CRIME DATA ANALYSIS - SEATTLE

Bhoomi Thanki, Rakesh Balan Lingakumar, Udayasri Sai Buddhi

Abstract— Crime analysis and prevention is a systematic approach for identifying and analyzing patterns and trends in crime. Our system can predict regions which have high probability for crime occurrence and can visualize crime prone areas. With the increasing advent of computerized systems, crime data analysts can help the Law enforcement officers to speed up the process of solving crimes. Using the concept of data mining we can extract previously unknown, useful information from an unstructured data. Here we have an approach between computer science and criminal justice to develop a data mining procedure that can help solve crimes faster. Instead of focusing on causes of crime occurrence like criminal background of offender, political enmity etc. We are focusing mainly on crime factors of each day.

Introduction

Crime data analysis is fundamental to effective crime prevention. The crime data can be Quantitative or Qualitative. The data regarding date of crime, time of crime, location of crime, type of crime are quantitative crime data which describes and explains the phenomena that those observations reflect statistically. On the other hand, narratives of crime reports are qualitative crime data that helps in discovering underlying meanings and patterns of relationships.
There are different types of Crime Analysis-Intelligence Analysis, Criminal Investigative Analysis, Tactical Crime Analysis, Strategic Crime Analysis, Administrative Crime Analysis. In this project we perform Administrative Crime Analysis. The primary purpose of administrative crime analysis is to inform audiences. These audiences may vary from one situation to the next, which is why the type and quantity of information should vary as well. Audiences can be police executives, city council, media, citizens, and neighborhood groups or a combination. Determining if particular crimes are increasing; identifying the hot spot locations where crime is concentrated; understanding the temporal trends of offending and analysing potential reasons for crime trends.

The first thing that you realise when you begin analysing crime data is the sheer volume of information at your disposal. The second thing is about how best you can represent the data.

1.RELATED WORKS

A geographic information system (GIS) is a set of computer-based tools that allow a person to modify, visualize, query, and analyze geographic and tabular data. A GIS is a powerful software tool that allows the user to create anything from a simple point map to a three-dimensional visualization of spatial or temporal data. A GIS is different from manual pin maps and computer maps in that it allows the analyst to view data behind the geographic features, combine various features, manipulate the data and maps, and perform statistical functions. There are many different types of GIS programs, which include desktop packages (e.g., ArcView, MapInfo, GeoMedia, Atlas GIS, Maptitude) as well as professional software (e.g., ArcInfo and Intergraph).

ArcGIS Online is a complete, cloud-based mapping platform. As a cloud-based service, ArcGIS Online is designed from the ground up to automatically scale to meet peak periods of demand, all day. Whether there are hundreds of viewers or millions, ArcGIS scales it with nothing for to install or manage. ArcGIS Online comes with a suite of basemaps, high-resolution imagery, and the highest rated demographic data. Make 2D and 3D maps with the built-in map viewer and scene viewer. It allows to access maps and layers on hundreds of topics in the Living Atlas of the World. ArcGIS gives you the modern mapping tools needed to visualize data. ArcGIS includes detailed imagery of the world, which reveals both the present state of the planet and change over time. These image layers allow to view recent, high-resolution imagery for most of the world; lower-resolution imagery of the planet updated daily; and near real-time imagery for parts of the world affected by major events, such as natural disasters. This includes intelligent layers that enable you to restyle the imagery to highlight specific characteristics, such as healthy vegetation.

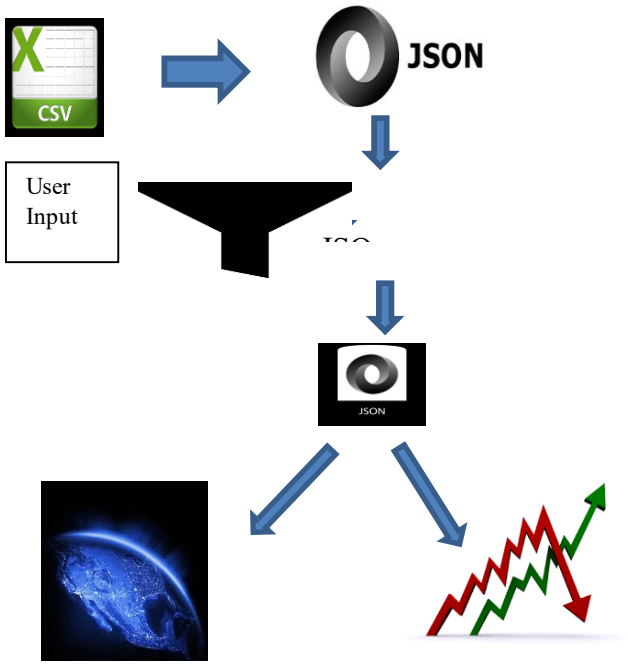
We used Spring Framework to develop the project for providing smooth interaction. The Spring Framework is an application framework and inversion of control container for the Java platform. The framework's core features can be used by any Java application, but there are extensions for building web applications on top of the Java EE platform. It provides Core support for dependency injection, transaction management, web applications, data access, messaging, testing and more. The Spring Framework provides a comprehensive programming and configuration model for modern Java-based enterprise applications - on any kind of deployment platform. A key element of Spring is infrastructural support at the application level: Spring focuses on the "plumbing" of enterprise applications so that teams can focus on application-level business logic, without unnecessary ties to specific deployment environments.

