
Memory retention	20	10	68 %

transmit information from different aspects. In this way, the information can be fully realizing the psychological resonance, and ultimately to ensure that information can arrive at the destination fast, accurate, and timely [1].

## 96.3 Design Methods of the Visualization of Music

Visual music is actually a kind of application of synesthesia, divided by some researchers divided into three categories according to different formation method level of synesthesia: feel transfer (single synesthesia), feel stack (multiple synesthesia), and sensory mutual communication (psychological synesthesia) [2, 3]. but, in the conversion of the music and visual art, the department will be reflected in the final form, for example, two and shy; Space design and film and television work, this is the result of a transformation. As for the process and the method, the author is tend to put them into directly related to the conversion, the official related conversion and emotional about conversion, demonstrates the use of cases, as noted below [4, 5].

### 96.3.1 *Direct Relevance*

Direct correlation is refers to convert the voice of direct object. In this case the four different object discussed the first three attached to a voice equipment, through the music will be direct power, make visual movement of the object. These activities will be recorded used for the following design of posters and multimedia resources, can present to the audience a voice video form, to offer them the opportunity to experience and to witness the program design [6].

Element 1: water. Change decibels, scale, and frequency of the music, have a series of conventional linear change in waves [7, 8]. Funny pictures and disturbances to produce a variety of diffractions are perfect to reflect the strong linear rules and repeated rhythm of the music. This simple physical interpretation can be used to extract elements (Figs. 96.2, 96.3).

Element 2: Small pieces of paper. On the stage voice small pieces of inanimate paper get their mood, in deep into the background music, they now express their instant feel the most natural physical condition. Light the movement of objects is irregular; this is a good emotional reaction to music and can be used to extract the key elements.

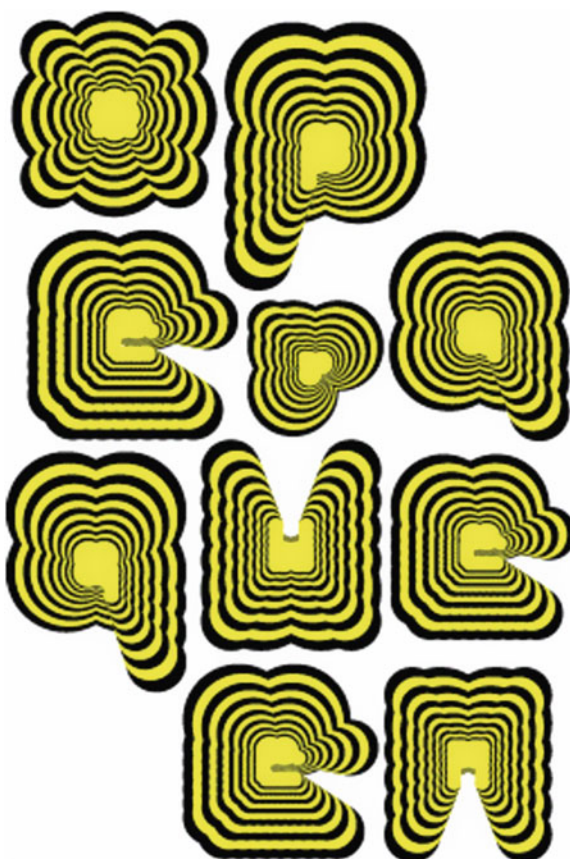
Element 3: Small stones. This show is completely different elements 2, because the scale of the stone of the rules of the sport, this is clearly proved the rhythm of the music and visualization can be used to extract can track point elements.

Element 4: mouth. Singing is a kind of important method for human explains music, and its visual also is the most direct. Therefore, the movement of the lips can make us feel more vivid visual art and is used to extract the surface elements.

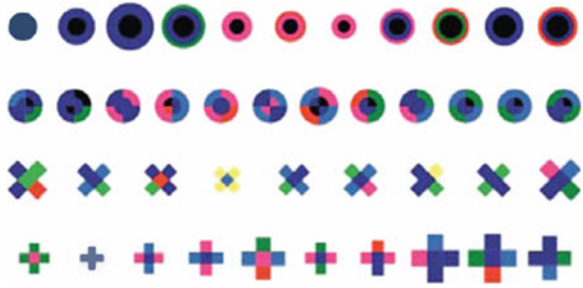
**Fig. 96.2** Extract the line element from water



**Fig. 96.3** Extract the line element from water



**Fig. 96.4** Symbols to represent the brand



### 96.3.2 Formal Relevance

In formal correlation, this is basically the rules of formal beauty of rhythm and melody, both in the play the leading role conversion. This design as an example, in order to guide the audience's active role exploration and explain the contents of the convey the image, according to different music features designers also adopted different symbol for a responsibility of the band members (guitarist, and drummer, bassist and singer) (Fig. 96.4), then use them organization different combinations, to the formation of a new movement. These images to explain according to the band's sound of, represents a series of changes based on rhythm, melody, strength (Fig. 96.5).

Each symbol has different meanings and different assembly sequence, the variation of the tone and exciting performance tone. According to the schedule of vertical, the symbols are in space arrangement, and form a new pattern of actions. Composition method is based on the appearance of the moment in a music instruments and place the corresponding image. In this way, the original music will vividly demonstrate in a different visual form [9, 10].

