

THE SIMPLE SPATIAL DISAGGREGATION APPROACH TO SPATIO-TEMPORAL CRIME FORECASTING

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Received August 2006; revised December 2006

ABSTRACT. *Reported criminal damage incidences in the City of Cardiff, UK were modelled using an avant-garde statistical modelling technique, namely the Hierarchical Profiling Approach (HPA). With HPA, salient events affecting crime levels are identified and their influences modelled, thus providing a catalogue of profiled events. These profiles are incorporated into crime model. The model is subsequently spatially disaggregated using the crime forecasts over the entire study area. The Simple Spatial Disaggregation Approach (SSDA), developed within a Geographical Information System (GIS) environment, utilises four cluster forecasting techniques to provide a best cluster forecast. The hot spot detection routine procedure utilised was the Spatial and Temporal Analysis of Crime (STAC) technique which ignores fixed administrative boundaries. The spatio-temporal errors of the forecasts were then calculated and compared to one another using novel two-dimensional error evaluation techniques, namely the Spatio-Temporal Mean Absolute Percentage Error (STMAPE) and the Spatio-Temporal Mean Root Squared Error (STMRSE). An average prediction error of ± 3.51 crimes per day for the city as a whole was obtained using HPA alongside an optimum STMRSE of 1.131 errors per weekday per cluster with SSDA.*

Keywords: Hierarchical profiling approach (HPA), Geographical information system (GIS), Spatial and temporal analysis of crime (STAC), Mean absolute percentage error, Mean root squared error, Spatial disaggregation, ARIMA

1. **Introduction.** Police crime prevention efforts would significantly profit from spatio-temporal crime forecasting. The forecasts should allow an optimum distribution of their manpower over the area of study at any given time. [1] investigated spatial patterns of crime in Lima, Ohio, USA. They demonstrated that there is a significant relationship between the features of a location (*e.g.*, demographic, socioeconomic and environmental structures) and the evaluated clusters of crime. Those relationships were investigated at a micro and macro level with average numbers of crime allocated to each cluster. Although the analysis provided delimited areas whereon the police should focus their