

Objective:

The objective of this project is to utilize data visualization to detect and highlight high-crime areas in Washington DC from 2012 to 2018, enabling the police department to concentrate their efforts where needed most. By employing geographical maps, bar graphs, and heat maps, we aim to pinpoint specific blocks with high crime rates and categorize the types of crimes, such as murder and sexual abuse, for targeted intervention and resource allocation.

Raw Data:

Source of Raw Data: OpenData DC (<https://opendata.dc.gov/search>)

Data sets for DC crimes from 2012-2018, each containing approximately 35,000 lines in a CSV file.

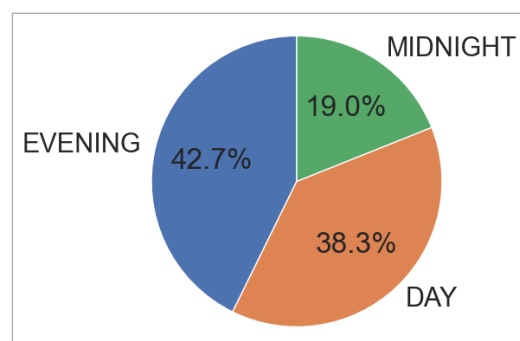
Total Incidents: 231,547 crime incidents (2012-2018)

Attributes Included:

- Geographical Coordinates: Latitude and longitude
- Crime Classification: Violent vs. non-violent
- Method of Offense: Various methods including 'Knife', 'Gun', 'Others'
- Shifts: Day, Evening, Midnight
- Specific Offense Types: Homicide, Robbery, Theft, Arson, etc.
- Block Location: Specific block where the incident occurred
- Neighborhood Clusters: Areas within the city
- Police District Identifiers: Districts and Police Service Areas (PSAs)
- Time-Related Information: Report date, start date, end date

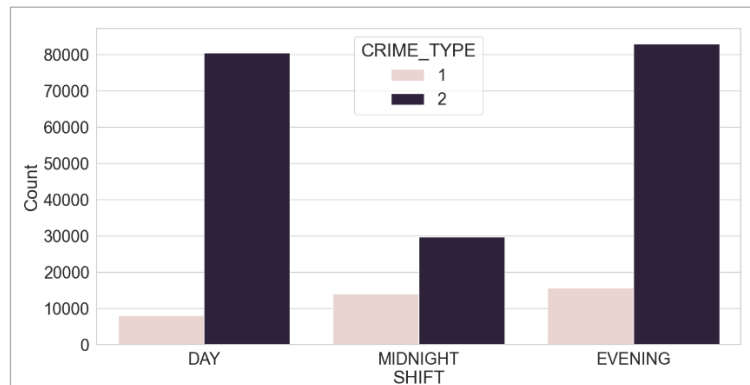
Python Script:

https://github.com/viraj-dhane/Python_CrimeAnalysis/blob/main/DC_CrimeAnalysis.py

Visualization and Analysis**Crimes by Shift:**

Most crimes occur during the Evening, making up 42.7% of the total, followed by the Day shift at 38.3%. The Midnight shift has the lowest crime rate at 19.0%. This indicates a higher

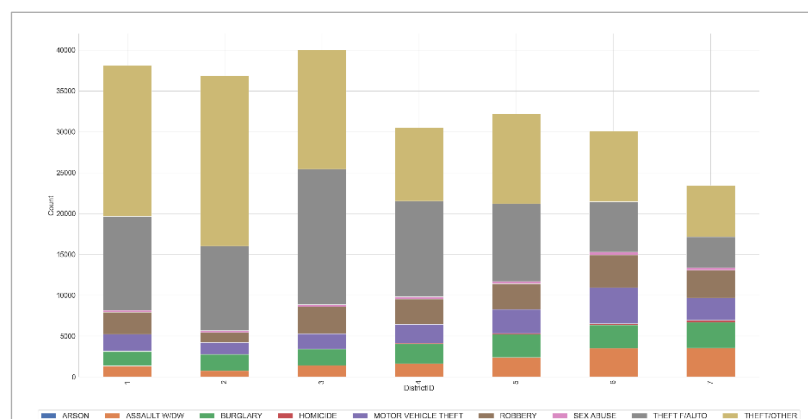
concentration of criminal activity during the Evening and Day shifts, suggesting a need for increased law enforcement during these periods.