In the image, the formation of the combination methods, like displacement, stack and restructuring are used to create a new model of the image. Produce strong unstable, irregular images in the exciting good dynamic movement in camera, orderly combined methods shall be broken. In addition, image representation methods of multimedia files in a CD, such as shadow, fuzzy screen, and together with the exaggerated the representation method, image is more similar life and movies. Therefore, the audience will feel of artistic conception music more directly, and experience more emotional and understand better band.

### 96.3.3 Emotional Relevance

Emotional correlation mainly refers to the acceptance of an audience and resonance of the transformation of the music and visual art, and this is reflected in the formation of the atmospheric visual art, including a literal expression, light application, setting, and so on. With the rapid development of technology, the

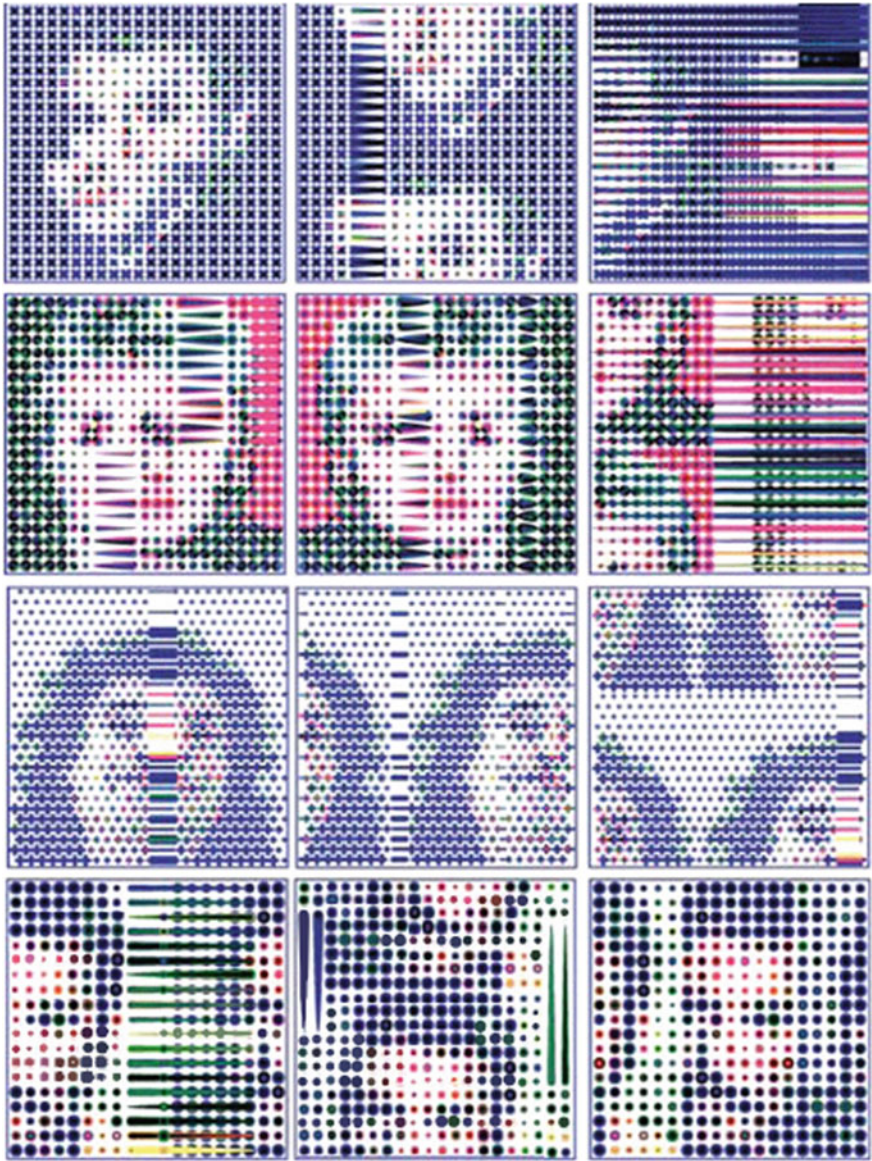


Fig. 96.5 Organize the symbols to a series of graphics

change trend and change the requirement of design consumers, sensory stimulation on a physical level can no longer represent the emotional appeal. In order to let the public accept, any works even products must have human emotional resonance. In this design “if music is a string of.....” Is a derivative of the scene design theme,

reflecting, when you are in the music and gradually relaxed, hidden feelings will fully spread to the end?

Synesthesia design can mobilize the interaction of sensory awareness and make each design much more diverse and interesting. At the same time, “synesthesia” in deep level can use stimulation of the senses of the integration of the mobilization feel better emotional, therefore, to fully realize the function of emotion design and led the audience psychological republic.

The application of the method is different characteristics, but complements each other. Direct relationship is two different feeling the link between is visible; Formal correlation is by rhythm and melody; Emotional connection with the combination of emotional and objects. The three methods are mutual infiltration and interaction, but have different visibility and strength.

## 96.4 Conclusions

With the development of technology, the visibility wants more and more, it is the new mode. When the visual and auditory effect can achieve harmonious and unified artistic influence visual art design, it is absolutely, humanity will have a beautiful enjoyment.

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# Chapter 97

## Police Wrestling Skills Teaching Based on Multimedia Feedback Method

Lin Yang

**Abstract** Multimedia feedback teaching method is concluded from the teaching practises according to the principles of “information theory, system theory and control theory”. It plays a very important role in the improvement of the teaching effect of police wrestling skills. In this paper, the experimental study of the multimedia feedback teaching method on the teaching of police wrestling skills is analyzed, and the result shows that the teaching method plays a positive promotion role in training the wrestling skills and adaptability of policemen, exerting the principal effect of policemen, and increasing the teaching effect of wrestling skills.

