Geographical Crime Prediction Tools

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Abstract: The increase in criminal activity has led individuals to consider seriously before choosing a safe area to live. The reason for the selection of this topic was to let ordinary people learn about and comprehend the crime rate in a certain district in Maharashtra. All of the data on prior crimes committed by criminals in Maharashtra was the basic necessity in this project to make use of the deep learning module to make predictions based on the acquired data. A raw dataset was created using data acquired from several online sources like Google, Kaggle, and Twitter. Fb prophet, a deep learning module was used in this project. The work is categorized into three parts: crime analysis, crime prediction, and crime prevention measures. The data columns that make up our raw dataset are used to conduct crime analysis. The forecast chart will display the number of crimes that will be committed in a certain district in the future. Various crime-prevention techniques that would help individuals to explore the safety of the area based on the predicted crime rate are also discussed in this project.

Index Terms - **Crime, Prediction tool, Streamlit, Fb prophet, Dataset**

I. INTRODUCTION

The fact that emerging countries like India have strong police forces and technological advancements, criminal activities continue to occur on a regular basis. It is difficult for a person to choose a work field and a safe environment to reside in. People are often unaware of criminal inclinations, which lead to a rise in certain offenses. With the advancement of technology, the developers came up with the notion of predicting crime ahead of time so that people may learn about the crime rate in a certain location before understanding the safeness for a particular location before settling down. A crime prediction model can be useful for determining if the given place is safe or not based on factors such as wrongdoings, the likely time of the crime, the status of previous crimes, and so on. Living in an environment where people feel secure is what is the inspiration to build this project Another reason for implementing this project is to protect innocent individuals from criminals.

II. LITERATURE SURVEY

The objective of Crime Analysis and Prediction Using Fuzzy C-Means Algorithm, 2019 [1] was "Tracking a specific area that is a crime-prone zone which will assist the individual in determining where the crime will occur based on prediction" and for this Fuzzy C means algorithm of Machine Learning was used. If the use of fuzzy C-means algorithm to cluster the crime data for total cognizable crimes was done, it would have helped individuals learn in which area the crime will occur.Crime Prediction Using K-Nearest Neighbor Algorithm, 2020 [2] this research focuses on a technique of predicting crime and fraud in a city and as given in the title, the algorithm used is K Nearest Neighboring. The limitations faced here is that areas could have been labeled as crime-prone zones or risk-prone zones based on the time as well. Here, the use of the KNN algorithm of Machine Learning to approximately predict the type of crime, location, time of the crime, and the pattern of crime could have been done. Prediction of Crime Based on statistical models, 2018 [3] forecasts crime based on prior years' statistics, assisting both native and international guests in learning about the crime rate. If machine learning models had been utilised, it would have been more accurate and the solution would have been more resilient.

Data mining and Region Prediction Based on Crime Using Random Forest, 2021 [4] forecasts locations based on crimes, allowing investigators to take preventative measures to reduce crime rates. Because this article is focused on predicting locations based on crimes, the results were not accurate.Crime Analysis and Prediction Using the Optimized K-Means Algorithm, 2020 [5] analyses and organises crime rate data according to age groupings. Although the study demonstrated much needed accuracy, it did not identify additional crime methods such as crime type or time at which the crime occurred.Crime Prediction and Analysis, 2020 [6] describes the differences in crime patterns, which are continually changing due to the many forms of crimes in the current environment. The dataset they utilised included just a few factors, which were insufficient to reliably predict crime.

The purpose of the study ANN Based Crime Detection and Prediction Using Twitter Posts and Weather [7] is to recognise crime-related tweets and subsequently forecast crime. Assuming the crime date and time is not accurate, it may mislead an inquiry. The main purpose of the Using CNNs, RNNs, and Machine Learning Algorithms for Real-time Crime Prediction, 2019 [8] study is to create a deep learning model that can identify video stream segments as normal or abnormal. To improve accuracy and usability for more specific behavior categories, systems can be trained on area-specific data.

III.RESEARCH MODEL

Geographical crime prediction tools are a system that provides crime analysis with respect to various factors such as district, crime type, crime count, resolution status, and time of the crime in the form of charts and graphs and crime prediction using the time attribute for predicting future crimes. The user guide is given to provide easy navigation. Precautions that need to be taken while visiting certain areas are to be mentioned. The system is a crime prediction application that is built using a web-based framework as front-end. Streamlit is used for providing a user interface to our system. Data processing steps are performed in the background.

