A New Mode of Protection and Inheritance Based on Xinjiang Traditional Folk Arts Pattern

Haiying Zhao[1], Hong Peng[2], and Chen Hong[3(✉)]

[1] Mobile Media and Cultural Calculation Key Laboratory of Beijing, Century College, BUPT, Beijing 102613, China
[2] College of Network Education, Xinjiang Normal University, Urumqi 830054, China
[3] College of Information and Electrical Engineering, China Agricultural University, Beijing 100083, China
norman_chen@263.net

Abstract. Xinjiang traditional folk arts and crafts design as the human history of civilization heritage, is not only a high cultural value immaterial cultural relics, but also precious material for the research of the development of the ancient human civilization. However, as the cultural heritage of the heir is gradually reducing, the protection and inheritance of intangible cultural heritage has become a new and difficult task. This paper puts forward motif gene is the basic unit of inheriting the national cultural connotation, and through the design segmentation algorithm to obtain traditional motif genes, through a variety of generation model and genetic recombination, deformation to create regenerating motif gene. To establish a new design model for protection and inheritance of traditional folk arts and crafts, and give a new model of system structure as well as the realization strategy in paper.

Keywords: Motif genes · Traditional motif genes · Regenerating motif genes · Various generation model · Innovative design

1 Introduction

According to from the United Nations educational, scientific and cultural organization all previous frequently confirmed and modified definition, human intangible cultural heritage concept is expressed as follows: through the group or individual verbal expression, from traditional and adopted by the same cultural community, can represent the cultural and social characteristics of the form. It mainly has legends, performance art, customs and etiquette, technology skills, etc.

This work was co-supported by the NSFC Project (grant no: 61163044) and Social science fund of China (grant no 12AZD120; 12AZD118); the Project of Science and Technology Committee of Beijing (Z141110004414074, Z141100001914035); the project of National Science and technology (grant no: 2012BAH48F03).

Z. Pan et al. (Eds.): Transactions on Edutainment XI, LNCS 8971, pp. 200–206, 2015.
DOI: 10.1007/978-3-662-48247-6_18

Xinjiang traditional folk arts and crafts design is valuable intangible cultural heritage; many cultural heritage is no reproducibility and uniqueness. Once destroyed, it losts its own unique charm, which will never recover. The reason is that most inheritance mode of the intangible cultural heritage still rely on teachers oral and written. This kind of inheritance mode is difficult to meet the need of traditional folk process of cultural heritages preservation, transmission, sharing and research. This paper proposes to design motif gene as the basic semantic unit to protect and inherit the national arts and crafts design.

In addition, many Xinjiang traditional folk arts and crafts design such as clothing, carpet, hats, construction and other design patterns have the uniformity in time or space, which means that intangible cultural heritage implicit many useful and interesting model. The model not only expressed the non-material cultural heritage content, organization structure and common features of time and space, but also the semantic information of intangible cultural heritage content in specific environment. This is the existence of motif gene. Through the description of the pattern gene we can understand and summarizes the specific semantic information and potential knowledge. This new protection and inheritance mode will play a great role in intangible cultural heritage protection and inheritance.

2 Related Work

How to with information technology, new method with form of culture protection, has aroused general concern. This paper puts forward generating traditional gene based on the research of division pattern primitives as generator; constructing regeneration gene based on many kinds of generation algorithm, fractal generation models, cell automatic evolution model, plant growth constraint model and so on. It is a kind new method of protection and inheritance Xinjiang folk arts and crafts pattern.

Through duplication checking, the related domestic literatures in the research field mainly include: Reference [1], it explores the realization of the elaborate structure of textile art pattern with weak chaos image. Design new pattern draft by applying the weak chaos image in textile design. Reference [2], it put forward a model based on Case which can produce pattern. Reference [3], based on the combination of a genetic algorithm and the fractal artistic design, a new method of fractal pattern generation based on a genetic algorithm was proposed. Reference [4], authors construct corresponding vectorization patterns to form a paper cut-out pattern. Reference [5], a new scheme that employs the image as weight matrix is introduced to build a chaos neural network which has improved from the Hopfield neural network. Reference [6], an improved production algorithm for art patterns was developed based on cellular automata.

