Project 1 Report

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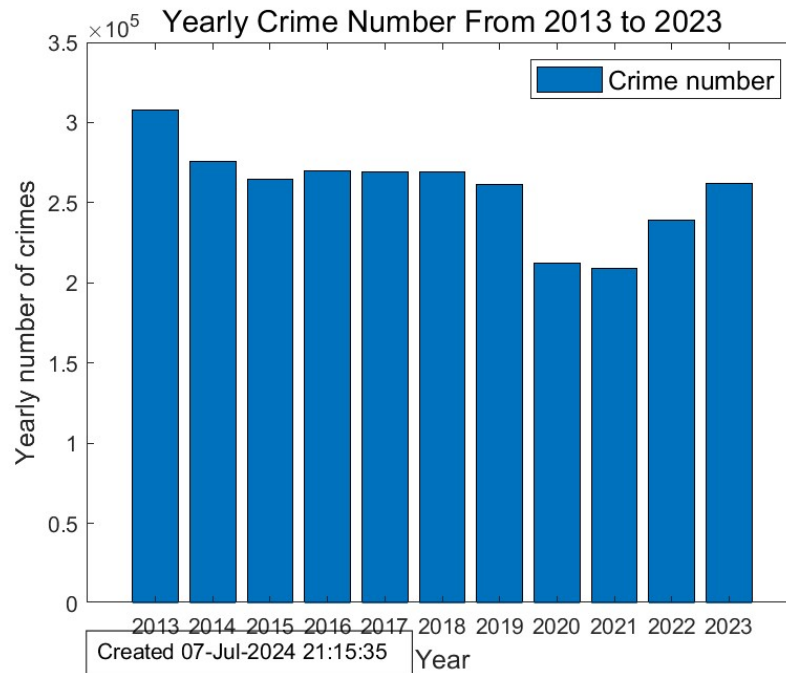## 1 Analysis of crime number by year

Figure 1: Yearly crime Number from 2013 to 2023

Explanation: This figure illustrates the total number of crimes each year from 2013 to 2023.
From the figure we can observe that:

- There is a noticeable decline in crimes from 2013 to 2018, a slight increase in crime rates is observed from after 2019.

- The highest number of crimes occurred in 2013(307561).

- The impact of COVID-19 in 2020 and 2021 is evident with reduced crime rates.

Influence Factors:

- Socioeconomic conditions and community initiatives.

- Law enforcement strategies and changes in policing practices.

- Pandemic-related restrictions(especially in 2020 and 2021)

2 Analysis of crime number by month
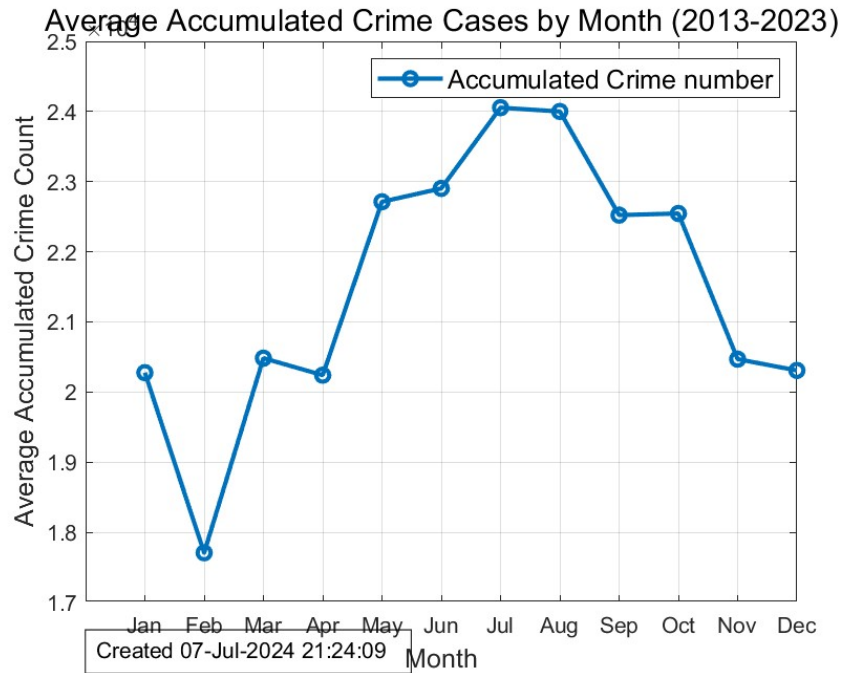
2.1 Average accumulated crime cases in a year

Figure 2: Average accumulated crime cases by month(2013-2023)

Explanation This figure shows the average number of crime cases accumulated each month over the years 2013 to 2023.