2. SYSTEM DESIGN

The design of Crime Data Analysis- Seattle is divided into two sections. First we had to obtain and cleanse the relevant data. Then, we had to implement visualizations for multiple attributes and connect them to the predictive model.

2.1 **Obtaining and formatting the Data**

For our project we have collected the dataset from https://data.seattle.gov/Public-Safety/Seattle-Police-Department-911-Incident-Response/3k2p-39jp. This dataset reflects reported incidents of crime that occurred in the City of Seattle from 2010 to present. The dataset is all the Police responses to 9-1-1 calls within the city. This data is extracted from the data.seattle.gov system. In order to protect the privacy of crime victims, addresses are shown at the block level only and specific locations are not identified. It also contains Geo-location information to identify the exact location of the crime.
In this project, we filtered the data to work on smaller set of records for visualizations based on most frequent crimes and reduced them to 5000 records by considering crimes from 2013, 2014, 2015 and 2016. General Offense Number, Event Clearance Code, Event Clearance Description, Event Date, Event Year, District/Sector, Zone/Beat, Longitude, Latitude.
The above diagram depicts the workflow of the project. Initially, the data we collected is in CSV format. In order to implement filtering based visualisation through ArcGIS converted the entire CSV file into JSON file format.



Geo-Spatial View Line Trends

JSON is a language independent data format. It has its origin from JavaScript. The user gives the input regarding the crime type and the year that he wanted to visualize. The given input filters the large JSON file produced in the previous step into small JSON file. This small JSON file has the information about the crime type and the year that user has selected.

2.2 Visualizing the data

Trends Lines:
Trend Lines are an important tool in technical analysis for both trend identification and confirmation. A trend line is a straight line that connects two or more price points and then extends into the future to act as a line of support or resistance. Trend lines fit a line that best represents the pattern contained within detailed data plots.

Trend lines for our visual analysis system:
We have used trend lines for our system to show the increasing decreasing trend of various crimes for Seattle area. We have allowed the used to select various years from dropdown box. The user will also be able to select the crime for which he wants to see the trend. Using the data, various users like police official can see whether the crime for area has increased or decreased. If they are taking any measures to reduce the number of crimes, then are they really effective. One of the graph also shows all crimes for a particular year. So comparison between all crime rates also becomes easier.

Geovisualization:
Geovisualization is a short form of Geographic Visualization, refers to a set of tools and techniques supporting geospatial data analysis through the use of interactive visualization. Geovisualization allow for more interactive maps; including the ability to explore different layers of the map, to zoom in or out, and to change the visual appearance of the map, usually on a computer display.

Geovisualization for our visual analysis system:
Geovisualization helps us to locate the exact location of the crime. By visualizing the locations of the crime across the map, we could identify the locations that recorded more crime and mark them to be the unsafety zone. In our visual system user could give the input about the type of crime and year. So we can also identify the unsafe zones with respect to each crime. The year attribute helps us to identify the trends across the years over the types of crime.

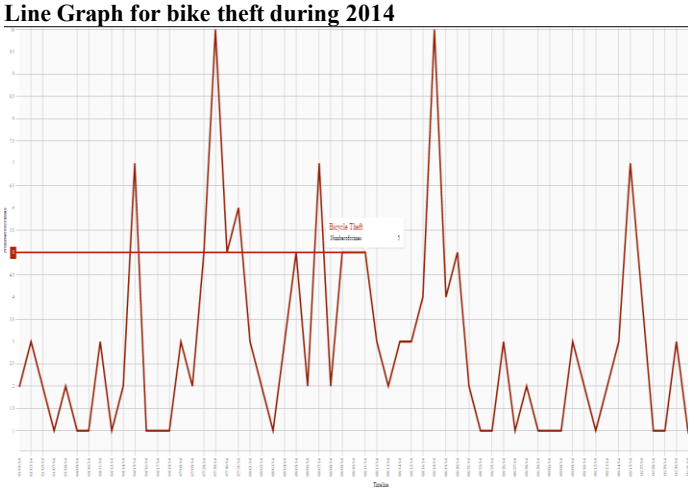
There are different kinds of crimes such as We used different icons to represent different crimes.

