

## **An Analysis of Residential Burglary Patterns Using Exploratory Spatial Data Analysis (ESDA), Case Study: Zahedan City**

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### **Introduction**

In recent century, human safety from crime is very important in everyday life. In terms of human needs, Maslow's (1943) hierarchy of needs suggests that sustainable environments should cater for biological and physiological needs, safety, affiliation, self-esteem, and self-actualization, respectively. Crime and avoidance from of are surely important in people's agenda as the most important issues in many countries worldwide. Geographers deal with the distribution of a wide variety of geographical entities and phenomena amongst human safety and freedom. They analyze spatial distributions, pattern of this distribution in terms of objective and subjective phenomena, spatial variability and so forth. The concept of spatial analysis is related to discovery of spatial patterns, causes and effects of phenomena, autocorrelation, etc. In the past, when performing spatial crime analysis, geographers were limited to mapping crimes in locations and regions. However, technological improvements, first and foremost in the computer processor capabilities, have become essential in recent analytical advances in the methods available for analyzing place-based data. The initiation of computer mapping applications and additional geographic information systems (GIS) are important to being able to measure and represent the spatial relationships in data. ESDA is a collection of techniques to describe and imagine spatial distributions; identify unusual locations or spatial outliers, discovering patterns of spatial association, clusters, or hot spots. Also, it suggests spatial regimes or other forms of spatial heterogeneity.

### **Material and Methods**

The present study used results of the 2006 census of population and housing, Residential burglary

data of Zahedan as none-spatial data, and census Zone map of Zahedan as spatial data.

In order to measure the spatial distribution,

autocorrelation and autoregressive we used Moran's I and LISA index in ArcGIS 9.3 and GeoDA 0.9.3 software. Spatial aggregation of objects produces a variety of distinct spatial patterns that can be characterized by the size and shape of the aggregations, and can be quantified according to the degree of similarity between the objects in their attributes or quantitative values. These properties of spatial patterns can be indicative of the underlying processes and factors that generate and modify them through time. The Moran's I (Spatial Autocorrelation) tool measures spatial aggregation based on both feature locations and feature attributes or quantitative values simultaneously. It evaluates whether the objects occurred, occurrence is clustered, dispersed, or random. LISA index identifies concentrations of high values, concentrations of low values, and spatial outliers. The following steps were used to perform research:

**Step1:** Preparing and pre-processing data.

**Step 2:** Making spatial units base on census zone map of Zahedan for Residential burglary data.

**Step 3:** Spatial data aggregation

**Step 4:** Setting Moran's I and LISA

**Step 5:** Analysis results

**Step6:** making maps

### Discussion of Results & Conclusions

Crime mapping can play an important role in the policing and crime reduction process, from the first stage of data collection through to the monitoring and evaluation of any targeted response. It can also act as an important mechanism in a more pivotal preliminary stage, that of preventing crime by helping in the design of initiatives that are successful in tackling a crime problem.

Spatial data is characterized by changeability and non-stationary. Examination of spatial pattern is an important subject in spatial analysis, which

includes some components such as spatial pattern, spatial autocorrelation and autoregressive. One of the favorites in spatial analysis is discovering spatial pattern by ESDA. Several indexes and tools have been developed for analyzing spatial pattern. At this paper we used Moran's I and LISA for crime occurrence spatial pattern. The results of present study show that portion of immigrant population, activity type and lifestyle have spatial association with Residential burglary. The Moran's I +0.85 showed that Residential burglar's distribution is clustered on regions surrounded by high portions of burglary. Two types of Contiguity (Rook & Queen Contiguity) used in analysis and the result showed clustered zones on Zahedan. In multivariate LISA index for relationship between socio-economic variable and burglary value and portion, it became clear that immigrant, unmarried population- especially males-, and population density have a meaningful relationship with burglary. LISA index showed that zones with high value of burglary are surrounded by zones with high portions of immigrant population and high percentage of unmarried men.

**Keywords:** Exploratory Spatial Data Analysis (ESDA), Spatial pattern, Global autocorrelation, Moran's I, Local indicator of spatial association, Residential burglary.

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