

# Primary Research on Geo-Informatic Tupu for Crime Spatio-Temporal Analysis

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**Abstract.** Geo-Informatic Tupu is a complex spatio-temporal analysis method. Its detailed, simple image analysis and expression ways can better meet the crime spatio-temporal analysis needs. This paper summarizes the research background and current situation of crime spatio-temporal analysis, and discusses the significance and content of this research. And also this paper puts forward own ideas about research ways, which is in order to provide a new method for method references and decision supports in the crime spatio-temporal analysis practices.

**Keywords:** Geo-Informatic tupu · Crime spatio-temporal analysis · Review

## 1 Introduction

First, crime spatio-temporal characteristics require constant prolongation of crime spatio-temporal information analysis technology. As a part of society, the occurrence of criminal activities is an inevitable social phenomenon, whose change with time and space rules of typical. A growing body suggests there is an inevitable relationship between the crime phenomenon and the geographical environment. From the city spatial anticrime point of view, crime spatio-temporal analysis will become an important means of policing activities understanding, analysis and prediction. The current crime spatio-temporal analysis technology is developing rapidly, so the old style of pin map has been taken place with crime mapping technology. Advantage of crime spatio-temporal analysis has a profound deeply impact on the crime analysis efficiency.

Second, crime spatio-temporal analysis provides a methodology for spatial information compound analysis. The crime spatial distribution is a complex temporal evolution processing, the inversion, simulation and prediction research of this is a composite study of an integrated time and space, which needs an effective support of effective temporal and spatial analysis theory. The geographical information Tupu theory is based on inheriting the traditional China research results, which is on the basis of temporal 3S technology, information network and other contemporary advanced technology. As a showing way of related information processing and display, the geographical information Tupu provides theoretical basis for crime spatio-temporal

analysis. The related information includes variation characteristics and time sequence of phenomena spatial structure.

Third, the investment in the ministry of public security and the ministry on the police geographic information technology provide guarantee for the crime spatio-temporal analysis work. In July 13, 2012, in the guidance and support of the ministry of public security and Jiangsu province public security division, Changzhou City Public Security Bureau, Nanjing Normal University, Jiangsu Police Institute, founder International Software Co., Ltd. and other units jointly established the Jiangsu Provincial Public Security Bureau police Spatial Information Technology Key Laboratory. The Ministry public security PGIS project office members attend to laboratory construction and operation. In December 28, 2013, Changzhou City Public Security Bureau and Nanjing Normal University establish “Key Laboratory of the Ministry of public security police geographic information technology” together. The construction of Laboratory solves the practical business application problems such as grassroots work and investigation and case solving, which provides researchers with a good exchange platform. One of the key research directions in the laboratory is crime spatial analysis and crime mapping, which puts forward higher requirements on crime spatio-temporal composite analysis.

## 2 Research Review at Home and Abroad

The existing crime spatio-temporal analysis technical usually uses crime mapping technology. On the one hand, crime mapping technology has accurate and number requirements of crime data, which has some difficulties in the data acquisition and application. On the other hand, the crime spatio-temporal analysis based on crime mapping technology mainly is the embodiment of the results, which is lack of process embodiment and causes attention.

Thus, Geo-Informatic Tupu is a complex spatio-temporal analysis method. Its detailed, simple image analysis and expression ways can be better meet the needs of crime spatial analysis, which will not only reduce the crime data requirements, but also can promote the understanding of crime spatio-temporal analysis process.

Even so, crime spatio-temporal analysis based on Geo-Informatic Tupu is still in the blank at home and abroad. There is a huge space in this study. This research can contribute to the understanding of crime spatio-temporal process, which has the characteristics of image concise. At the same time, as a new kind method of spatio-temporal variation analysis theory and expression method, the application of Geo-Informatic Tupu in crime spatio-temporal analysis can expand and enrich the theory and method system.

