

# 2015 - 2017 Clustering of Crime Statistics in Nashville and Davidson County

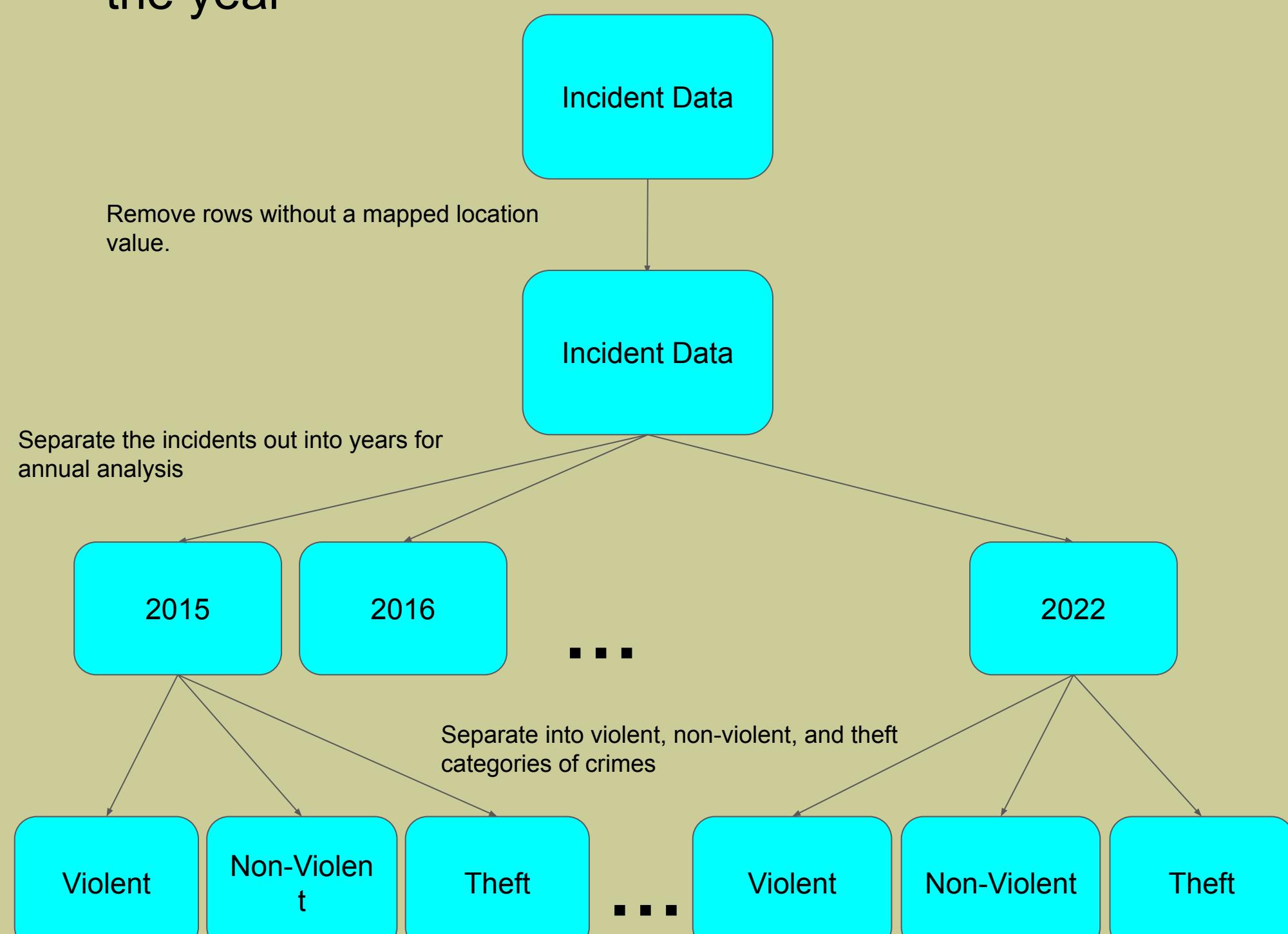
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## Motivation

- Understanding crime data can benefit both police and the general public.
- Support citizens wishing to avoid dangerous areas
- Provides a basis for creating new policing policies .
- By analyzing the past police incidents, we can identify trends in crime and understand what areas are problematic.