The bar chart shows the count of violent (Type 1) and non-violent (Type 2) offenses across different shifts. Non-violent crimes are significantly more prevalent than violent crimes in all shifts. Both the Day and Evening shifts see the highest number of non-violent offenses, each exceeding 80,000 counts. The Midnight shift experiences fewer offenses overall, but non-violent crimes still dominate. This indicates a critical need to address non-violent crimes, particularly during the Day and Evening shifts, to enhance public safety.

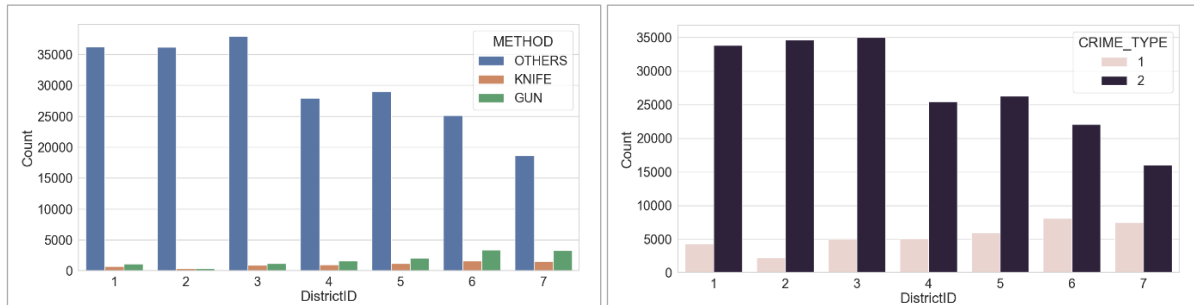
Crimes by City's Police Districts:

The stacked bar chart below provides details on the various types of crimes typically occurring in the Washington DC area, categorized by the city's police districts. Each district is represented by a stacked bar plot to visualize the crime data. This chart counts the number of occurrences for each crime type and presents the results using vertically stacked bar heights.



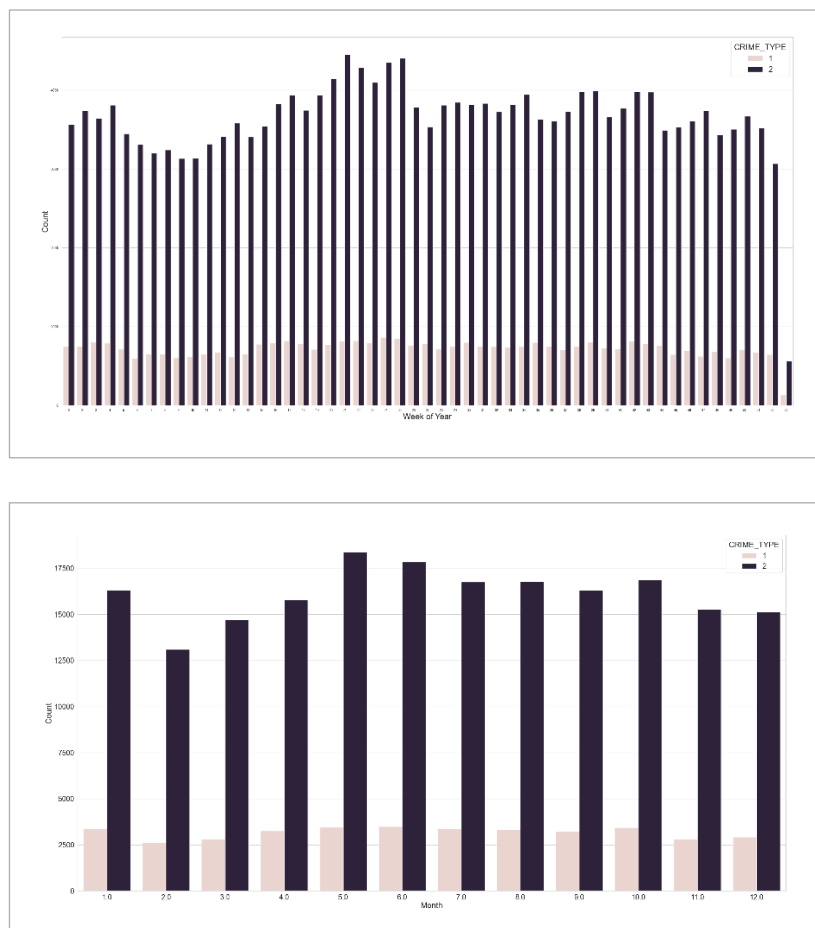
The stacked bar chart displays the distribution of various crime types across different police districts in Washington DC from 2012 to 2018. Theft/Other is the most prevalent crime in all districts, followed by Theft from Auto. Districts 1, 2, and 3 report the highest overall crime rates,

while District 7 has the lowest. This pattern suggests a need for tailored crime prevention strategies focusing on the most common offenses in each district.



