Carjacking Analysis in Chicago: Visualizing Trends for Policy Implications

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Introduction

Background

- Carjacking is a pressing urban issue, with significant impacts on public safety, insurance policies, and law enforcement resource allocation.
- According to WTTW News in 2023, Chicago is reporting more incidents than any other city in the United States.
- Carjacking incidents in Chicago vary widely across neighborhoods and time.

Research Questions

- How do temporal and spatial patterns of carjacking incidents in Chicago inform actionable policy and insurance solutions?

Methods in Data Analysis (1)

Data Sources

- Chicago Data Portal: Carjacking Incidents (2001-2024) and Chicago Community Area Boundaries (GeoJSON)

Key Data Attributes:

- Incident date, time, and coordinates
- Neighborhood area boundaries

Data Preparation:

1. API-based data retrieval
2. Spatial Joins and aggregations by year, month, and time of day

Methods in Data Analysis (2)

Visualization and Shiny Dashboard

- Static choropleth maps and line charts to explore trends.
- Shiny app for dynamic filtering by neighborhood and date range.

NLP Analysis

- Collected text data on Chicago auto insurance, carjacking, and insurance policy using web scraping and APIs and Applied NLP for sentiment analysis: Subjectivity and Polarity

Challenges faced:

1. **API Limitations**: The Chicago Data Portal limits API downloads to 1,000 rows per request, hence we used pagination to retrieve all 22,192 records.
2. **Data gaps**: Missing or incomplete records, such as missing coordinates, required exclusion (144 data rows per November 30th, 2024).

Spatial Patterns

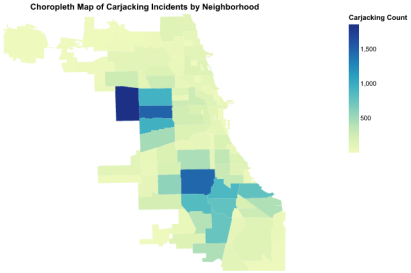

Figure 1: Choropleth Map of Carjackings

Analysis

- Hotspot Neighborhoods: **Austin, West and East Garfield Park, Englewood**.
- Hotspots align with areas facing economic challenges and limited community infrastructure
- Suggests localized interventions for those areas

Temporal Trends

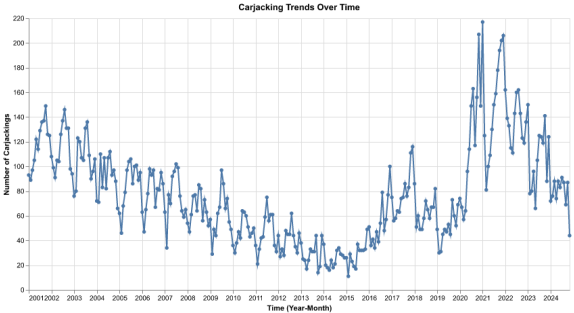

Figure 2: Carjacking Trends Over Time

What might explain the 2020-2021 spike?

- Pandemic disruptions
- Economic uncertainty
- Police resource reallocation during social unrest

Shiny Interactive Dashboard

- Dynamic choropleth map for spatial analysis with date and neighborhood filters
- Dynamic line charts for time series analysis with date and neighborhood filters
- Empowers policymakers and stakeholders to explore patterns interactively

NLP Analysis: Polarity and Subjectivity

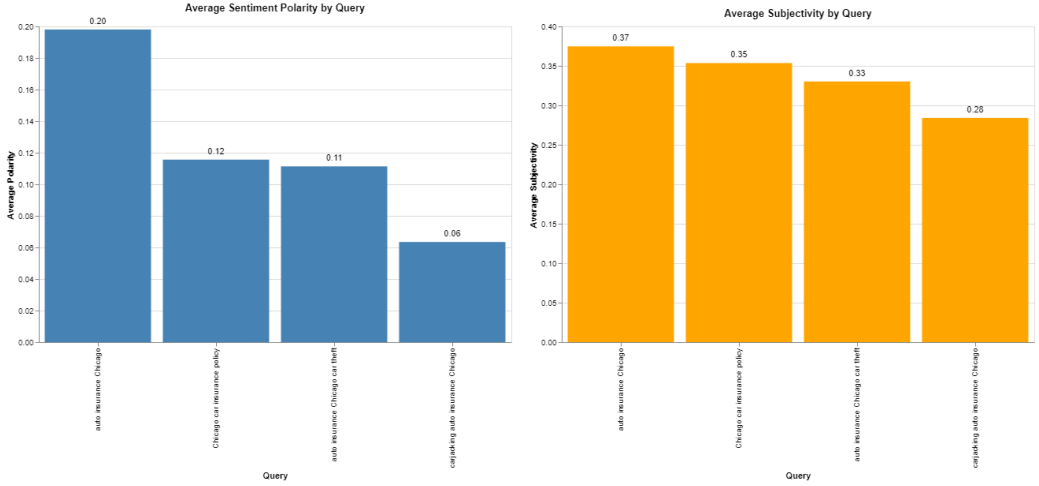

Figure 3: Average Polarity and Subjectivity by Query

Policy Implications

Targeted Interventions for Hotspots:

- Increased patrols and community safety programs.
- Infrastructure improvements (lighting, cameras).

Temporal Resource Allocation:

- Deploy resources strategically during crime spikes.
- Prepare for surges in external crises.

Fairer Insurance Policies:

- Risk-based pricing.
- Incentives for safety measures.
- Collaboration between insurers and law enforcement.

Conclusions

Key Takeaways:

- Combining spatial, temporal, and sentiment analysis provides a holistic view of carjacking trends and public perceptions

Future Directions:

1. Integrate additional datasets (e.g. traffic patterns, socioeconomic factors)
2. Enhancing the dashboard's interactivity and performance by optimizing data structures will improve user experience and scalability.