Analyzing and Identifying Patterns of Temperature and Crime in Chicago

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Research Objective

Our primary objective is to investigate the relationships between temperature trends and crime trends in City of Chicago. By utilizing publicly available historical crime data, and temperature data (1x1 km) from the Weather Research and Forecasting (WRF) model, we conduct a comprehensive analysis at the census tract level to identify specific neighborhoods that are particularly sensitive to high crime rates and elevated temperatures, and which demonstrate patterns similar to those observed across the entire city.

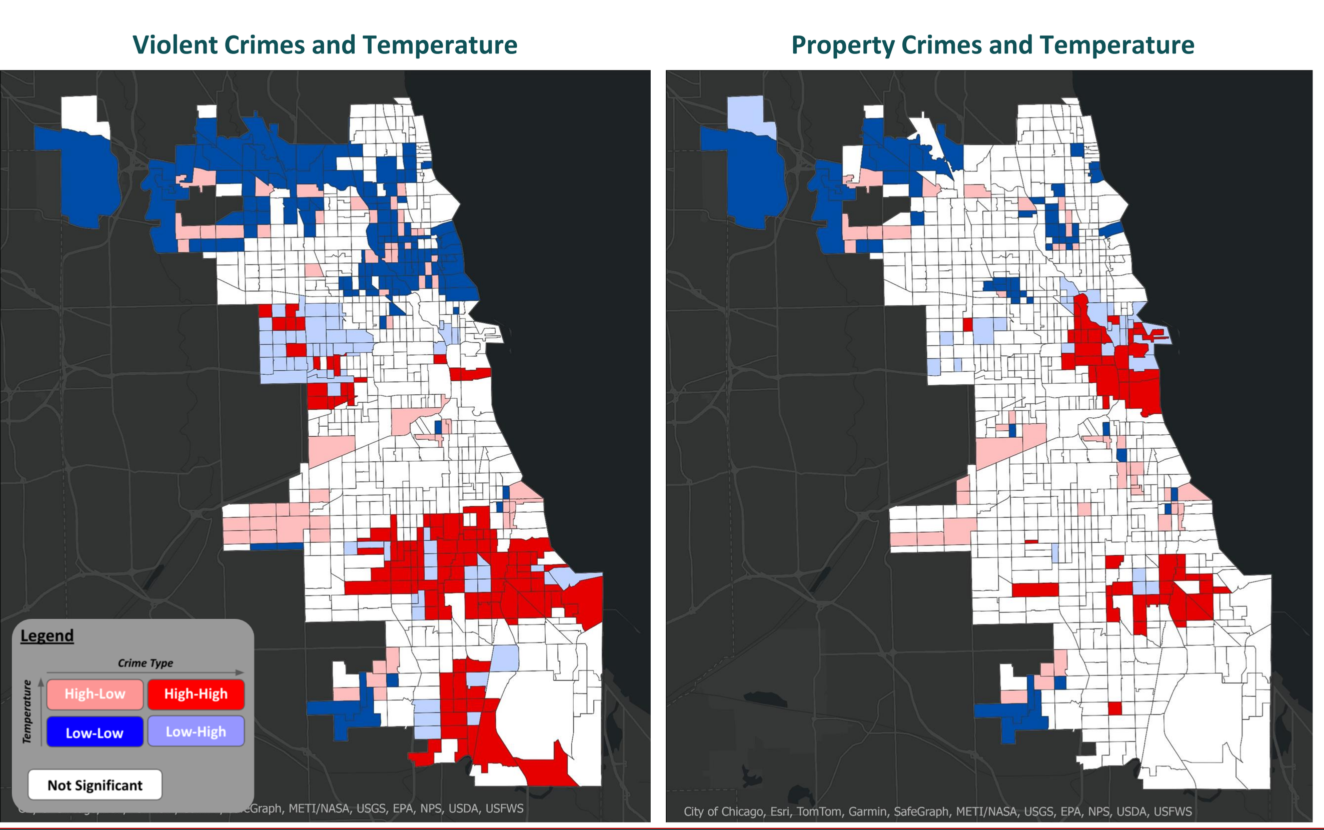
Association Rule Mining

Association rule mining is a data mining technique used to uncover interesting relationships, patterns, or associations among a set of items in large datasets. In this case, we used crime and temperature of past 2 days, and calculate threshold using 75th percentile for each annual winter season using Apriori algorithm.

antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
(TH2, TH1)	(CH1)	0.125602	0.247265	0.081838	0.651568	2.635102	0.050781	2.160350	0.709640
(TH3, TH2, TH1)	(CH1)	0.093217	0.247265	0.063457	0.680751	2.753126	0.040408	2.357832	0.702237

As can be seen in the table on the right, when we see a combination of three consecutive warmer days, there is a high confidence (68%) that high crime might occur on the given day. We are able to capture close to 25% of high crime (0.063457 (support) out of 0.247265 (consequent support)) using this pattern. We also observe a lift of over 2.75, attesting to the association between these two happening together.