- There is a clear increase in crime rates during summer (June to August) and a decrease during the winter months (November to January).

- The lowest number of crime cases occur in February, significantly lower than any other month.

Influence factors:

- Temperature and Season effects: Higher outdoor activity during warmer months leads to more opportunities for crime.

- Colder temperature and harsh weather (e.g snow storms) in winter months significantly reduce crime. This effect in significant in February.

- Holiday seasons and school vacations (from June to September) increase crime rates. Showing much of the crimes are convicted by juvenile.
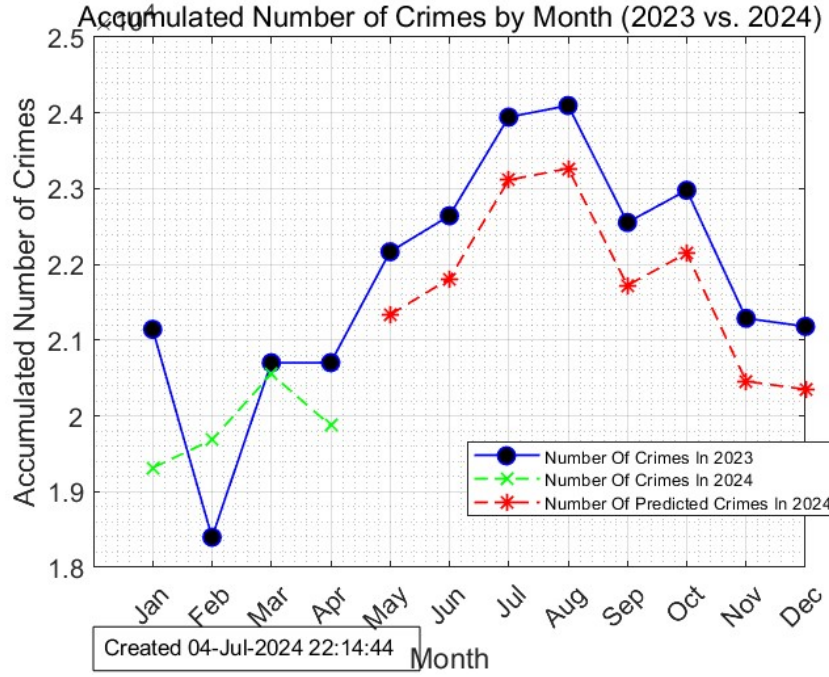
2.2 Prediction of crimes in 2024

Figure 3: Accumulated number of crimes by month

Explanation: The blue and green line shows the number of crimes in 2023 and 2024 respectively, while the red line shows the predicted data in 2024. The prediction for the last 8 month of 2024 is calculated based on the following formula:

$$C_{(2024,m)} = C_{(2024,m-1)} + C_{(2023,m)} - C_{(2023,m-1)} \tag{1}$$

- In 2023,crimes increases steadily and reached its peak around July, and then declines towards the end of the year.

- In 2024, crimes initially follows a similar trend as 2023 but stabilize with a lower accumulation rate.

- The prediction show there is a slightly lower crime rate for the remaining months of 2024 compared to the same period in 2023, signifying a safer community.

Influence Factors:

- Seasonal variations: Peaks in summer months and declines in winter.

- Policy changes or law enforcement strategies implemented in 2024 may be reducing the crime rate.