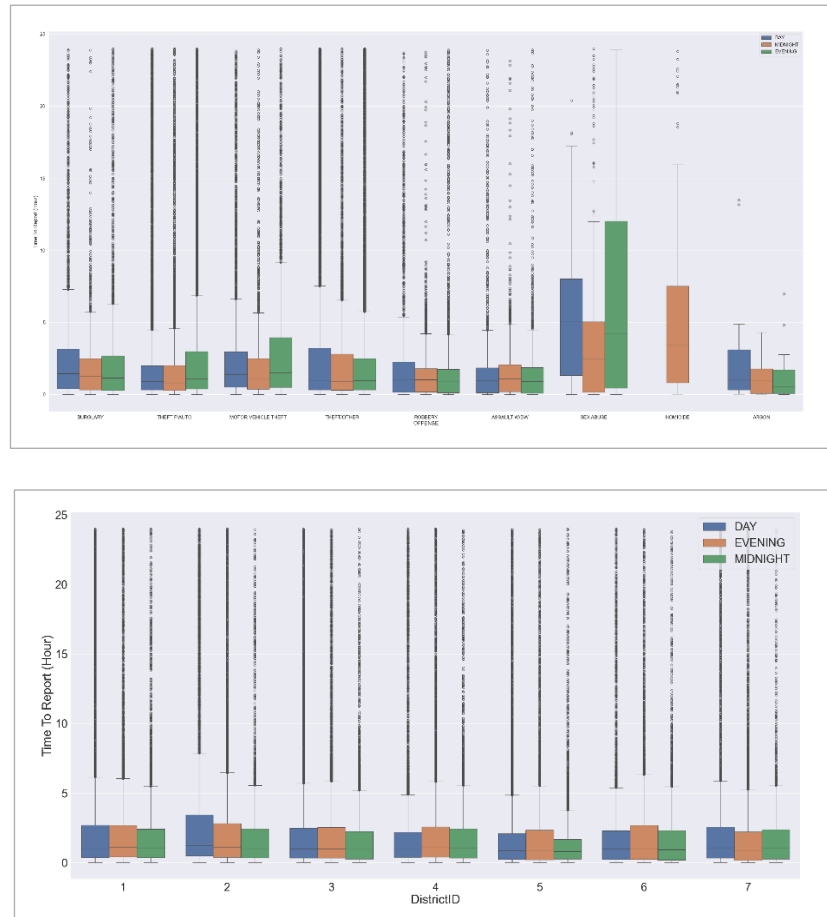
Left hand side chart shows that 'Others' is the most common method of offense in all police districts, with districts 1, 2, 3, and 4 having the highest counts. The right-hand side chart reveals non-violent crimes are more prevalent across all districts, with districts 1, 2, and 3 reporting the highest rates, while district 7 has the lowest. This highlights the need for targeted strategies to address the dominant offense methods and the high rate of non-violent crimes in these areas.

Crime distribution over months and weeks of year:

