Exploring the spatial-temporal relations between burglary and socioeconomic factors using GIS

Rafael G. Ramos\textsubscript{1}, Keith Clarke\textsubscript{1}, Bráulio F. A. da Silva\textsubscript{2}

(1) Dept. of Geography, University of California, Santa Barbara; (2) Universidade Federal de Minas Gerais
rafaelramos@geog.ucsb.edu; kclarke@geog.ucsb.edu; braulio@crisp.ufmg.br

Introduction

Property crimes like burglary have often been linked to economic disparities. Can the spatial distribution of burglaries be explained by the distribution of different income levels in a city?

Objective

Investigate how urban environmental factors, including income level, interrelate and explain the distribution of burglaries in the city of Belo Horizonte, Brazil, for 2010.

Data

● Burglaries: 44416 geocoded cases for 2008-2014, including 6588 cases for 2010 (Policia Militar de Minas Gerais).
● Income level and demographics for each of the 3936 census tracts of Belo Horizonte (Censo 2010).
● Land use: 727900 geocoded locations (IPTU).
● Road network (OpenStreetMap).

Results

● A metric based on the proportion of residences with more than three minimum salaries per capita, the proportion of single family houses and empty lots, and population sparsity appears to be a relevant factor for explaining burglary distributions in Belo Horizonte.

● While the concentration of burglary varies throughout the day, the distributions are positively correlated and the peaks remain relatively stable.

Acknowledgements

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Minimum salary in 2010 (per month): R$ 510.00 ~ US$ 290.31

Methodology

Urban environmental factors analysis

● Aggregate land use and burglary cases to census tracts.
● Plot how factors vary in each burglary level (classified in deciles).
● Map an overlay of the most significant factors & compare to burglary distributions.

Temporal patterns analysis

● Separate burglary cases by four times of the day; generate kernel density estimates of the four groups and the total.
● Overlay the four times of the day (as a product overlay) to detect common peaks; compare to kernel density of the total.

Predicted

Adjusted R-squared in linear model:

Observed distribution = 0.1665
Using prior distribution = 0.3231

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<th>Burglary count</th>
<th>Correlation</th>
<th>Total</th>
<th>12am to 6am</th>
<th>6am to 12pm</th>
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