MAPPING CRIME: GRAPH DATA SCIENCE FOR CRIME INVESTIGATION

Sidra Aamir, Areeb Kazmi

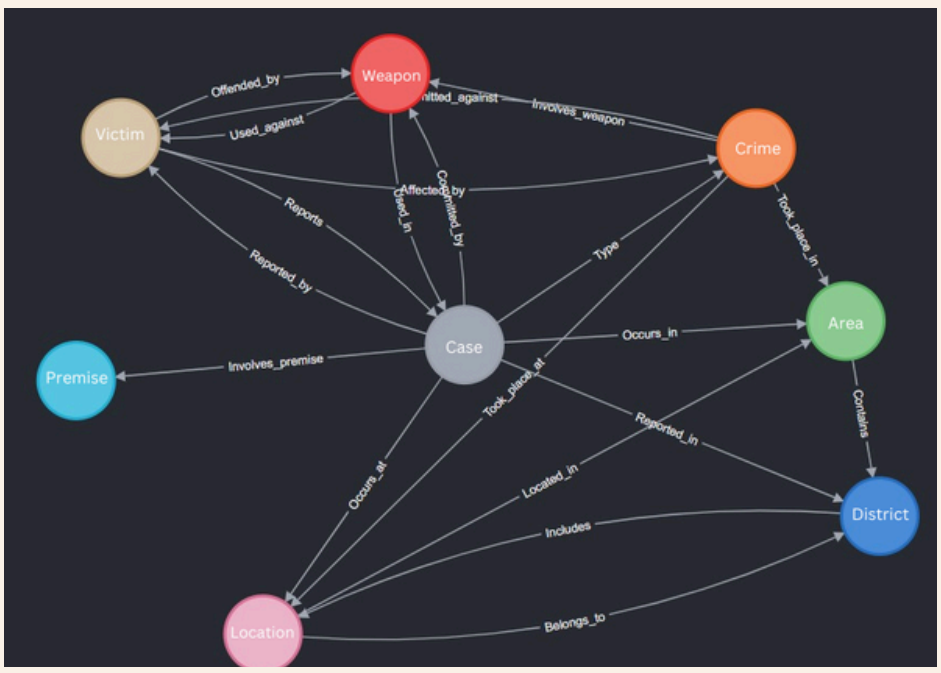
Problem Statement

Conventional crime investigation faces challenges with large, complex datasets, leading to lengthy analyses and incomplete results. Reliance on Relational Database Management Systems (RDBMS) can overlook vital connections between entities involved in criminal activities. Therefore, there's a pressing need for innovative approaches using Graph data modeling and Machine Learning to streamline investigations and uncover hidden connections crucial for effective crime resolution.

Objective

1. Identify criminal linkages.
2. Analyze suspect movements.
3. Identify potential witnesses.
4. Link stolen items to crimes/people.
5. Identify crime hotspots.

Model



Methodology

1. **Data Acquisition and Preprocessing:** The post-crime deals with victims, the case they reported, place, and other details.
2. **Graph Schema Definition:** Modelled the graph as separate node labels for each category and assign meaningful labels. Loaded using the Neo4j's Cypher query language and potential data quality checks will be in place.
3. **Network Analysis and Exploration:** Explored connections within the graph based on the objectives. 4.Graph Enhanced ML: Applied Machine Learning for Node Classification and Link Prediction.

Results

Most Affected Gender:
- Male Victims: 163 cases

Top Crime Incidence:
- Theft from Motor Vehicle - Grand ($950.01 and over): 4776 cases

Crime Characteristic Cluster:
- Theft from Motor Vehicle - Grand ($950.01 and over): 2109.83 score

Most Affected Age Group:
- Average Victim Age: 29.43

Weapon Frequency by Descent:
- Hispanic (H): Strong-Arm (Hands, Fist, Feet or Bodily Force) - 2154 cases

Conclusion

Our project showcases the transformative impact of Graph Data Model and Science on crime investigation. Using graph databases and advanced analytics, we've established a robust framework for analyzing crime data comprehensively. Our methodology unveils hidden connections and patterns, augmenting the efficiency of investigations. Moving forward, our work promises to advance crime investigation practices, benefiting law enforcement agencies and communities.

Future Scope

1. Incorporating real-time data streams into the analysis to enable proactive crime prevention and faster response times.
2. Developing predictive models to forecast crime trends and hotspots, enabling preemptive measures to mitigate criminal activities.

References

- Crime Investigation - Explore connections in crime data using the POLE - Person, Object, Location, Event - model in a public dataset from Manchester, U.K. (github.com)