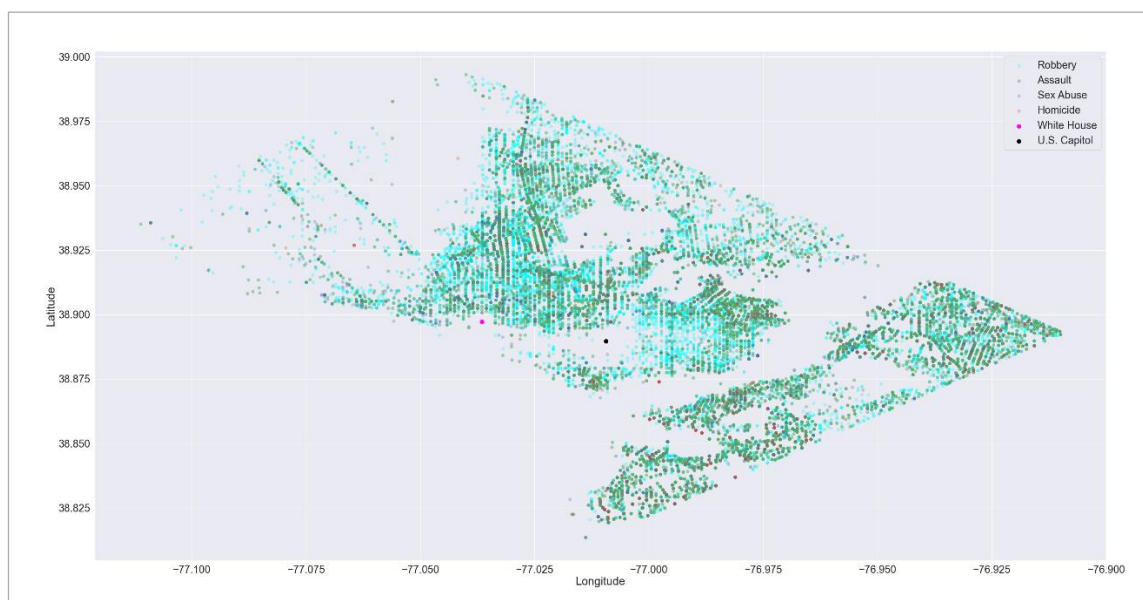
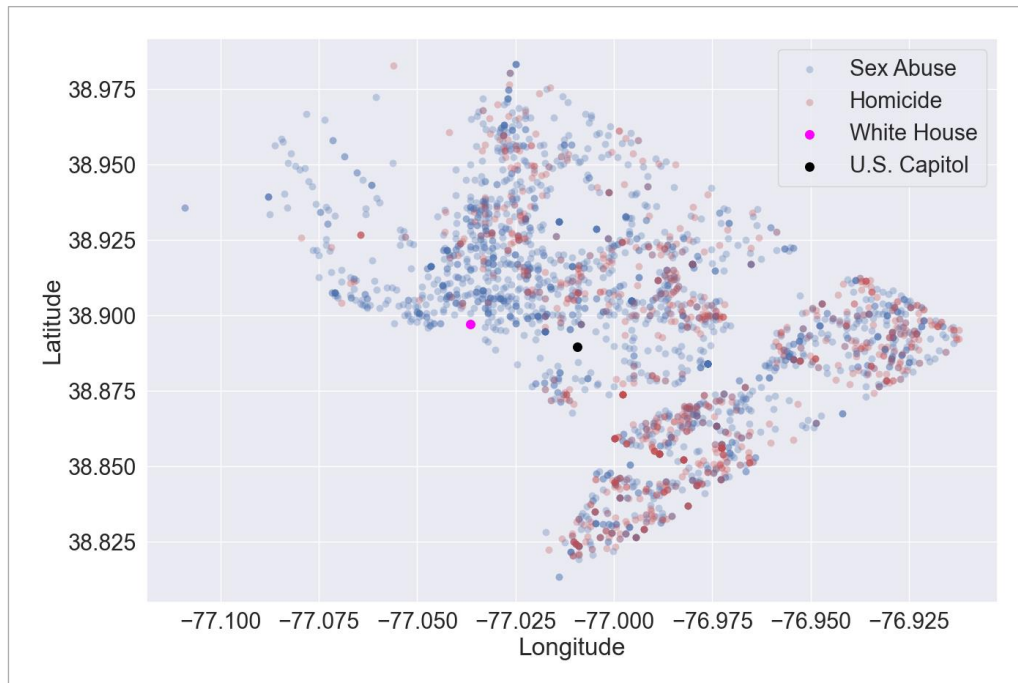


Non-violent crimes consistently outnumber violent crimes throughout the year. The highest crime counts are observed in the summer months (June to August) and weeks 25 to 35, indicating a seasonal trend in crime rates. This overlap suggests that crime prevention efforts should be intensified during summer.