The related foreign literatures in the research field mainly include: Reference [7], Their work has three main facets: the description of the geometric content of ethno-mathematical artifacts; the classification of this content; and the generation of grammatical rules for the creation of new designs based on the studied artifacts. Reference [8], star patterns created by author can be designed equally well to fit the Euclidean plane, the hyperbolic plane, or the surface of a sphere. Reference [9], the

kind invitation to present of plant modeling using L-systems relate the results obtained to the growing array of other contributions. Reference [10], the National Research Council of Canada (NRC) has developed several high-resolution 3D imaging systems as well as data modeling and display software for heritage recording applications. Reference [11], Human art gene pool is proposed and used by Chinese minority art. In reference [12], the author proposed to synthesize art patterns with curvilinear features from exemplars. In reference [13], the author proposed a method for drawing Yazdi-bandi in 2D schema based on primary rules of geometry. In reference [14], the authors have designed special motifs coupled with templates, resulting in a parameterized set of decorative paper-cut patterns.

3 New Mode of Protection and Inheritance Based on Motif Gene

3.1 Pattern Gene

The existing primary environment of intangible cultural heritage is a special kind of carrier, which bear the specific information of the non-material cultural heritage. Therefore, in order to reveal the rich content of the cultural connotation, the paper puts forward the new model of the inheritance and protection, that is motif gene as the basic carrier. It is defined as follows:

Motif gene refers the basic information mode formed in the specific regional and national culture environment, which has the stability and inheritance. It reflects the unique Xinjiang ethnic style, and have these characteristics of representability, quantification, and analysis.

3.2 Classification of Motif Genes

Analyze the characteristics of Xinjiang folk arts and crafts design, mining, decode and design internal source, introduce the gene engineering method. In biology, gene is a functional unit. Gene can not only transmit the genetic information to the next generation through copying, but also can express the genetic information. Borrowing biological gene vocabulary, the basic factors are formed in the certain region, a certain national culture environment, which has certain stability, typicality, the inheritance of characterization, play an important role in expressing and restricting, are regarded as the specific national art gene [10]. A picture is made up by different genes. But it is not only for genetic machinery polymer, but higher semantic level of unit combination. For this reason, pattern genes are divided into two kinds: “traditional pattern gene” of loyal to the national style and “regeneration pattern gene” which can restructure and regeneration. But traditional design gene: mainly is got by the design segmentation model decomposition. Regeneration pattern gene: by a variety of generation model (fractal generation model, the cellular automata evolution model, plant constraint growth model) to generate, recombine, gene splicing generate genetic variation generation.

3.3 Pattern Gene Acquisition

Establish design segmentation model to extract traditional genes: choose the popular active contour model as design segmentation model. This model has higher accuracy and reliability, which is helpful to realize the automatic segmentation (Fig. 1).

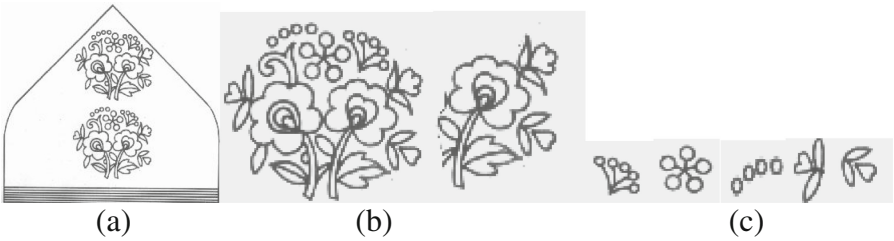


Fig. 1. (a) Uighur cap pattern. (b) Segmentation process. (c) Extracting motif gene.

Building regeneration motif gene based on a variety of generation models: including fractal generation model, cellular automata evolution model, and plant constraint growth model, etc. Fractal formation models, including IFS generation spells build by laying bricks or stones design, escape time algorithm, L system, square residual function and expansion of the Picard group for the formation of way (Fig. 2).

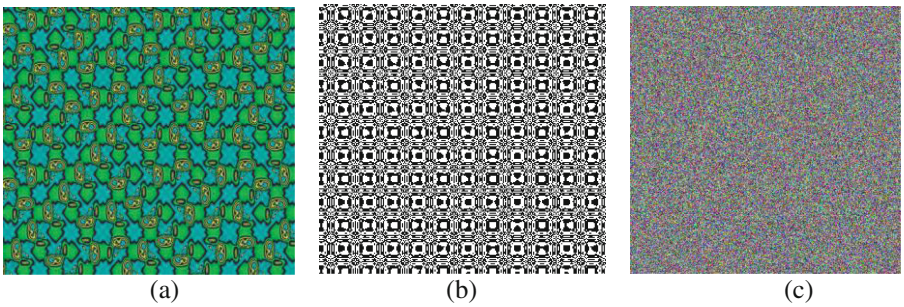


Fig. 2. Fractal formation quasi carpet pattern (a) iterative function generation cycle tile pattern. (b) Symmetric iteration function generation pattern. (c) Square residual function generation pattern.

The evolution of cellular automata model: cellular automata in complex system is the most simple model to explore the local and the whole of the interactive relationship. This model can be regarded as the basic calculation model of the analysis of the evolution (Fig. 3).