## 3 Research Significance and Application Value

From the theoretical point of view, the present crime spatio-temporal analysis mainly includes method research, model study, and researching typical area, all of this should be breakthrough and upgrade. Then Geo-Informatic Tupu is pulled into crime

spatio-temporal analysis. Geo-Informatic Tupu analysis provides a theoretical basis for crime spatio-temporal analysis and a new idea for the study of crime spatio-temporal analysis. At present, the present Geo-Informatic Tupu research mainly focuses on physical geography and human geography, and less involve in criminal geography. The application of Geo-Informatic Tupu in crime spatio-temporal analysis, can not only expand the application field of Geo-Informatic Tupu, further enrich the theory of Geo-Informatic Tupu, but also open up new ideas for the study of crime spatio-temporal analysis.

From the practice point of view, Geo-Informatic crime Tupu is a concept extension into certain fields, and also a practical research of Geo-Informatic crime Tupu research. The research content, method and extraction process of crime spatio-temporal analysis, and the discussion about crime spatio-temporal analysis based on Geo-Informatic Tupu in this paper can provide similar studies with a prior knowledge and experience. The results of crime spatio-temporal analysis can carry out spatial distribution of crime and achieve optimization of spatial anticrime. All this can promote the transition from traditional policing mode to the new police model, which has important practical significance.

The more direct application value embodied in the study is the method reference and decision support in crime spatio-temporal analysis practice, which can be available in many relevant administrative departments, such as the information department, intelligence department, and emergency department.

#### **4 The Main Research Contents**

Taking the remote sensing image, statistics data and crime data as the data source, using Geo-Informatic Tupu theory as the support, this paper researches the composition, generation method and application of Geo-Informatic crime Tupu. And also this paper studies on driving force which affecting the crime spatio-temporal analysis. The research process can be described as following: firstly, crime spatio-temporal information must be collected, from which the time and spatial information Tupu can be construct. Basing on the information Tupu, the overall local characteristics can be carried out by crime spatio-temporal analysis. And then driving force of Geo-Informatic crime Tupu is researched in order to cognize the time evolution of criminal activities from the spatial graphics point. On the basis of the criminal activities time evolution, spatial differential features and crime driving mechanism are deeply studies. Specifically, the main contents of the research include as follows:

First, Geo-Informatic crime Tupu is consist of crime time evolution Tupu and spatial characteristics Tupu. All these Tupu foundation is based on the analysis of Geo-Informatic crime Tupu, which is only on the condition of crime spatio-temporal analysis.

Second research is crime time series of whole evolution analysis. By the crime information extraction, we can analysis the crime time evolution, crime time transfer evolution, and also the overall characteristics evolution by means of a variety of indices to measure.

Third research is criminal spatial distribution analysis. The difference of spatial distribution characters in every area, every position and every direction can be attracted by spatial index and crime spatio-temporal analysis model. Then the overall crime spatial distribution characters such as the overall, local, and detailed features can be summarized, which will come to conclusion about the leading direction, expansion mode and phase morphology.

Forth research is the driving force related with Geo-Informatic crime Tupu. The crime spatial distribution has stage, diversity and complexity characteristics, which is under the comprehensive effect of internal, external social forces, expansion in the different stages. In this paper, the combination of qualitative and quantitative analysis is used to analysis the correlation between city development and Geo-Informatic crime Tupu.

Crime spatio-temporal analysis mainly focus on three aspects which includes temporal, spatial and the driving force. The details are as follows:

First is characteristics extraction and analysis of crime temporal Tupu. With all the crime statistics data as data source, multi-temporal crime information metastasis boundary is extracted, and the crime temporal Tupu is built in the certain time. Then taking the crime temporal Tupu in each time point as Tupu unit, the crime temporal Tupu can be analysis overall.

Second is crime characteristic Tupu and spatial difference analysis. On the basis of the overall crime temporal Tupu analysis, The local spatial difference Tupu and detail spatial difference Tupu can be extracted by the analysis based on the 1 hectares unit. Then the detail and local spatial characteristic can be analysis, which can conclude the spatial distribution characteristic and transfer mode in the different stage of crime.

