Predicting Property Crime in Vancouver Using GIS and a Decade of Data

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Introduction

Different crimes commonly occur throughout cities and present spatial and temporal patterns that crime analysts and municipal police agencies can use to more effectively allocate resources to address illicit activity. Fitterer, Nelson and Nathoo (2014) analyzed the patterns for breaking and entering (BNE) crime data in Vancouver from 2001 to 2012 to inform two models, with one model incorporating spatial data of the environment and socio-economic features and the other strictly using BNE crime data. The researchers' goal is to eventually be able to create a predictive model for future property crimes in Vancouver. Fitterer et al. (2014) describe their research as a "pilot project," but note other North American cities, like Los Angeles and Minneapolis, have employed similar techniques of hot spot mapping to strategically deter crimes pertaining to violence, drugs or property in specific regions of cities.

Methodology and Applying GIS

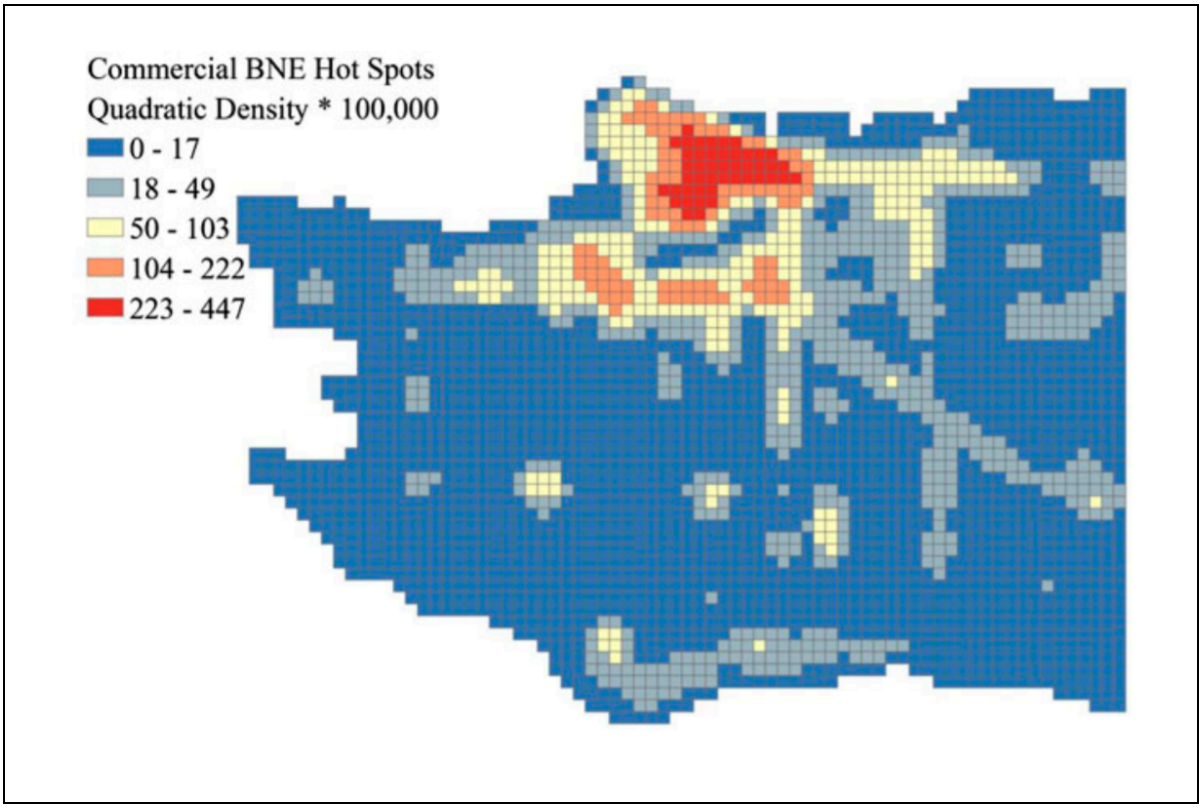
They formatted the study area of Vancouver into 3,014 cells at a resolution of 200m by 200m. Data for residential and commercial BNE crimes were extracted from the Vancouver Police Departments PRIME database. Then using the x, y coordinates associated with each crime, Fitterer et al. (2014) spatially joined the BNE crime data to the map consisting of 3,014 cells. The BNE crime data also included temporal data. They also joined spatial data pertaining to land use, land value, road density, property counts, number of street lights, weekly graffiti rates, ambient population, and population to each cell used in model one to explore covariates of BNE crime.

Model two focussed on the spatial and temporal relationships found between BNE crimes and disregarded confounding environmental variables. Fitterer et al. (2014) found that there was a 53% increase in the chance of a recurrence of a residential BNE after 24 hours and within a 850m radius of the original BNE crime. Model two also found that there was a 53% increase in the chance of a recurrence of a commercial BNE after 24 hours and within a 500m radius of the original BNE crime. They do not distinguish whether the original BNE crime is uncategorized or matches the type of crime being predicted.

Critique

The scope of this pilot project was too large and the amount of maps presented overwhelmed the point of the research. There were fourteen grid maps of Vancouver with data and the discussion section only referred to one of them. Fitterer et al. (2014) could have produced more effective maps had they clipped their 3,014 cells to a basemap of Vancouver with greenspaces and water areas, such as False Creek. This would portray the data more effectively because otherwise it appears their model predicts commercial BNE crimes to occur on the boats in False Creek (see fig. 1).

Fig. 1 (Originally Figure 10 in Fitterer et al., 2014)



Fitterer et al. (2014) failed to disclose how they produced their template of the crime prediction grid map of Vancouver consisting of 3,014 cells, and failed to justify why attributing counts of crime to cells of 200m by 200m was an optimal resolution to do so at. The grid cell's borders are not consistent with any road network or land use boundary lines in Vancouver, which

means there are mixed pixels and potentially exaggerated homogenization of the ancillary data in model one. Furthermore, they did not conduct the analysis at different spatial resolutions to better understand how this particular organization of Vancouver might affect their results. Instead they focused on different temporal resolutions and

Fitterer et al. (2014) do not make clear how or if they accounted for temporal changes to the ancillary data used for covariates in model one. This may be a major limitation to model one's reliability because they are likely using more recent data collected on the covariates like 2011 census populations, land values, and graffiti rates and comparing it with crime rates found in prior years when crime rates were higher. Also, graffiti rates could be extremely variable depending on the year or season, which Fitterer et al. (2014) use "as a surrogate of socioeconomic status," and do not substantiate this reasoning with other research or justification. So, the results from model one where 11 data-sets were found to be statistically significant predictors of BNE crime with an alpha level of 0.05 should be taken with a grain of salt considering Fitterer et al. (2014) related temporally stagnant data to an entire decade of BNE crime data.

So, overall I would give their research a 5/10 because they were able to effectively model the relationship between BNE crimes and other BNE crimes that took place within certain time frames after and within certain distances. Fitterer et al. (2014) noted that their models are at a high risk of predicting some likelihood of breaking and entering crimes where in reality none may exist. However, they applied partially irrelevant ancillary data to model covariate predictors, failed to display the data effectively, and did not address any potential for the modifiable areal unit problem in their representation of BNE crime.

Work Cited

Fitterer, J., Nelson, T. A., & Nathoo, F. (2015). Predictive crime mapping. *Police Practice and Research*, *16*(2), 121-135. DOI: 10.1080/15614263.2014.972618