**Keywords** Multimedia feedback teaching method · Police wrestling skills · Multimedia technology

### 97.1 Introduction

Feedback refers to the information produced in actions or after actions. It is usually called as the feedback produced by action. Also, it can be further divided into inherent feedback and augmented feedback. Inherent feedback is the exerciser’s feeling provided by the kinesthetic sensor of muscle in an action, or the direct observation on his own behavioral results. Augmented feedback is the feedback information provided by teachers, coaches, or some kinds of automatic record devices for the exerciser [1].

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At present, the class hours for the teaching of the technical courses about police wrestling skills are being reduced. Therefore, how do teachers complete the teaching task meeting the quality and quantity requirements in few hours? Relying on the modern teaching media for assisting the teaching process, synchronous feedback, short-term feedback, and staged feedback can play a positive role in making an enhancement to the perceptual knowledge of students, extending the teaching time, helping cultivate the principal role of students, and improving the teaching effect of wrestling skills [2].

## **97.2 Purpose and Objects of Experimental Study**

### ***97.2.1 Purpose of Experimental Study***

Multimedia, as a new teaching model, is being accepted by more and more educational workers [3]. It is a new type of teaching method, which integrates images, texts, sounds, and videos together, makes the teaching and learning activities more colorful, facilitates the students master the skills and techniques, and promotes the teaching of teachers to be easier. In the process, students can intuitively see the teacher's demonstrative actions and their own actions. In multimedia feedback teaching method, the central nervous theory and the feedback principle of the loop neural connection are used for allowing vision to constantly monitor the activities of reflection and also making the reflection of somatic actions constantly coordinated in both time and space. Thus, the standardized skills and techniques can be mastered within the shortest time, and the teaching task can be completed.

Through watching the discs or videos about the police wrestling, students can get a complete and correct understanding of the wrestling actions and techniques. Then, they can find out the differences after watching the videos about their own wrestling actions. Thus, a good teaching effect can be achieved.

### ***97.2.2 The Significance of the Experiment***

Wrestling is a technical sport item. In teaching, the technical actions in the demonstrations of the teacher may not be clearly seen by students. Also, students can not make a comment on whether their actions are correct or not after exercises. However, this shortcoming can be overcome with the application of the multimedia feedback teaching method. In the process of playing videos or discs, the speed can be slower or faster according to the actual needs of students. Thus, the actions of students can be clearly seen and commented and then can be improved, promoting students to learn wrestling actions more quickly and efficiently.



### ***97.2.3 Study Objects***

In this study, the equivalent group experimental method was applied. In Zhejiang Police Vocational Academy, 48 male students were randomly selected and divided into experiment group (24 students) and control group (24 students). The daily results of students in wrestling course were used as fundamental results.

### ***97.2.4 Study Method***

In this study, the experimental teaching model was applied. By using teaching method as control variable, which was exerted on experimental group the original teaching method was still used in control group and no influence was exerted.

## **97.3 Construction of the Multimedia Information Feedback Teaching Experiment**

### ***97.3.1 Synchronous Feedbacks at Class***

The techniques and actions of students were shot with a digital camera and was also shown to students for synchronizing feedbacks. The standards for the techniques and actions of students were presented comparatively to students so as to make an enhancement to the perceptual knowledge of students and promote them to learn actions more quickly.

### ***97.3.2 Short-Term Feedbacks Before (After) Class***

Before and after class, multimedia courseware (CAI courseware) was played for students, so as to deepen the students' understanding of the correct action concept and to implement short-term feedbacks among students. This helps students establish the perceptual knowledge of students in techniques and actions.

### ***97.3.3 Staged Feedbacks After Class***

In spare time, network teaching can be conducted by relying on school network platform and the uploaded classroom teaching FTP files, and teachers can provide answers and explanations to the questions of students by using message board and online BBS. Students can review and consolidate what they have learnt at any point, so as to strengthen the formation of the concept of actions.

### ***97.3.4 Experimental Condition Control***

The wrestling course of both experiment group and control group was taught by the same teacher. Before experiment, the indexes such as physical shapes, sport physical quality, and daily examination results of the students of two groups were tested, and the result shows that there were no significant differences between experiment group and control group in all indexes. In the experimental process, in addition to the multimedia teaching equipment of experiment group, all other conditions such as teaching contents, teaching progress, and class hours of the two groups were consistent.

### ***97.3.5 Experimental Model***

In practice, teaching of the wrestling skills, the experimental teaching was implemented with the multimedia information feedback teaching method in experiment group; the teaching for control group was still conducted with the conventional teaching method; the teaching contents were the same in both groups. The results of the skills evaluation standard exam were rated and measured by three teachers at the end of the teaching. Meanwhile, mathematical statistics were conducted on the rates of good and excellent exam results, aiming at verifying the effective and scientific degrees of the experiment.

## **97.4 Experimental Result and Analysis**

The class hours for teaching and training the experiment group and control group were same; they were taught by the same teacher; basic teaching plans were generally the same for two groups, except the additional special training contents for experiment group. Before the experiment, students in two groups were educated about the experimental significance, making them to know well about the significance of learning and correcting learning attitude. Summative target hitting and skills evaluation were implemented according to the unified standards; to prevent the prejudices of experimental teacher in evaluation, standardization and skills evaluation were made by nonexperimental teacher; the videos of the experiment group before and after the experiment were used as references for skills evaluation. Before and after the experiment, three teachers were respectively invited to make an evaluation on the wrestling techniques of the students of two groups according to the wrestling techniques evaluation standards, and simultaneously summative target hitting and skills evaluation were conducted. The standard technique evaluation include not only the actions' continuity, coordination, stability, accuracy, and effectiveness, but also the actions' strength, speed,

rhythm, sequence, flexibility, and other psychological performance qualities. These can be defined as the quality of the performance of the action. Action quality and performance quality were evaluated with a hundred-mark system, respectively.