Third is related effect analysis of driving force on crime time division. The crime temporal and spatial distribution is not only a single driving force result, but also many factors related influence result. The aspects of driving force related effects on regional spatial and temporal information of crime from the natural, economic, social, historical and cultural, in order to help the relevant policies and measures to promote crime prevention and control system, the development of the region to the direction of rationalization.

## 5 The Research Ideas and Methods

### 5.1 Research Ideas

The research on spatial information Tupu takes crime statistics data as the main data source, and uses GIS spatial statistical analysis methods and spatial analysis to study on Geo-Informatic Tupu. The study step can be described as the three following steps: crime spatio-temporal information extraction, time evolution of crime distribution, spatial differentiation analysis, and associated driving force effects research. Research general framework and technical route are shown in Fig. 1.

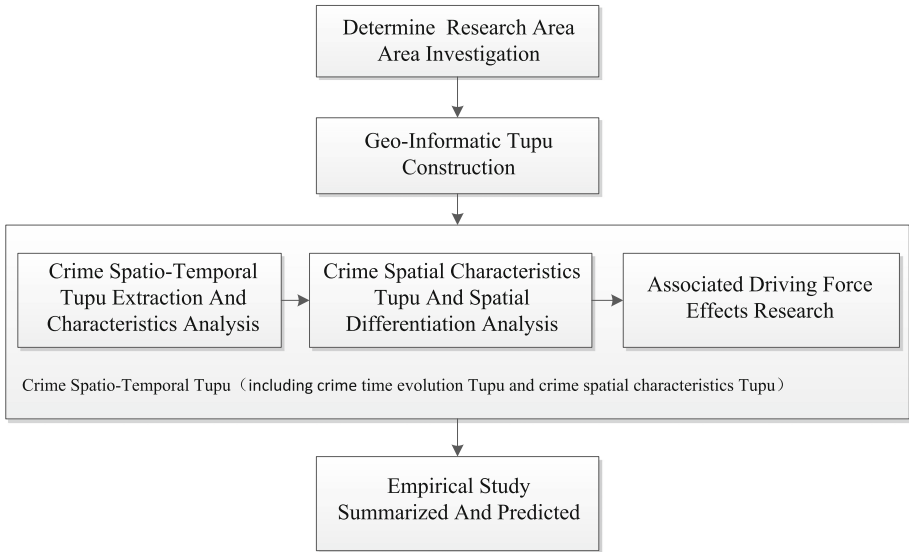


Fig. 1. Research general framework

## 5.2 Research Methods

- (1) Literature research method. Through checking books and reference materials and computer network technology, the study can learn from the latest research achievements and utilization. Then the summarizing analysis can be done by the monograph books, research reports, journals and newspapers and other relevant information etc. which carries on the thorough discussion to the crime temporal-spatial information.
- (2) Comparative method. To study the theory of crime spatio-temporal analysis, some kind of association between the spatio-temporal characteristics and criminal behavior can be summarized. The theory of crime spatio-temporal analysis technology is widely used in Europe and the United States, and there are some successful cases. With the idea of science and technology strengthening police, comparison method can be used to provide deeply background support for this dissertation.
- (3) The pilot study. The pilot study is selecting the appropriate cities as pilot while studying. The study closely cooperates with the city public security bureau and police geographic information technology laboratory, Geo-Informatic Tupu analysis technology is put into practice. And the theory becomes perfection in the practice, which the conclusion of the study has application value and promotion effect.

## 6 Concluding Remarks

The crime spatio-temporal TuPu is a development and refinement of Geo-Informatic Tupu theory. Through the analysis of Geo-Informatic Tupu, this paper raises basic contents of crime spatio-temporal TuPu on the basis of research contents, research ideas and research methods. In this research, crime spatio-temporal TuPu consists of crime time evolution TuPu and crime spatial characteristics TuPu. And the empirical study should be done, then the association driving force effects on crime spatio-temporal TuPu is extracted.

The crime spatio-temporal TuPu research can provide reference and decision support for the practical work in crime investigation. These research findings will put practice in the public security organs of the information department, and information department.

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