Spatial-Temporal Crime Forecasting and Analysis For Policymakers Using SARIMA and LSTM Models

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If patterns and structure can be found in crime data then it can be understood and exploited. The aim is to understand the extent that time series forecasting and data analysis can be used by policymakers to reduce future crime.

Time series analysis identified Public Order Offences as a growing problem. Figure 2 indicates a three-fold increase from 2010 to 2024, and animations show this is uniform across London. Figure 1 shows a rise in racially and religiously motivated crime, increasing by a factor of 26.

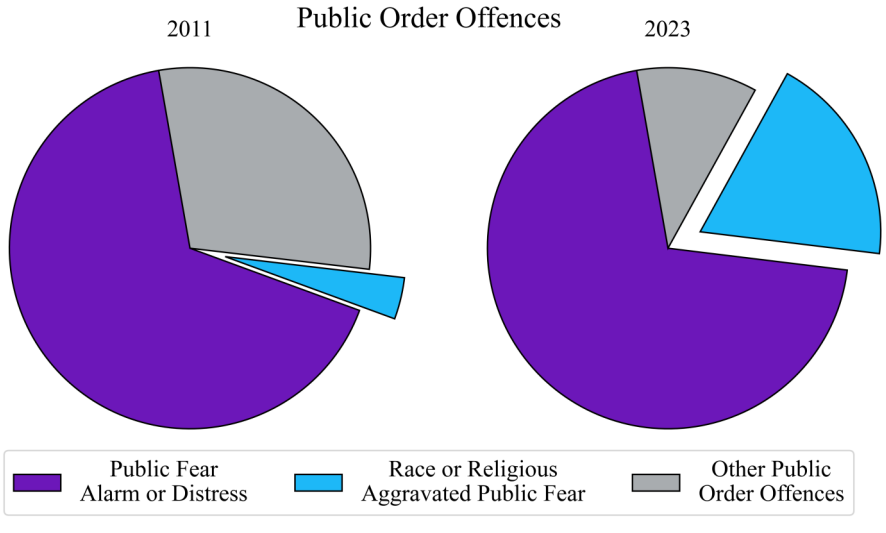

Figure 1. Increasing proportion of public hate crimes

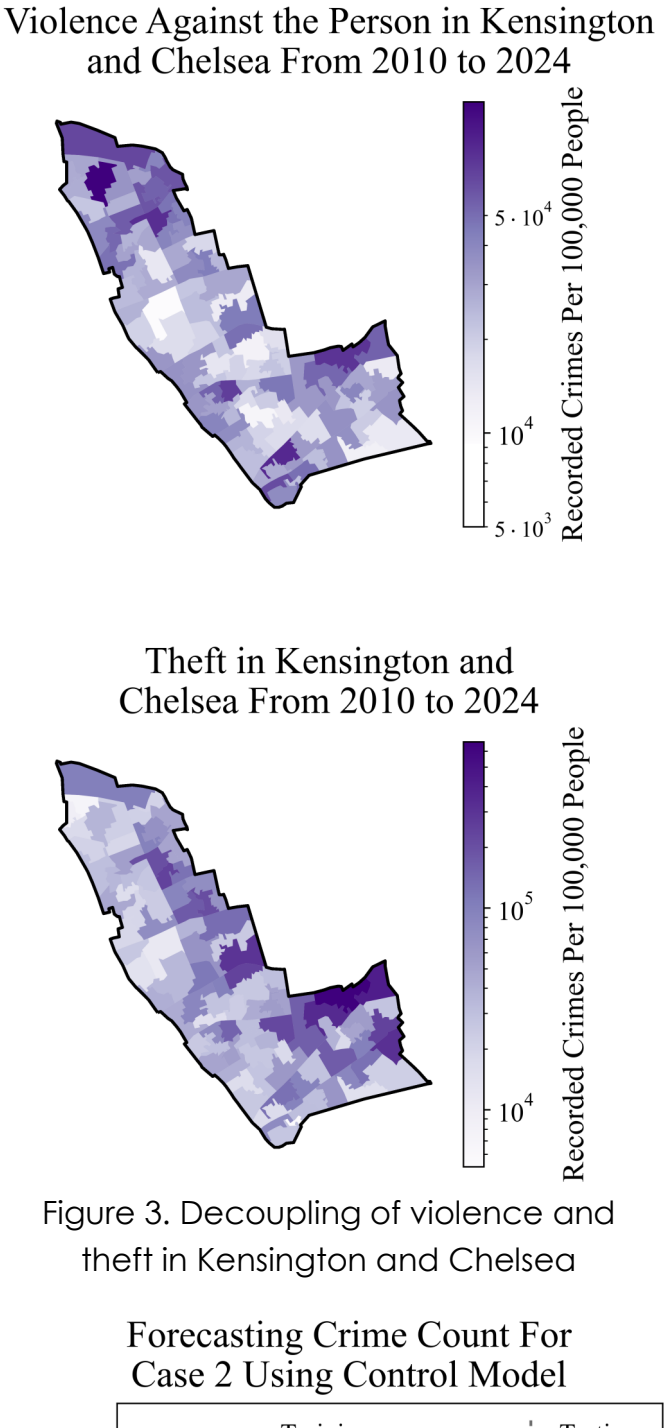

Figure 3. Decoupling of violence and theft in Kensington and Chelsea

The spatial correlation between Theft and Violence is much weaker in Kensington and Chelsea than other boroughs, and the distribution is shown in figure 3. This allows policymakers to explore underlying symptoms separately to better understand and approach each crime category.