**97.4.1 Analysis of Students’ Target-Hitting and Skills Evaluation Results**

Through techniques evaluation, it was found that there were large differences between two groups in the results of the wrestling techniques (see Table 97.1). After the statistical test on differences, in target hitting, results of differences between two groups is of high significant ( $P < 0.01$ ), indicating the teaching effect was notable; in skills evaluation, the results of differences between two groups were also significant ( $P < 0.05$ ). Therefore, the data in Table 97.1 shows that the differences between two groups in target-hitting and skills evaluation results were significant.

**97.4.2 Multimedia Feedback Teaching Method Helpful for Improving the Police Wrestling Skills**

To reflect the training effect more accurately, the physical qualities and main physical shapes of students of two groups were tested before and after the experiment; the changes in physical qualities and main physical shapes were used as an experimental irrelevant variables to be controlled. Test results shown in Table 97.2 suggest that there were differences between two groups in physical qualities and main physical shapes. However, through statistical test, it was found that the differences were not significant. Thus, the conditions of the students of two groups were basically the same, and the experiment was conducted under the same conditions.

**Table 97.1** Comparison on target-hitting and skills evaluation results of experiment group and control group

	Target-hitting result			Skills evaluation	
				Action quality	Performance quality
Experiment Group	92.3 ± 8.23	89.27 ± 6.12		73.70 ± 3.6	
Control Group	86.7 ± 7.39	81.22 ± 4.58		67.83 ± 5.74	
T value	2.04 <sup>b</sup>	1.86 <sup>a</sup>		1.79 <sup>a</sup>	

Note <sup>a</sup>  $p < 0.05$  means difference is significant; <sup>b</sup>  $p < 0.01$  means difference is highly significant

**Table 97.2** Comparison on physical qualities and main physical shapes of experiment group and control group before and after experiment

	Before experiment		After experiment	
	Control group	Experiment group	Control group	Experiment group
Height	1.70 ± 0.42	1.71 ± 0.48 <sup>a</sup>	1.71 ± 0.32	1.71 ± 0.19 <sup>a</sup>
Weight	73.12 ± 2.41	71.31 ± 2.31 <sup>a</sup>	71.59 ± 2.23	71.22 ± 1.26 <sup>a</sup>
Heart rhythm	56.31 ± 3.24	56.62 ± 4.24 <sup>a</sup>	55.97 ± 2.51	56.53 ± 3.35 <sup>a</sup>
100 m race	11.58 ± 0.43	12.07 ± 0.68 <sup>a</sup>	11.64 ± 0.36	11.53 ± 0.51 <sup>a</sup>
Jump height	2.56 ± 0.27	2.61 ± 0.15 <sup>a</sup>	2.69 ± 0.71	2.68 ± 0.19 <sup>a</sup>

Note <sup>a</sup>  $p > 0.05$  means difference is not significant

Accurate and effective feedback is the key to control the formation of techniques and skills. Table 97.2 also shows that multimedia information feedback teaching method can be more helpful than the conventional teaching method for improving the techniques and skills of students.

### ***97.4.3 Multimedia Feedback Teaching Method Helpful for Improving the Theory of Wrestling Skills***

The teaching of wrestling skills is not only the foundation for students' intelligence development and ability training, but also the foundation for learning sport techniques and skills. Therefore, an evaluation was made on the theoretical knowledge of students after the teaching experiment. The exam results of students of two groups after the experiment were significantly different, suggesting multimedia information feedback teaching method can be more helpful than the conventional teaching method for improving the theories of students.

### ***97.4.4 Multimedia Feedback Teaching Method Helpful for Improving the Creative Thinking Way of Students***

The way of creative thinking is a senior thinking form, but also can provide new and valuable results. After the teaching experiment, the creative thinking way of students was tested. The creative thinking way test results of students of two groups after the experiment were significantly different, suggesting multimedia information feedback teaching method can be more helpful than the conventional teaching method for improving the creative thinking way of students.

## **97.5 Conclusion and Suggestions**

### ***97.5.1 Conclusion***

The students in experiment group, could see their own actions through the multimedia feedback teaching method . They could find out their action defects, watch theirs excellent wrestling actions, and could imagine excellent wrestling actions and improve their mistaken actions in subsequent exercises. However, the students in control group could not see their own actions and could only imitate the actions of teacher, and also it was difficult for students to clearly see the demonstrations of teacher. Therefore, the technique actions were learnt slowly and also very laboriously by these students, .

The application of multimedia feedback teaching method in the teaching of the police wrestling skills can stimulate the students' interest in practice and arouse their enthusiasm in learning. Also, it helps students to increase practice time and training results, to learn the police wrestling skills, and to improve the ability in observing, analyzing, and solving problems. It is better for improving the creative thinking way of students, creating the harmony and cooperative classroom teaching atmosphere, helping students to learn on their own, and playing the leading role of the teacher. In addition, it helps teachers to control the teaching process reasonably and effectively control the teaching process.

