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Predictive Analysis of Spatiotemporal Crime Data

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ABSTRACT

There has been a rise in the use of visual analytic techniques to create interactive predictive environments in a range of different applications. These tools help the user sift through massive amounts of data, presenting most useful results in a visual context and enabling the person to rapidly form proactive strategies. In this paper, we present one such visual analytic environment that uses historical crime data to predict future occurrences of crimes, both geographically and temporally. Due to the complexity of this analysis, it is necessary to find an appropriate statistical method for correlative analysis of spatiotemporal data, as well as design an interface to present these results to the user in a timely fashion. In our approach, we make use of the Dynamic Covariance Kernel Density Estimation (DCKDE) method to visualize the data in a geospatial context. The results are represented as a heat map showing the areas with a higher probability of crime. In the temporal context, a modified Seasonal Trend decomposition based on Loess (STL) is used to decompose time series signals in order to isolate trends that are used to predict the number of crime occurrences in pre-defined areas for a given time interval. These techniques were applied to Tippecanoe County to make predictions for the next time step. We evaluated the results of our prediction technique against observed data. We note that our methods are applicable to any situation where incidents may have a local spatial correlation.

KEYWORDS

Visual Analytics, Predictive Analytics, Dynamic Covariance Kernel Density Estimation, Seasonal-Trend Decomposition