Spatial Clustering (Bivariate Local Moran's I)

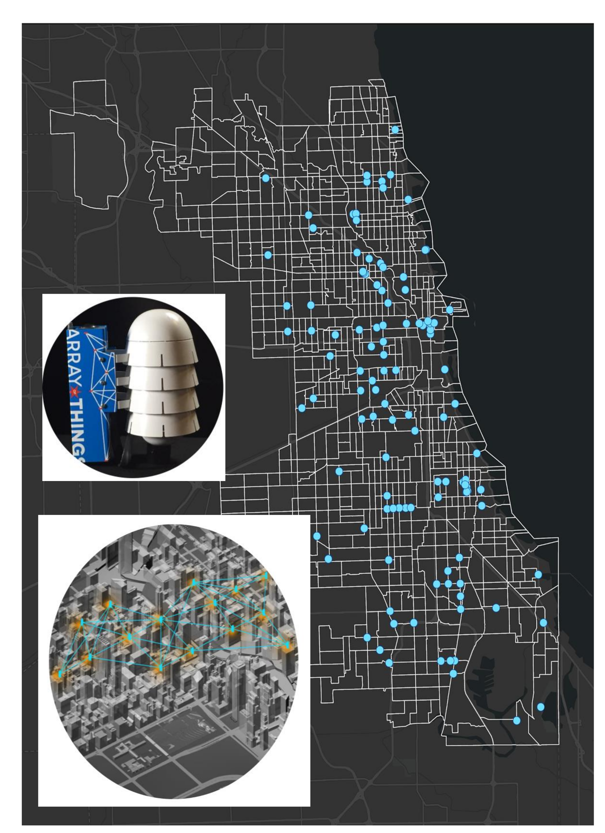


AoT Data Integration

The Array of Things (AoT) is an urban sensing project designed to collect real-time data on various environmental and infrastructure conditions in cities. Launched in Chicago, the initiative involved installing networks of sensor nodes on streetlight poles and other urban infrastructure to gather data in real time on air quality, temperature, humidity, noise, light, and other factors.

Why are we using it?

- High spatial-temporal resolution temperature data
- Better representation of temperature on ground
- Enhance current effort to explore relationship between crime and temperature (as compared to WRF coarse resolution temperature data)



Installed AoT Node Location

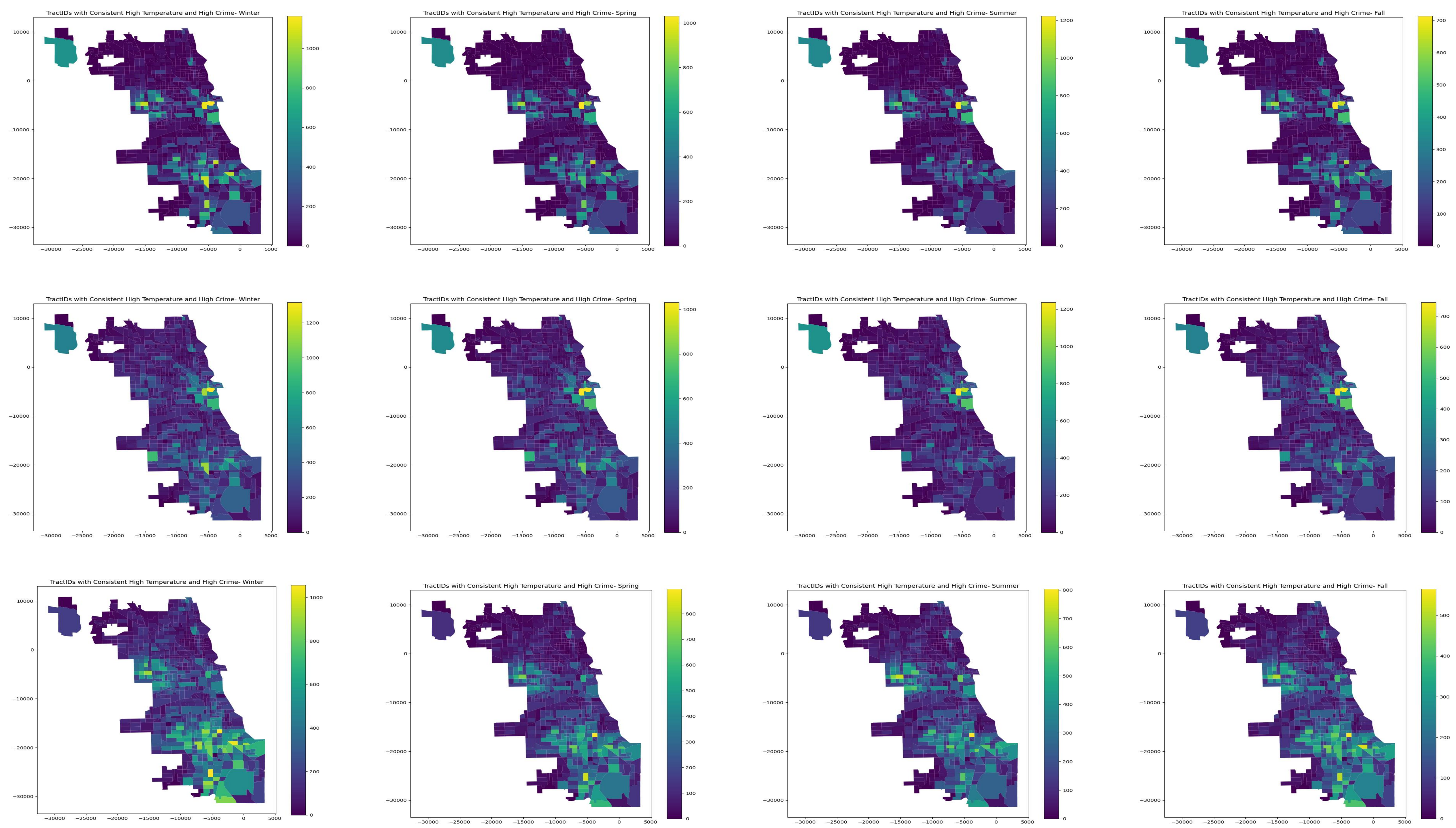
Spatial-temporal Distribution of Crime and Temperature

Winter Spring Summer Fall

Overall Crimes

Property Crime

Violent Crime



Work in Progress: AOT Data Processing Model in GIS