### ***97.5.2 Suggestions***

First, it is necessary for teachers to carry out an effective control at classroom, skillfully collect information, timely feedback information, improve the teaching quality, and train the students' comprehensive ability according to the actual characteristics of students and teaching materials. Therefore, it is suggested that this teaching method can be promoted in the education of police academy.

Second, higher requirements are proposed in the multimedia information feedback teaching method on teachers. Therefore, it is suggested that teachers should make an improvement on their own quality without a stop. Specifically, it is necessary not only to learn basic professional knowledge, basic skills, teaching methods, and teaching means, but also to know the teaching ideas and teaching theories of relevant interdisciplinary, thus laying a theoretical foundation for the teaching.

Third, multimedia information feedback teaching method also has many requirements on equipments and facilities and school network platform. Therefore, it is suggested that police academy should make an enlargement in the investment for teaching facilities and the construction management of network platform, thus providing a guarantee for teaching reform.

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# Chapter 98

## Sports Teaching Model Analysis Based on Computer Technology

Haiying Quan

**Abstract** Computer-Aided Instruction (CAI) in computer-aided teaching and learning activities, dialogue with students to discuss course content, and arrangements for the teaching process, teaching and training methods, and techniques. The use of computer technology for teaching and research in physical education teaching process is to improve the efficiency of physical education teaching and improve students' enthusiasm for computer technology in college physical education, which is more open use of space.

**Keywords** Computer-aided instruction · Physical education teaching · Computer-aided teaching

### 98.1 A Computer-Aided Teaching Characteristics

Computer-assisted Instruction (CAI) is computer-aided teaching and learning activities, dialogue with students to discuss course content and arrangements for the teaching process, teaching and training methods, and techniques [1, 2]. CAI provides students with a good personal learning environment. Comprehensive application of multimedia, hypertext, artificial intelligence, network communication, and knowledge of computer technology has overcome the single way of the traditional teaching situation, with its one-sided shortcomings [3]. Its use can effectively shorten the learning time and improve teaching quality and efficiency to achieve the optimal teaching objectives.

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### ***98.1.1 Multimedia Computer-Assisted Instruction Can Accurately Reflect the Students' Learning***

In traditional physical education teaching methods, learning feedback comes mainly from the teacher and through the teacher to observe, analyze, and correct it. The information in this feedback process has varying degrees of distortion. In larger classes, the teacher's attention is easily distracted, everyone cannot be taken care of, and for students it is difficult to get timely feedback. The students do not realize the extent of their grasp, and cannot timely improve. Multimedia teaching students can retain the right action, correct wrong action, by videotaping the action teaching, students can know their own actions and the gap of the standard action viewing, coupled with the analysis of teaching, correct the error action to be timely improvements to enhance the learning effect.

### ***98.1.2 Multimedia Computer-Assisted Instruction has a Wealth of Expressive***

Computer-aided teaching in the classroom teaching process, for different teaching content, the integrated use of sound, image, video, animation and other multimedia tools to create situations, mobilize the enthusiasm of the students, to stimulate students' interest, it also be able to fully demonstrate teaching content, focused and Overcoming Difficulties, and guide students to actively explore, active learning. Some sports several consecutive actions are completed one-time and some action at the moment, alone teachers on demonstration difficult for students to understand and grasp. For example, when teaching students running, running is the technical complexity, the continuity of a strong cyclical movement, the second support period and the second during the Tang Li, relying on teachers to simply talk, cannot give the students the concept. Computer-aided teaching, not only for students to show a complete and correct action arm movements such as running, swinging legs folded before the pendulum action, but also on the stride frequency and stride length in running for a quantitative analysis to help, guide the students targeted exercises [4]. In addition, some projects such as gymnastics, back hop high jump, long jump, teachers cannot "frame" in slow motion to complete, while the use of computer-aided teaching according to the actual needs of teaching technical action decomposition teaching so that students fully understand the action structure and the whole process; matched by a strong stimulus to music, the senses of the students, enhance memory, master action essentials.



### ***98.1.3 Computer-Aided Instruction has a Large Capacity***

The Use of multimedia technology can increase classroom teaching capacity, open up the horizons of students and improve teaching efficiency. Such as how to enjoy the sports competitions, a lesson, teachers use multimedia technology to enable students to appreciate the game-related text, pictures or video clips, teachers guide the students in-depth which gradually mastered how to enjoy a sporting event; *basketball rules lesson*, teachers ask students using multimedia tools to see the rules text, pictures, and video clips to create the situation to enable students to understand the rules and some simple violations and fouls to make the right judgment, so as to promote students understand and master students learned knowledge.

### ***98.1.4 Computer-Aided Instruction has a Great Deal of Shared***

With the development of network technology, it is possible to have network class. Such as in the way of life and health and Sports Travel and other lessons, the teacher gives questions and provides some of the URLs, so that students browse the Internet, find answers, and train the students to analyze problems, and problem solving skills. Thus, CAI increased the capacity of classroom teaching, to improve the expressiveness and interactivity of the traditional instructional media, and improve the teaching effect. We have to draw on collective wisdom of the use of Computer-assisted Instruction in Physical Education Teaching to a higher level.