1. Streamlit

Streamlit is a software company offering an open-source platform for machine learning and data science teams to create data applications with python.The platform uses python scripting, APIs, widgets, instant deployment, team collaboration tools, and application management solutions to help data scientists and machine learning engineers create python-based applications.

Applications created using Streamlit range from applications capable of real time object detection, geographic data browsers, deep dream network debuggers, to face-GAN explorers. Frameworks compatible with Streamlit include: Scikit Learn, Altair, Bokeh, latex, Keras, Plotly, OpenCV, Vega-Lite, PyTorch, NumPy, Seaborn, Deck.GL, TensorFlow, Python, Matplotlib, and Pandas.

2. Fb prophet

Prophet is open-source software released by Facebook's Core Data Science team. Prophet is a forecasting procedure implemented in R and Python. It is fast and provides completely automated forecasts that can be tuned by hand by data scientists and analysts.

Prophet is a procedure for forecasting time series data based on an additive model where non-linear trends are fit with yearly, weekly, and daily seasonality, plus holiday effects. It works best with time series that have strong seasonal effects and several seasons of historical data. Prophet is robust to missing data and shifts in the trend, and typically handles outliers well.

Algorithm:

The FB Prophet algorithm is used to provide a time series forecasting of future crimes. Crimes can be predicted for a period of 1-365 days.
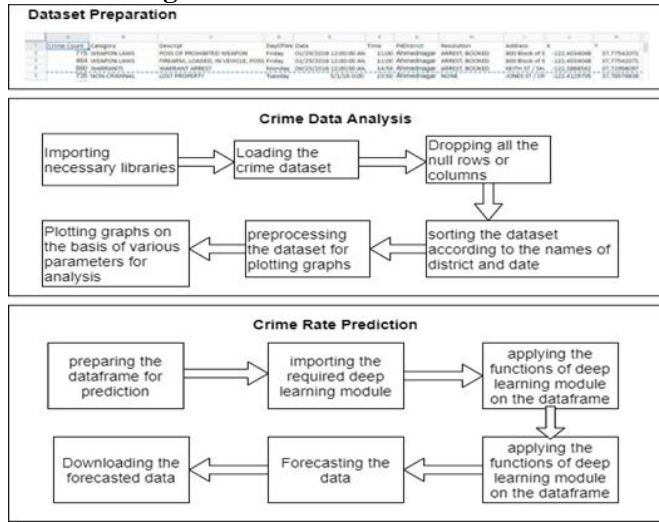
Process Design:

Figure 1 Process Design

The hardware and software used in this project are listed below

- Streamlit
- Python
- Google Colab
- Fbprophet

IV. RESULTS AND ANALYSIS

Our crime predictions application consists of five pages namely the home page, user guide page, crime analysis page, crime prediction page, and precautions page. The detailed function of each page is given below.

1. Home Page:

The home page is the page that the user will 1st encounter when they visit our web application. It has a side navigation bar through which they can navigate to different pages. The side nav also consists of the names of the members who have contributed to the making of the project as well as a mail id through which users will be able to contact the maker of the project to get their queries resolved.

Figure 2 Home Page

2. Page Navigation

Using the side navigation, the user can navigate to the different pages which are available for the user. Side navigation consists of a dropdown list through which users can navigate through the web application.

Figure 3 Page Navigation

3. User Guide:

The user guide page will contain guidelines to make effective use of the application.