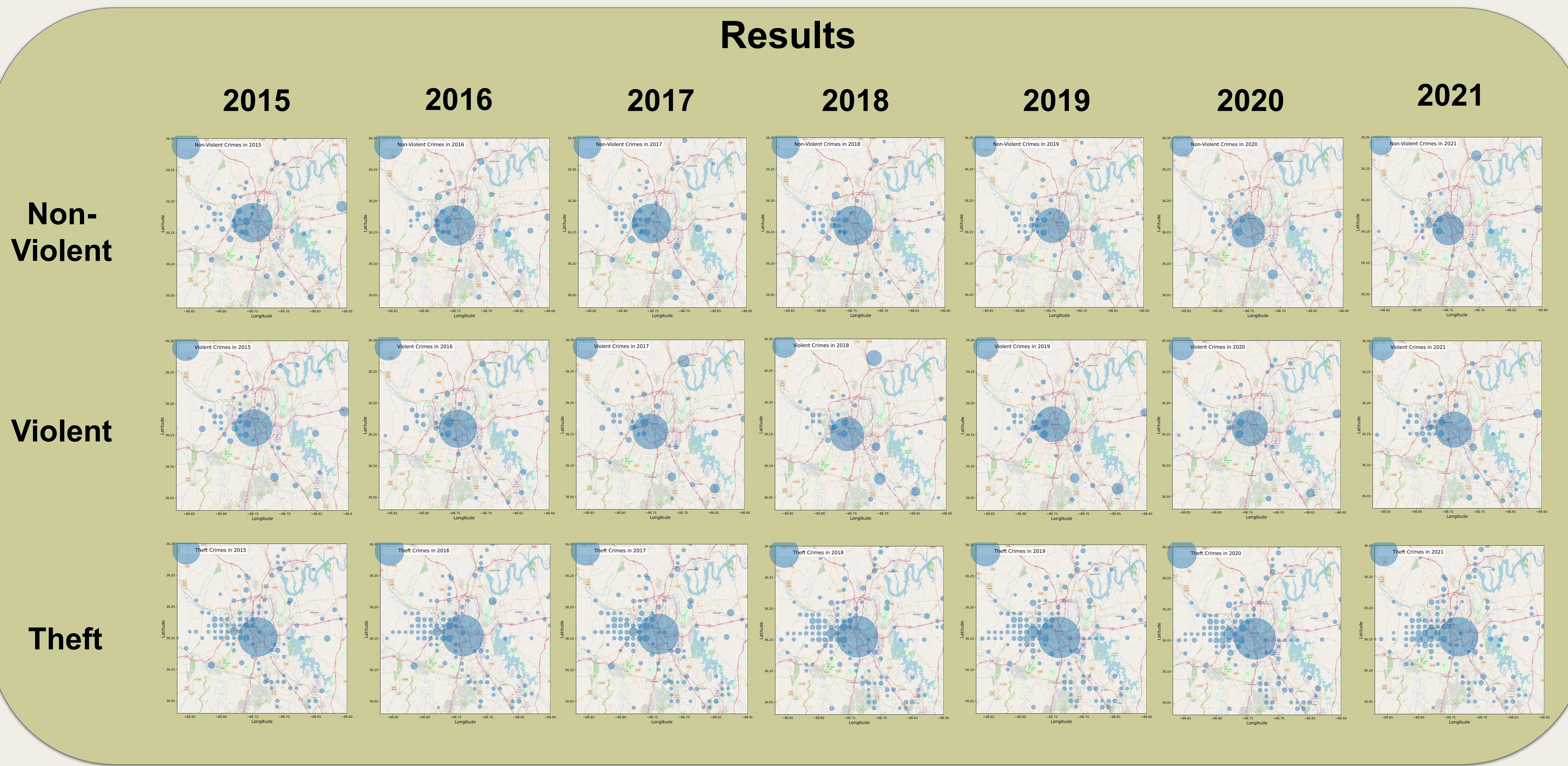
## Methodology

- Data is preprocessed to prepare it for a cluster analysis
- 2022 data was removed as it is incomplete for the year



- Each type of incident for each year is clustered using the HDBSCAN algorithm.
- HDBSCAN is a hierarchical variation on the traditional DBSCAN algorithm with some key differences
  - Form clusters of varying density
  - Account for noise in the dataset
  - Form clusters of arbitrary shape
- Because of the arbitrary shaped clusters, traditional evaluation methods for clustering are not optimal
- A hyperparameter search of the two available parameters (min\_cluster\_size and min\_samples) was performed over a range of values
  - min\_samples: [4, 8, 10, 15, 20, 30, 50, 75, 100, 125, 150]
  - min\_cluster\_size: [10, 25, 50, 75, 100, 125, 150, 200]
- Optimal parameters selected: 100, 100

## Results



## Data Description: Metro Nashville Police Department Incidents

- Contains data from 2015 to 2022 on every incident recorded in Davidson County
- An incident is defined as: "one or more crimes committed by an individual or a group of individuals acting in concert and at the same time and place"<sup>1</sup>
- Contains 883 thousand incident reports and 31 columns to represent each incident, including the type of crime, coordinates of where it occurred, and date it occurred

## Summary

### All Crime

- Largest cluster indicates crime mostly occurs in and around the south side of downtown
- All crimes are more prevalent near airports and TN State uni. and Vanderbilt.
- Majority of crime happens in downtown Nashville and to the west and south
- Violent and non-violent crime from 2020 to 2021 has continued to increase to the west of Nashville, specifically in the area Bell's Bend

### Non-Violent

- More clustered around marinas, campgrounds, and golf courses compared to violent crimes

### Violent

- Relatively little north of the Cumberland River above downtown Nashville

### Theft

- Much more spread out than the other categories, largely concentrated to the west

## Conclusions

- HDBSCAN is able to accurately identify areas of increased crime throughout the nashville area (confirmed through matching large clusters to known areas of high crime)<sup>2</sup>
- Enables visual understanding of where particular types of crimes occur in and around Nashville
- For places outside Nashville proper, offers insight on where to avoid (e.g. Hermitage Golf Course consistently has non-violent and theft crimes occurring despite little else around)
- Can be a valuable tool for individuals not familiar with the city and wishing to stay safe
- Offers police and lawmakers insight into dangerous areas to help inform policy decisions.

1. <https://data.nashville.gov/Police/Metro-Nashville-Police-Department-Incidents/2u6v-ujjs>

2. <https://www.areavibes.com/nashville-tn/most-dangerous-neighborhoods/>