## **98.2 The Advantages of Computer-Aided Teaching**

### ***98.2.1 Application of Multimedia Technology Can Compensate for the Lack of Teachers' Demonstration***

Any educational activities are inseparable from the corresponding explanation; the same is true for the physical education teaching, and teachers' explanation and demonstration play a very important role. Students upgrade their level through the absorption of teachers' explanations. However, there are some sports in sports teaching demonstration is often a result of the movement speed too fast to allow students to dazzle. Slow speed will affect the rhythm and accuracy of the physical education teaching by example. For example, teachers in the Demonstrations in the high jump, long jump action essentials, you can let the students by watching some of the information and pictures so that they understand the correct technique of high level athletes, to understand the physiological principle of muscle structure and action, to make students understand the vacated process, the best movement of

each joint angle is, why such a campaign point of view is the best angle? Action of the entire movement, it plays what role? Sports pay more attention to posture and feeling, skills teaching when students understand the in and out of the entire action before they can consciously understand and appreciate the teacher's action to explain rather than simply imitate the postural sensory abilities that will improve skills class teaching quality that will be a qualitative breakthrough.

### ***98.2.2 Stimulate Students' Interest in Learning to Broaden Students' Horizons***

Use of computer multimedia, voice, text, and images in the physical education teaching process, the use of high information capacity multimedia technology, is a new classroom experience to students. Among students in the class, the teacher teaching of traditional sports as the core passive indoctrination situation, will be able to take full advantage of the information contained in multimedia technology, and thus consciously grasp the corresponding knowledge. So you can maximum arouse students' enthusiasm and initiative, so that students in the learning process can give full play to their imagination and creativity. Multimedia technology to grasp the latest information anytime, anywhere can take full advantage of the wealth of information to carry out teaching activities to expand students' knowledge which constantly enhance the overall quality of students.

The role of computer technology in sports teaching practice. The teaching of technology in sports teaching mainly rely on the demonstration and explanation of physical education teachers, physical education teachers in the process of transferring of skills, a strong desire to do every demonstration action. However, the demonstration of each action are done so accurately, perfect for each physical education teachers and are more difficult if it is able to use a computer to synthesize each action would be accurate and more, this is one; Second, the teachers on a technology, should also make standard demonstration to the students. And many of the technical action complexes structure are completed in an instant, the completion of the teacher is difficult to decompose, for the students it is difficult to understand the main points. Especially now that many colleges and universities Wushu class, martial arts of some very complex routines, teachers with the increasing age and physical decline and some action in place, so students learn and practice to focus only on routine and skilled while ignoring the rhythm and the location. In Physical Education, Teaching take full advantage of computer technology, after finishing those difficult action technology, made computer animation, compiled into a concise text repetitive, slow, static, and dynamic combination of demonstration, adding students will clearly understand the Exercises; Third, the multimedia-friendly human-computer interaction, enthusiasm and initiative to mobilize learning to stimulate students' interest in learning as well as tap the individual potential of special significance.

### **98.3 Computer Technologies in College Physical Education**

Application of Computer network is studied in Physical Education Teaching. Sport is a comprehensive science; it combines the natural sciences and social sciences as a whole. The rapid development of science and technology today, the sport of professional knowledge system is also rapid development and expansion, especially in high-tech knowledge in competitive sports can be described as the “gold behind the technology war”. Textbooks as one of the carrier of the traditional knowledge have been far from satisfying the technology requirements of the turnover of knowledge and rapid development of Athletic Level. Network can provide a huge database bringing together the advanced schools around the world, research institutes, libraries and other information resources, a variety of educational resources, including education network, electronic books, virtual libraries, virtual software libraries, news, and other groups. It can understand the various disciplines, including the latest research in sports and scientific fields; can participate in global research organization the subject of cooperation, understanding the dynamics and trends of the discipline; can browse through the network of information browsing services and e-mail sports news, major tournament information, access the database, and sports documentation centers, and this information convenient and quickly downloaded from the network storage, as a valuable information resource for teaching and research.

### **98.4 Construction of Interactive Teaching Model**

Traditional teaching methods are mainly based on explanation from teacher, demonstration-based, and students as passive recipients. In this mode, once the student fails to keep up with the pace of the teacher’s card on an issue, then the follow-up points would be difficult to understand thoroughly the passage of time the interest in learning will be greatly reduced, which eventually led to give up the entire course of learning. Building a harmonious teacher-student interactive teaching mode can effectively enhance the interest of the students to explore new knowledge. Teachers can make real-time grasp the mastery of students’ knowledge in a timely manner to change the ways and means of teaching, in order to achieve good teaching results. Students can more thoroughly master and apply the knowledge learned.

#### ***98.4.1 Targeted Teaching Methods***

Reasonable method of teaching basic computer teaching has very important significance. Before the start of the program, through effective survey interactive

approach to a preliminary understanding of students' basic computer knowledge to grasp the situation, the basis of students is divided into three different levels of teaching. The teaching of basic computer operations to the level of the middle-level students to explain on exercises, exercise the degree of difficulty should be moderate, and focus on the basis of weak students, one by one for individual counseling. Students with strong basic capabilities can be arranged for them more difficult to practice, and often arrange for them to do presentations, increase their enthusiasm to explore new knowledge. Levels of teaching can improve the overall learning initiative to improve the efficiency of teaching.

#### ***98.4.2 “Task-Driven-Based Teaching Methods***

Computer teaching process should focus on the use of “task-driven pedagogy. Life examples to stimulate students' desire for knowledge, knowledge points interspersed with the game, create a pleasant atmosphere of interactive learning, allow students to learn basic computer knowledge to a more relaxed state of mind, to eliminate the theoretical study of the boring to mobilize the enthusiasm of active hands, to improve students' skills.