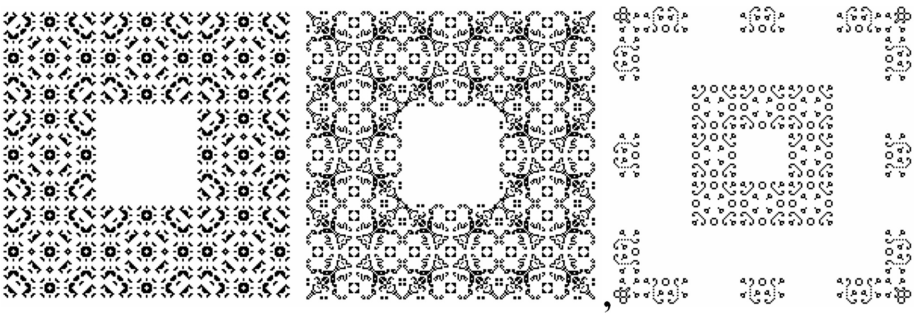


Fig. 3. Combining evolution generation tile pattern.

4 System Structure Based on Genetic Model

First, define pattern gene data model, redivide and extract basic factors of "traditional motif gene"; Second, construct "regeneration pattern gene" through the generation model; and finally integrated traditional and regeneration gene, to establish new mode of protection inheritance based on comprehensive deductive reasoning, its system structure is as follows:

The pattern generated based on the gene synthesis reasoning have a 5-tuple model. It is constituted by $N = \langle D, E, M, R, C \rangle$, including D for the entire pattern composition knowledge; E for pattern gene set; M for pattern topology configuration; R for synthesis reasoning rules set; C for color selection rule sets (Fig. 4).

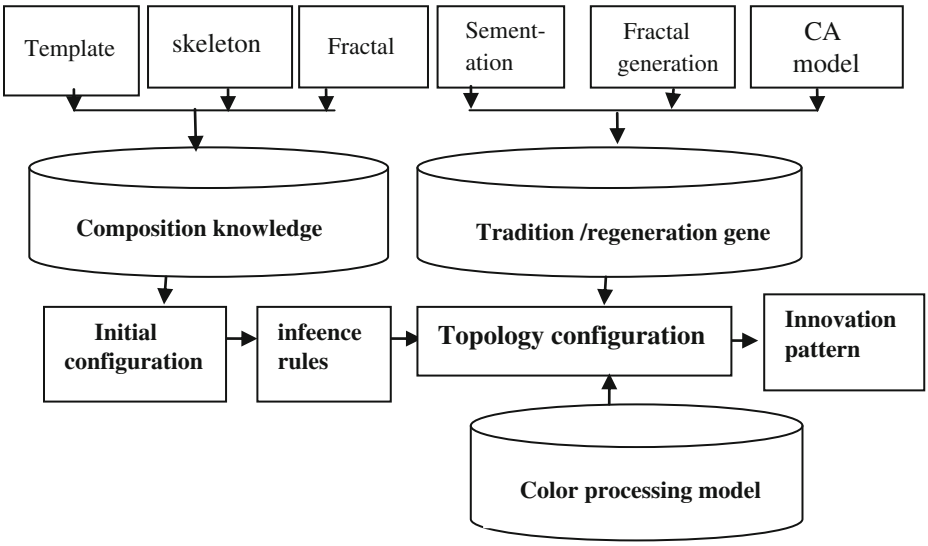
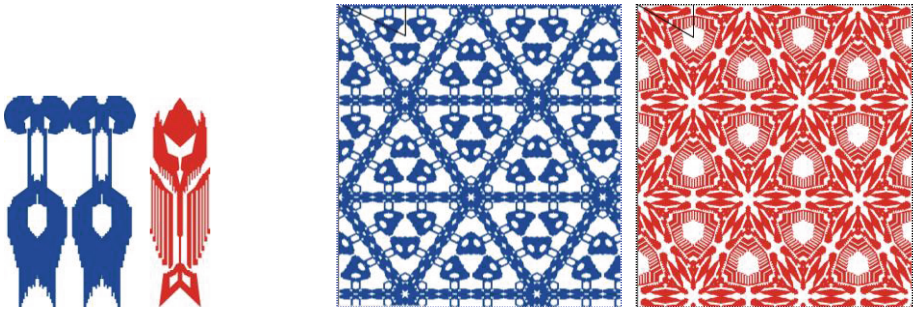


Fig. 4. System structure of protection and inheritance on genetic model.