3   Analysis of crime type

Distribution of Top 10 Crime Primary Types (2013-2023)
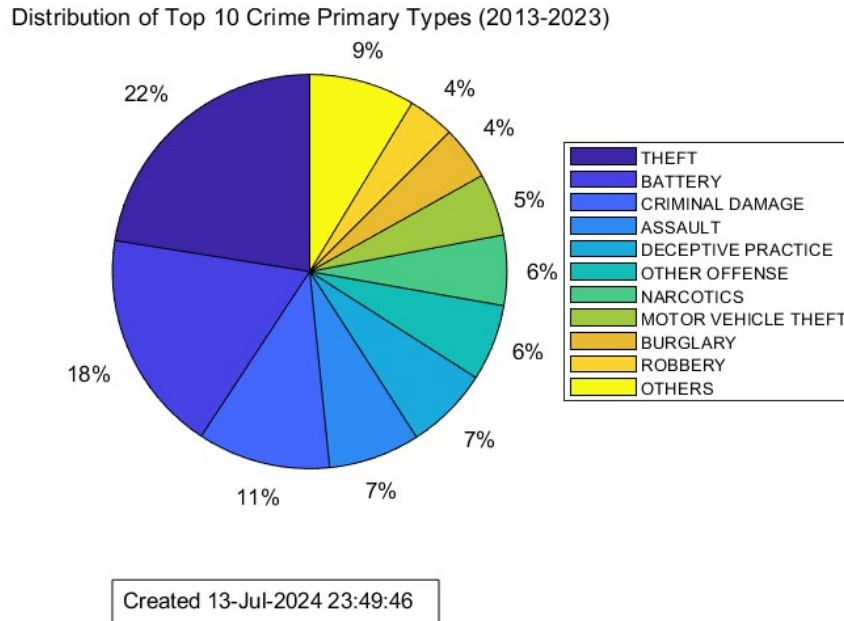
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Figure 4: Distribution of top 10 primary types

This figure displays the distribution of the top 10 primary types of crimes.

- Theft is the predominant crime type, accounting for nearly $\frac{1}{4}$ of the crimes, followed by criminal damage and battery.

- All these three are responsible for more than half of all the crimes.

- Other significant categories include public peace violations, assault, and burglary.

Influence factors

- Economic factors: Higher theft rates are often correlate with economic challenges. The slow economic growth in Chicago may be responsible.

- Urbanization: Criminal damage and battery are often caused by high density areas or over-crowed districts due to the gathering of citizens. This shows an imbalance in the distribution of citizens in Chicago.

Figure 5: Crime word cloud

Explanation The word cloud visualizes the most frequent words used in crime descriptions for the year 2023, with larger words indicating higher frequency. Common terms include "domestic battery," "simple," "over $500," "theft," and "automobile."

Influence factors:

- The prevalence of domestic issues and property-related crimes show that citizens are experiencing simple yet violent threat upon their property.

- It also shows lack of attention devoted to automobile such as car or bicycles.

- Law enforcement's focus are mainly on specific crime categories like theft and batteries.
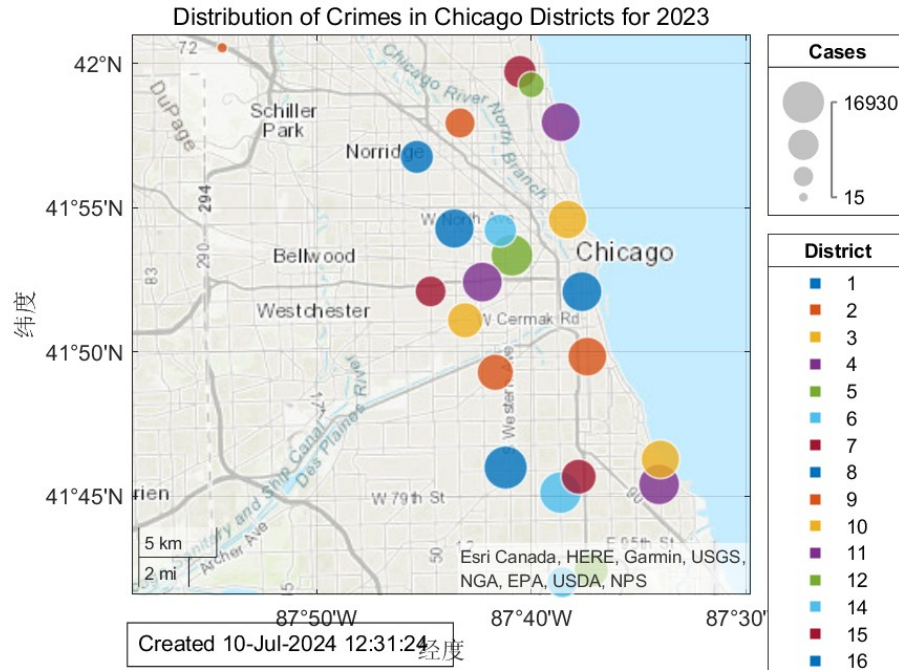
4   Analysis of crime location

Figure 6: Crime distribution (bubble)

Explanation: This bubble chart represents the distribution of crimes across different communities. The larger the bubble, the higher the crime density.
Crime is more concentrated in certain districts, with some districts showing significantly higher crime rates. The central and some southern districts have higher crime densities.
Influence factors

- Socioeconomic disparities across districts : Central and southern Chicago, with historically higher unemployment rates, align with the high-crime districts identified in the maps.