#### ***98.4.3 The Use of Interactive Teaching***

Qualified computer courses using multimedia technology, interactive teaching, teaching efficiency is much higher than traditional classroom teaching. The use of multimedia classroom projectors as demonstration equipment, classrooms, and electronic classrooms for interactive teaching facilitates the electronic roll call; screen sharing, remote operation, student presentations, exercises distribution, and upload can be easily achieved in the teaching process.

### **98.5 Shared Sports Multimedia Teaching System Architecture**

“The teaching system is composed of a set of interrelated parts, in the framework, the various parts work together reliably and effectively, to arrange for the necessary learning activities to complete the learning objectives that can be divided into classroom teaching, radio courses, self-learning package, online teaching, laboratory teaching, seminars, computer courseware and remote conferencing systems, etc. The more popular network teaching system based on B/S (Browse Server) system institutions. Therefore, we propose a structural model based on B/S

structure of the online sports online collaborative learning systems and computer-aided learning system based on C/S structure of the Stadium model. In this system, the client connected to the Web server connected to the repository server through the Internet and collaborative learning, asynchronous communication, asynchronous collaborative learning; multimedia courseware through the stadium museum's touch-screen terminal for real-time multimedia collaborative learning and video playback and analysis of video camera equipment to record the students' movements form a collaborative learning environment. Collaborative learning model incorporates Web Services features and artificial intelligence reasoning techniques, an adaptive knowledge-based systems. It was divided into synchronous collaborative learning and asynchronous collaborative learning of two parts, it allows learners to any node on the network through a Web browser flexibility in the use of collaboration services, tools, synchronous discussion (touch-screen teaching system, chat system), or asynchronous discussions (virtual classroom, BBS, and e-mail), from the geographical impact and limitations.

## **98.6 Online Independent Collaborative Learning**

Online independent collaborative learning is independent learning through online and offline in the online learning system courseware to enable students to master the basics of the project, technical rules, and the referee method. The students are learning the subject, students in autonomous learning activities to learning, and mastering the movement of knowledge and skills to carry out classroom group collaborative learning, and on this basis of shared collective training achievements. Online self-learning, to apply the concept of psychological compensation and self-learning in the construction of the system, students experience the fun in their own learning, develop students' interest in learning and improve students' sports teaching strategies ability to learn, and develop the scientific use of the network of independent study habits lay the foundation for lifelong physical learning to step into jobs in the future.

## **98.7 The Research of the Problem of Using Multimedia**

Multimedia courseware in physical education teaching has many advantages, is different from traditional teaching methods, but we also address such problems in the use of multimedia courseware for teaching. To improve audio-visual quality of the teachers in the use of multimedia technology and deal with the relations of good multimedia combination of teaching and traditional teaching, the opportunity in multimedia applications is to be appropriated. In the use of multimedia technology, we cannot deliberate pursuit of efficiency, ignoring the main role of the student, cannot blindly pursue multimedia, one-sided pursuit of the "technical"

content cannot entirely replaced the experiment, writing on the blackboard and textbooks. Specific production sports multimedia courseware should pay attention to the following aspects: properly handle the problems of teaching methods. The emergence of multimedia has revolutionized teaching methods, but it does not mean that traditional teaching methods are outdated, traditional teaching methods when conducting multimedia teaching cannot be ignored. Proper handling of the relationship between effectiveness and esthetics. Dynamic multimedia technology allows students to generate interest in learning, but to pay attention to the production cannot be too fancy, or easy distracting, causing the distraction of students. Properly handle the relationship between theory and practice. Physical education, practice teaching in the teaching program, accounting for a very important proportion of theoretical instruction, it is used to guide the students to conduct scientific physical training.

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# Author Index

## A

Abliz, Dilnur, [515](#)  
An, Haijuan, [449](#), [639](#)  
An, Wen, [79](#)

## B

Bian, Jing, [3](#)  
Bo, Jianzhu, [633](#)

## C

Cai, An'ning, [597](#)  
Chen, Dihui, [683](#), [691](#)  
Chen, Guobin, [119](#)  
Chen, Huaying, [515](#)  
Chen, Jiayi, [525](#)  
Chen, Jisheng, [809](#)  
Chen, Jyh-Herng, [341](#)  
Chen, Liangliang, [153](#)  
Chen, Min, [683](#)  
Chen, Shengjian, [589](#)  
Chen, Xin, [127](#)  
Chen, Xinmei, [423](#)  
Chen, Yihui, [719](#)

## D

Dai, Huimin, [691](#)  
Deng, Lei, [201](#)  
Deng, Lue, [701](#)  
Ding, Jinzhu, [235](#)  
Ding, Xiaobin, [227](#), [793](#), [801](#)  
Dong, Chang-e, [99](#)

Dong, Fenglin, [439](#)  
Duan, Rongyi, [35](#)

## F

Fang, Tian, [767](#)  
Feng, Qiaoling, [277](#)  
Feng, Xiaofei, [615](#)  
Fu, Chunming, [169](#)

## G

Ge, Yanhui, [525](#)  
Gu, Baoping, [189](#)  
Gu, Xitao, [21](#)  
Gu, Yiran, [235](#)  
Gui, Haitian, [683](#)  
Guo, Hongyan, [189](#)  
Guo, Zhengjun, [657](#)

## H

Han, Xiaoju, [399](#)  
Hao, Liping, [711](#)  
He, Boran, [785](#)  
He, Jianhua, [263](#)  
Hsieh, Cheng-Kuo, [341](#)  
Hu, Xiuqi, [625](#)  
Huang, You, [735](#)

## J

Jia, Dongchao, [13](#)  
Jia, Zhenhong, [201](#)