5 Genetic Model of the Protection and Inheritance Pattern

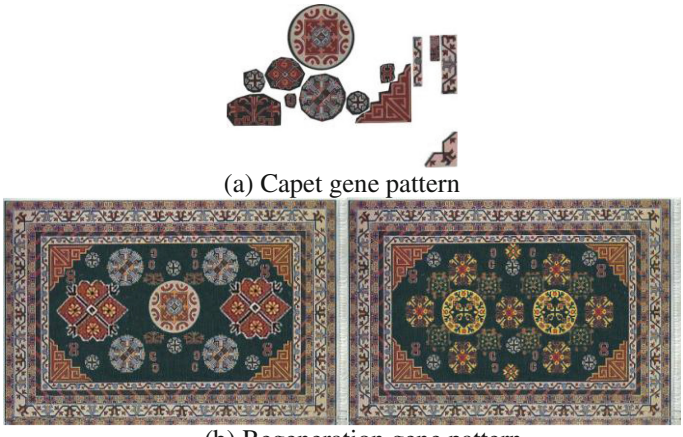
Experiment 1: extraction traditional costume design gene applied in regeneration pattern gene (Fig. 5).



(a) traditional gene patter (b) regeneration gene pattern

Fig. 5. Costume gene pattern and regeneration gene costume pattern.

Experiment 2: extraction carpet traditional pattern gene used in creative design new pattern (Fig. 6).



(a) Capet gene pattern

(b) Regeneration gene pattern

Fig. 6. Carpet gene pattern and regeneration gene carpet pattern.

6 Conclusion

Extracting cultural elements is the key to inherit intangible cultural heritage. The old culture system died, many of energetic cultural elements are still preserved. Task group called them “motif gene”. Therefore, a new mode is proposed which non-material

cultural heritage protection should be multi-level and multi-angle, multi-mode. Digital protection technology also should not only be limited to the original high precision simulation, and should be deeper. Motif gene as the basic mode of protection and inheritance, this paper proposed “traditional motif gene” and “regeneration motif gene” as basic concepts. A true sense of inheritance innovation will come true.

References

1. Zhang X.-W.: Study on Digital Textile Pattern Design Method Base on Weak Chaos Theory. Suzhou University (2009)
2. Shen, L.-Z., Xu, B.-Y., Zhao, L.: Application and design of image database based on textile. Appl. Res. Comput. 21(6) (2004)
3. Li, J., Liu, H.: A method of fractal artistic pattern generation based on a genetic algorithm. J. Shandong Univ. (Eng. Sci.) **38**(6), 33–36 (2008)
4. Zhang, X.-Q., Yu, J.-H., Jiang, L.-L., Tao, X.-M.: Computer assisted generation of paper cut-out images. J. Comput. Aided Des. Comput. Graph. **17**(6), 1378–1382 (2005)
5. Yu, W.-L.: Feature Representation of the Image Based on Iteration and Fractal. Dalian University of Technology (2006)
6. Zhang, X., Li, H.: Production of art patterns based on fractal cloud model cellular automata. J. Tsinghua Univ. (Sci. Technol.) **53**(8), 1098–1103 (2013)
7. Dudek, C.K., Sharman, L.: From ethno-mathematics to generative design: metapatterns and interactive methods for the creation of decorative art. In: Proceedings of the International Conference on Information Visualization, vol. 8, Proceedings - Eighth International Conference on Information Visualisation, IV 2004, pp. 941–946 (2004)
8. Kaplan, C.S., Salesin, D.H.: Islamic star patterns in absolute geometry. ACM Trans. Graph. **23**, 97–119 (2004)
9. Prusinkiewicz, P.: A look at the visual modeling of plants using L-systems. In: Bioinformatics. German Conference on Bioinformatics, GCB 1996, pp. 11–29. Selected Papers (1997)
10. Taylor, J.M., Godin, G., Beraldin, J.A.: Heritage recording applications of high resolution 3D imaging. In: 16th International Conference on Pattern Recognition, Proceedings, vol. 2, p. 520 (2002)
11. Li, X.-F.: Human art gene pool and Chinese minority art. Art Res. **2**(1), 47–50 (2004)
12. Wu, R., Wang, W., Yu, Y.: Optimized synthesis of art patterns and layered textures. IEEE Trans. Vis. Comput. Graph. **20**(3), 436–446 (2014)
13. Rasouli, P., Bastanfard, A.: A new approach on 2D Yazdibandi in Islamic geometry. In: 2010 2nd International Conference on Software Technology and Engineering, Proceedings, vol. 2, pp. V2344–V2349 (2010)
14. Li, Y., Yu, J., Ma, K.-H.: 3D paper-cut modeling and animation. Comput. Animation Virtual Worlds **18**(4–5), 395–403 (2007)