Crime Reporting Time Analysis:



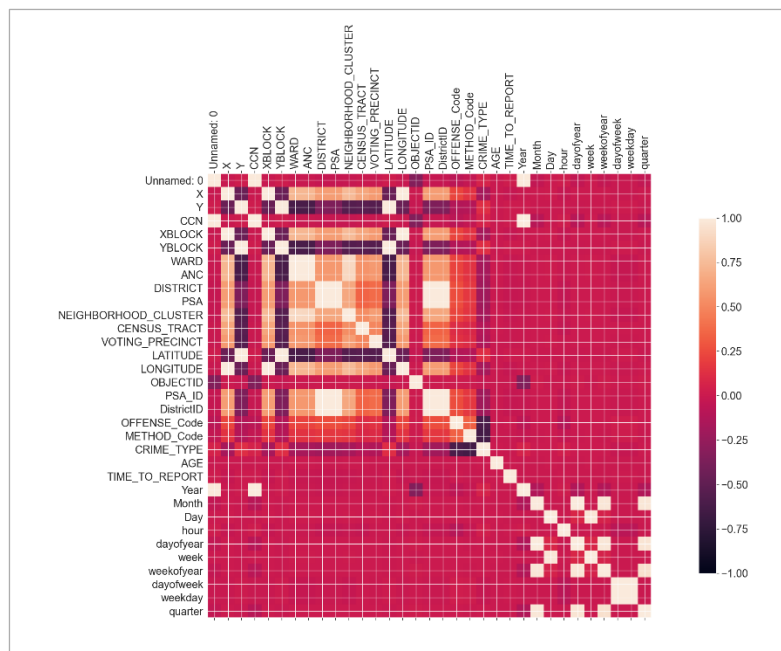
The first box plot shows the time taken to report crimes by shift across different police districts, indicating that the reporting time is generally consistent across all districts and shifts, with most reports being filed within a few hours. The second box plot compares reporting times across different offense types and shifts, revealing that offenses such as sex abuse and homicide have significantly longer reporting times compared to other crimes. The overlap in both charts indicates that reporting times are longest during the Midnight shift, particularly for severe crimes like sex abuse and homicide.

Crime Mapping across the District:

The first scatter plot maps the locations of sex abuse and homicide offenses in Washington DC, highlighting the proximity to key landmarks such as the White House and the U.S. Capitol. The second scatter plot extends this analysis to include robbery and assault, showing a broader

distribution of violent crimes across the city. Both maps reveal that violent crimes are concentrated in specific areas, particularly around central Washington DC. This spatial clustering indicates the need for focused policing efforts and community interventions in these high-risk zones to effectively reduce violent crime rates.

Correlation between data:



Conclusion:

The crime analysis for Washington DC from 2012 to 2018 reveals several important trends and insights. The data consistently shows that non-violent crimes significantly outnumber violent crimes across all shifts, with the highest concentrations occurring during the Day and Evening shifts. Reporting times for crimes are generally swift, though severe offenses like sex abuse and homicide take longer to be reported, particularly during the Midnight shift.

Spatial analysis indicates that violent crimes are concentrated around central Washington DC, especially near significant landmarks such as the White House and the U.S. Capitol. This spatial clustering highlights the need for focused policing efforts in these high-risk zones.

Seasonal trends are also apparent, with a notable increase in both violent and non-violent crimes during the second and third quarters of the year. This pattern likely correlates with increased outdoor activity and social interactions during warmer months, leading to more opportunities for crime. Conversely, holiday periods such as New Year, Independence Day, Thanksgiving, and Christmas account for a relatively small percentage of total reported crimes. This indicates that while holidays may influence crime rates, their impact is less significant compared to the broader seasonal trends observed throughout the year.

Further analysis distinguishes between general crime types (violent vs. non-violent) and specific offense codes (e.g., homicide, robbery, theft, arson). Time of day emerges as a critical factor, with evening hours showing higher crime rates than daytime. Geographic factors also play a role, with different trends observed in various political and police districts. These findings suggest that while geographic location influences crime patterns, it is intertwined with political and administrative boundaries, complicating the isolation of pure geographic effects.

In conclusion, the comprehensive analysis provides valuable insights for the Washington DC police department. It underscores the importance of time and location in understanding crime patterns and highlights the need for targeted strategies to address the high prevalence of non-violent crimes, especially during peak times and in high-risk areas. By leveraging these insights, law enforcement can better predict, prevent, and respond to crime, ultimately enhancing public safety and community well-being.