- Armed Robbery 
- Assaults Gang Related 
- Bicycle Theft 
- Burglary - Residential, Occupied 
- Gambling 

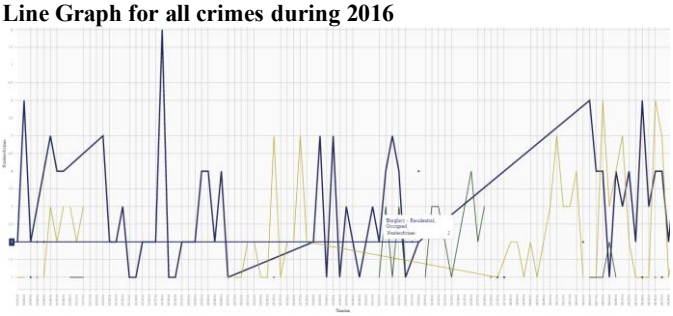
3. EVALUATIONS

Input:

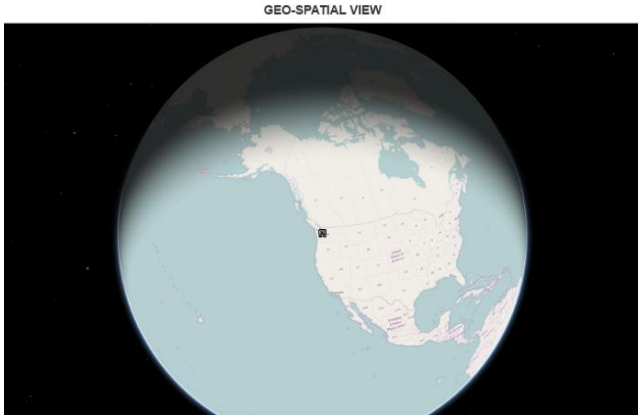
Line Graph for bike theft during 2014



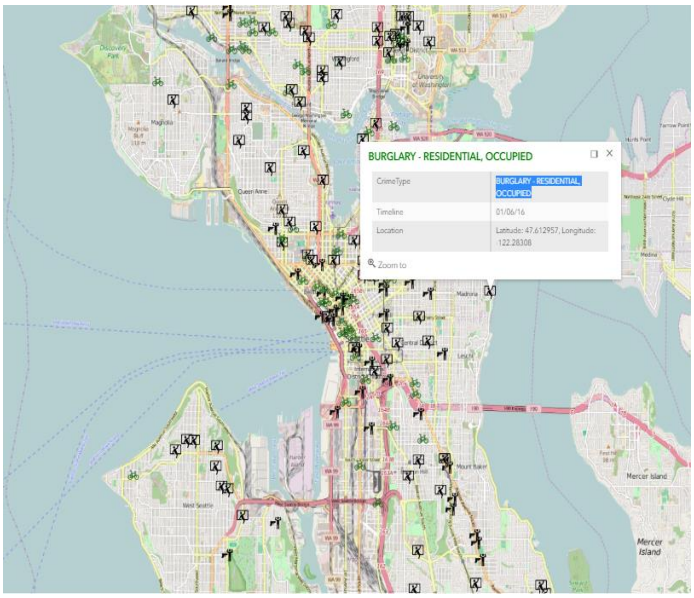
Line Graph for all crimes during 2016



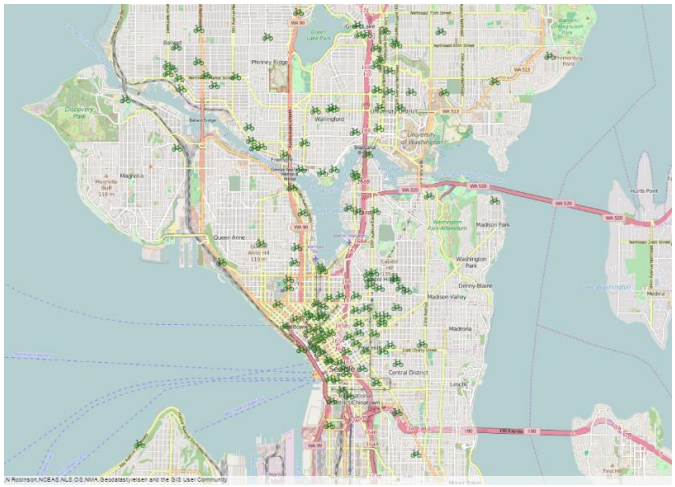
Geo Spatial View



Magnified Geo Spatial View for all crimes during 2016



Magnified Geo Spatial View for Bike Theft during 2014



4. CONCLUSION

By performing Seattle Crime Data Analysis we could identify the safe and unsafe zones in the city. This will help the police department to improve the security of the unsafe places and ensure public safety. It will also help citizens to wisely choose their place of living. This will also help in predicting future safety of the place.

Acknowledgments

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[5] https://en.wikipedia.org/wiki/Geovisualization
[6] https://en.wikipedia.org/wiki/Trend_line_(technical_analysis)