Chapter XVI

Remote Sensing and Spatial Statistics as Tools in Crime Analysis

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Abstract

This chapter explores the feasibility and utility of using aerial photography or remotely sensed satellite imagery to identify geographic or "place" features that may be associated with criminal activity. It assesses whether or not variables derived from satellite images can provide surrogate relationships between land use and crime. A review of the remote sensing literature suggests two basic approaches to the use of remotely sensed images in law enforcement: (1) tactical; and (2) analytical. The tactical approach uses the imagery as a background to the maps and other spatial information that an officer on the beat might have as he or she is investigating a crime or emergency situation. The analytical approach uses the remotely sensed images to create new variables that may serve as proxies for the risk of crime in particular locations. In this study we employ the analytical approach to the use of remotely sensed images, classifying

images according to the presence or absence of vegetation within a pixel, as well as the classification of specific urban attributes, such as parking lots. We also employ spatial statistics to quantify the relationship between features of the images and crime events on the ground, and these analyses may be particularly useful as input to policy decisions about policing within the community.

Introduction

The concept of place is essential to crime pattern theory because the characteristics of place influence the likelihood of a crime. Most crimes are not random events, nor are they randomly distributed in terms of where they occur (Rossmo, 1995). Some areas are more prone to criminal activity than are others (Coomb, Wong, Charlton & Atkins, 1994; Roncek & Maier, 1991). This spatial variability is a result of the spatially non-random distribution of people who will be motivated to perpetrate a crime, and the spatially non-random distribution of factors (the opportunities) that increase the odds that a person or property will be victimized (Hakim & Rengert, 1981). Motivation tends to be person-specific, whereas opportunity tends to relate more specifically to the characteristics of place (Eck & Weisburd, 1995). These place-specific characteristics may be institutional (such as the amount of police activity oriented toward preventing crime or arresting criminals) and/or they may be more environmental (such as the presence of a large parking lot full of automobiles).

Crime literature has abundant references relating crime patterns to specific geographic features. For example, opportunities for some crimes, such as burglary and robberies, may be particularly enhanced by the existence of commercial areas and parking lots (Canter, 1997; Hill, 2003). Brantingham and Brantingham (1994) reported crack houses induce crimes (dealing in illegal drugs) that have a multiplier effect in the neighborhoods in which they are located, raising the burglary and theft volumes in their vicinity as customers raise the money to buy the drugs. The recognition of the concept of place in crime theory allows a new dimension to implementing crime prevention. Mapping crime locations and associating crime activities to mapped urban features offers the potential to enhance an understanding of the non-random nature of crime locations and to improve crime prevention measures.

Crime event maps provide only a portion of the context of place. Context is provided more meaningfully through the use of remotely sensed images (aerial photographs and satellite images), which are then combined with the crime event maps in a geographic information system (GIS). Hirschfield and others (1995),

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