LSTM and SARIMA are two methods used for forecasting. Figure 5 shows a confident prediction that violence in Camden Town would increase after the pandemic. A policymaker could use this to plan, for example increasing police presence and social support

Uncertainty in forecasts is an issue. Figure 3 suggests good capturing of the data with one-step forecasts, although error accumulation means designing policy based on these results is risky. The other cases suggest their use in only broad or short-term decisions making.

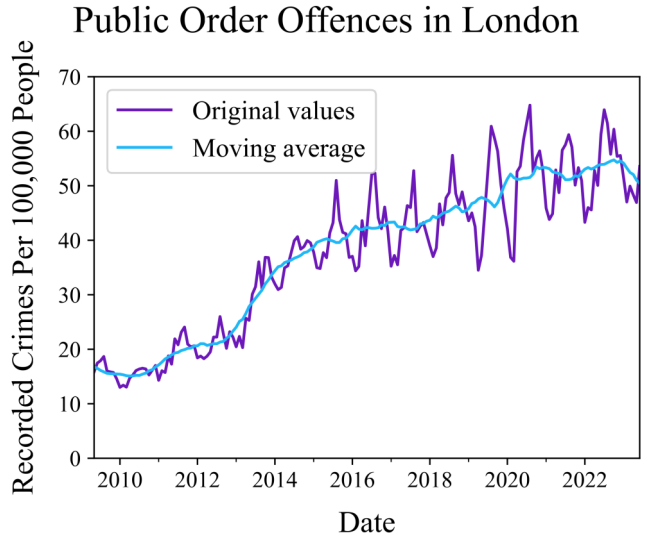

Figure 2. Public Order Offences rising significantly

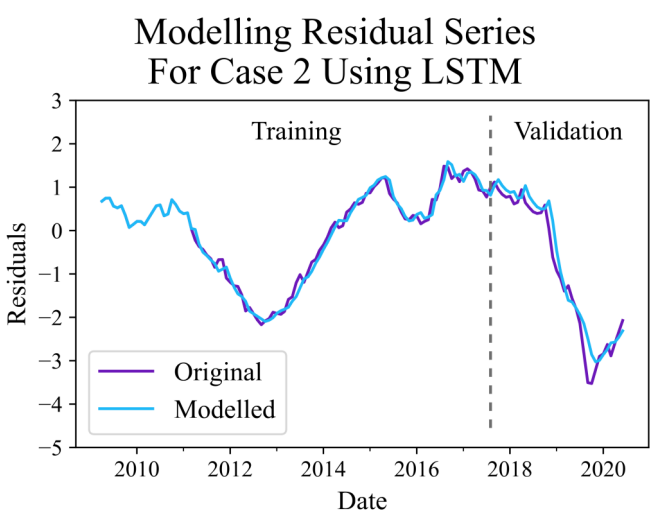

Figure 3. One-step forecasts are used for validation

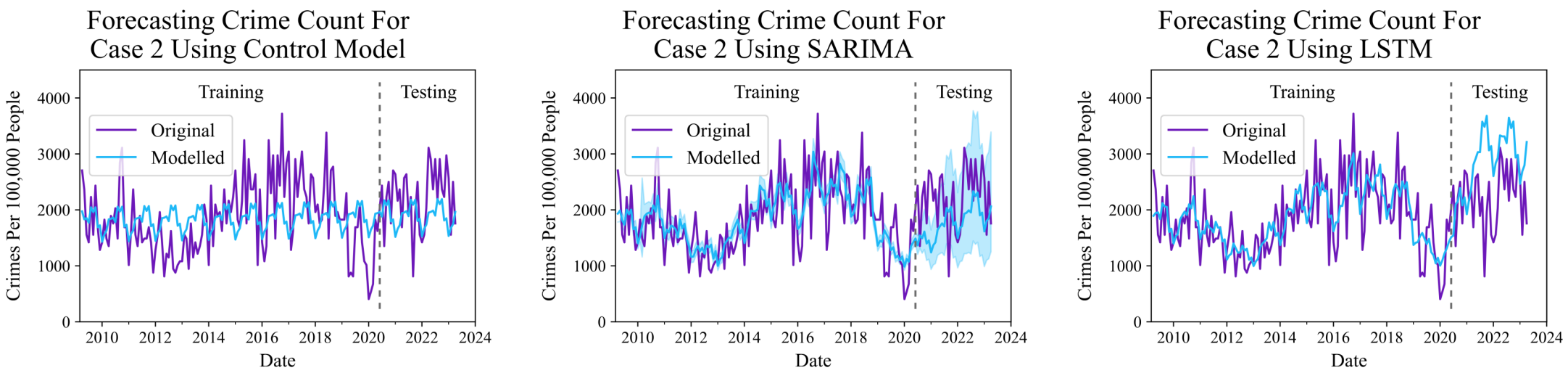

Figure 5. Forecasts of Violence Against the Person in Camden Town using a simple deterministic model, SARIMA, and LSTM respectively

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