**J** (*cont.*)

Jiang, Fan, 615  
 Jiang, Haiyan, 127  
 Jin, Xianji, 137

**K**

Kang, Li, 467

**L**

Lang, Nanjun, 567  
 Li, Cunbin, 161  
 Li, Desheng, 323  
 Li, Guanghui, 415  
 Li, Hongchan, 219  
 Li, Huilan, 665, 673  
 Li, Jianming, 299  
 Li, Jing, 607  
 Li, Linlin, 13  
 Li, Rui, 391  
 Li, Shaohuan, 475  
 Li, Suting, 581  
 Li, Xian, 161  
 Li, Xianyang, 43  
 Li, Xiaohong, 633  
 Li, Xiaoyan, 633  
 Li, Yifeng, 701  
 Li, Yunfa, 245  
 Liang, Yongfeng, 331  
 Liao, Bifeng, 43  
 Liu, Chunxue, 169  
 Liu, Fei, 3  
 Liu, Feng, 153  
 Liu, Gengcheng, 209  
 Liu, Hongqin, 533  
 Liu, Junying, 777  
 Liu, Ying, 35  
 Liu, Yiquan, 497  
 Liu, Zhi, 615  
 Liu, Zhiqin, 567  
 Lou, Junwei, 145  
 Lou, Xiaoyun, 491  
 Lu, Lei, 137  
 Lu, Yi, 817  
 Luo, Nanying, 119

Lv, Dongsheng, 431  
 Lv, Shanhui, 639

**M**

Ma, Jianxin, 457  
 Ma, Liang, 153  
 Ma, Xiaoxue, 3  
 Muharemu, Renaguli, 515

**N**

Nakamura, Masatoshi, 701  
 Ni, Chunzhong, 169, 573  
 Niu, Chunjuan, 633

**O**

Ouyang, Rong, 245

**P**

Pan, Yuexian, 407  
 Pang, Zhiyong, 683, 691  
 Pu, Peng, 439

**Q**

Qin, Xizhong, 201  
 Quan, Haiying, 833

**R**

Ren, Zujie, 245  
 Rozy, Anniwar, 515

**S**

Shen, Shaowei, 289  
 Shen, Yingying, 727  
 Shen, Zuiyi, 289  
 Shun, Fengxiao, 27  
 Song, Ning, 743, 751, 757  
 Song, Qingfeng, 647  
 Song, Shiji, 209  
 Su, Weitao, 665



Sun, Chunling, 665, 673  
 Sun, Jing, 483

**T**

Tan, Hongzhou, 683, 691  
 Tang, Xiaojie, 561  
 Tang, Yanping, 415  
 Tong, Weiming, 137

**U**

Ueng, T. H., 341

**W**

Wan, Jian, 245  
 Wang, Bei, 701  
 Wang, Cuiping, 111  
 Wang, Guoli, 657  
 Wang, Haiying, 581  
 Wang, Jiagui, 263  
 Wang, Jigang, 127  
 Wang, Jing, 743, 751, 757  
 Wang, Keqin, 567  
 Wang, Qun, 355  
 Wang, Sha, 647  
 Wang, Wenming, 177  
 Wang, Xiaohong, 391, 657  
 Wang, Xiaoyi, 633  
 Wang, Xingce, 127  
 Wang, Xuesong, 127  
 Wang, Zixian, 3  
 Wang, Zongjiang, 253  
 Wei, Guanghui, 153  
 Wei, Xianmei, 497  
 Wu, Cheng, 209  
 Wu, Fang, 727  
 Wu, Jianhui, 657  
 Wu, Zhongke, 127

**X**

Xia, Xiaoyan, 201  
 Xian, Xiuli, 735  
 Xiao, Zemin, 373  
 Xie, Jiayu, 35  
 Xue, Meng, 365  
 Xue, Ru, 51

**Y**

Yan, Yan, 647  
 Yang, Baoqiang, 633  
 Yang, Lin, 225  
 Yang, Mingli, 719  
 Yang, Shaoqing, 633  
 Yang, Sufei, 439  
 Yang, Xinsong, 271  
 Yang, Zhijian, 43  
 Yao, Xue, 449, 625, 639  
 Yin, Sufeng, 657  
 Yin, Wenzhuang, 315  
 Yu, Hongyan, 415  
 Yu, Jing, 79

**Z**

Zhang, Daomei, 307  
 Zhang, Feng, 73  
 Zhang, Guobin, 665, 573  
 Zhang, Ruochun, 525  
 Zhang, Shaojuan, 21  
 Zhang, Shitao, 169, 573  
 Zhang, Tao, 701  
 Zhang, Tingsen, 299  
 Zhang, Xue, 449  
 Zhang, Ying, 633  
 Zhang, Yuan, 383  
 Zhang, Yuanyuan, 21  
 Zhang, Zhihua, 727  
 Zhao, Hui, 271  
 Zhao, Li, 553  
 Zhao, Lin, 525  
 Zhao, Mingyue, 647  
 Zheng, Xiaoyi, 89  
 Zhou, Feiyan, 227  
 Zhou, Gefen, 59  
 Zhou, Lei, 665, 673  
 Zhou, Mingquan, 127  
 Zhou, Wen, 505  
 Zhou, Yanyun, 201  
 Zhu, Haodong, 219  
 Zhu, Xiaofeng, 227  
 Zhu, Xiaotong, 625, 633  
 Zhuo, Fengli, 543  
 Zou, Wensheng, 65