- The lowest crime rate occur in the northwest of the region with only 15 cases, this shows it is a safe place for residence.
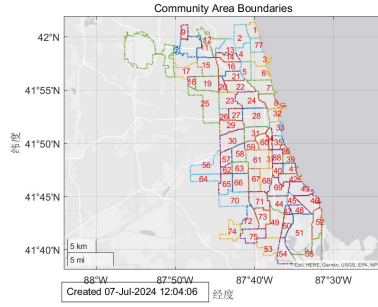
(a) Community Area Boundaries
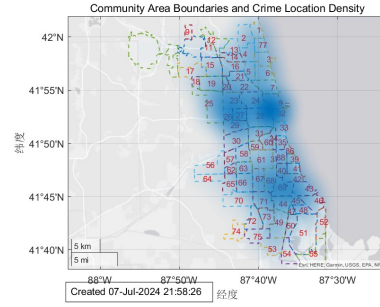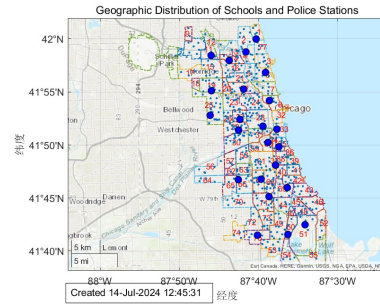

(b) Crime Location Density

Figure 7: Crimes distribution in Community Area

- Higher crime density in central and southern community areas.

- Specific community areas such as 28, 29, 30 (central) and 68, 69, 70 (southern) are particularly prominent in terms of crime density. These areas should be focuses for crime reduction and resource allocation.

- Northern and some western parts of Chicago show lower crime densities.

- Community areas such as 2, 7, 8, 12, and 13 have significantly lower crime densities. These areas might have better socio-economic conditions or more effective law enforcement presence.

Do it Yourself: What could influence crimes in Chicago?
Association with the distribution of police station and schools
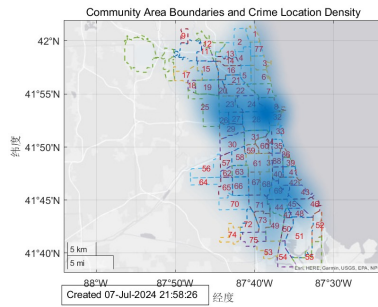
(a) Crime Location Density

(b) Distribution of Schools and Police Stations

Figure 8: Crime Location Density *versus* Distribution of Schools and Police Stations

fig(b) displays the locations of schools (small blue dots) and police stations

(large blue dots). fig(a)displays the density of crime density and community boundaries.

Compare the two figures:

Proximity to Police Stations and Schools:

- Areas with high crime density, such as central and southern regions, do not have as many police station as the neighbouring communities. This shows that even with police stations present, if the response times are slow or the police force is overwhelmed, crime rates can remain high.

- The east side of Chicago (e.g., communities 28 and 32) lacks educational resources and has a high density of criminal activity. Crimes in this region may be linked to not receiving proper education or under-developed socio-economic status.

- The south side of Chicago (e.g community 44 and 45) shows a wide distribution of schools yet has no police stations located. This presence of schools in high-crime areas highlights the need for collaboration between educational institutions and law enforcement to ensure student safety.

5   Conclusion

According to the above analysis, the current crimes may be related to the below factors:

- **Natural factors**

  - Seasonal change
  - Weather and Temperature change

- **Human factors**

  - Socioeconomic Disparities
  - Inadequate Police Presence
  - High population density and Poor urban
  - Weak Community Engagement and Educational Resources:

Current crime rates in Chicago is witnessing a good omen, with steadily declining cases. Stronger community ties, better access, better policy and legislative can mitigate some of the factors leading to crime. Additionally , more efforts should be devoted to the most common crime types by tackling common thefts and robberies. By addressing such issues Chicago can work towards reducing crime rates and enhancing public safety, and improving the quality of life for its residents.