Figure 4 User Guide

4. Crime Analysis:

The crime analysis page contains visual insights into crimes according to various influencing factors
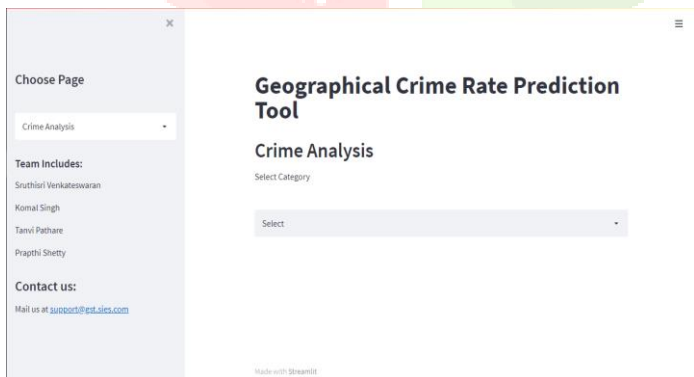

Figure 5 Crime Analysis

5. Category selection:

Category selection page consists of a dropdown list which allows them to select an option from the provided 6 options namely count vs address, count vs category,
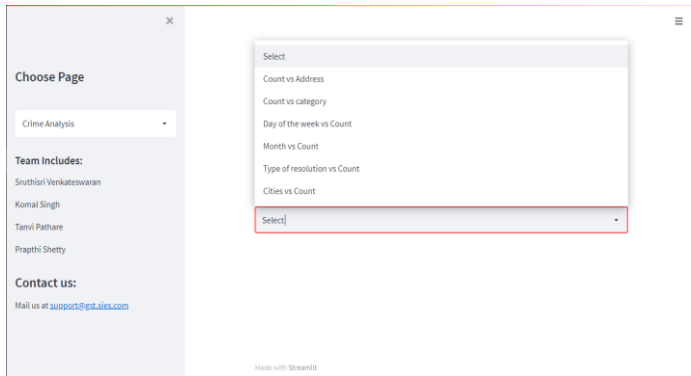

Figure 6 Category Selection

6. Count vs Address category:

Analysis based on address vs the count of crime will be displayed to the user in a graphical format.

Figure 7 Count vs Address

7. Day of the week vs Count category:

Analysis based on the days of the week vs the count of crime will be displayed to the user in a graphical format.

Figure 8 Day of the week vs Count category

8. Crime Prediction:

The crime prediction page provides pre-loaded data that will be used for future predictions. It also provides time series forecasting graphs for selected periods. Option to download the prediction results in the form of a .csv file is given.

Figure 9 Crime Prediction

9. Selecting period for prediction:

In the dropdown provided in which the user has to enter the number of days of which they wish to know the prediction of crime rate, they can enter any values ranging from 1 to 365.
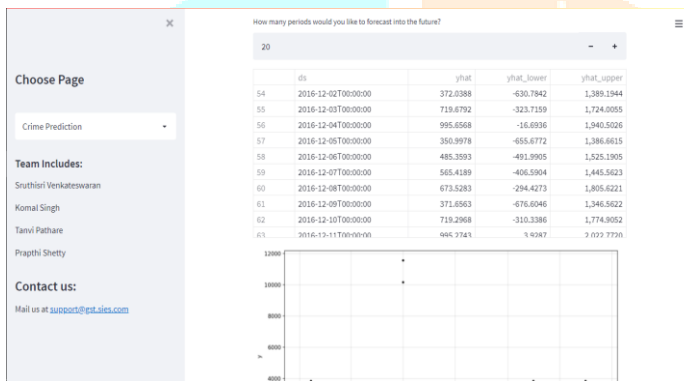

Figure 10 Selecting period for prediction

10. Time series forecasting:

Here the time series forecasting of the crime is displayed in graphical format.
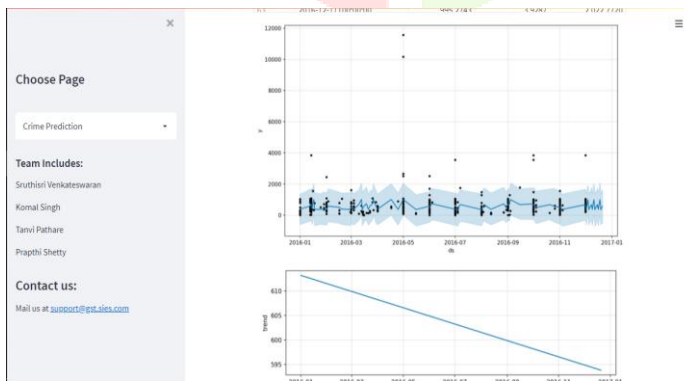

Figure 11 Time series forecasting

11. Prediction graphs:

It shows the predicted graph of crime rate with crime rate on Y-axis and dates as well as days of the week on the X-axis.
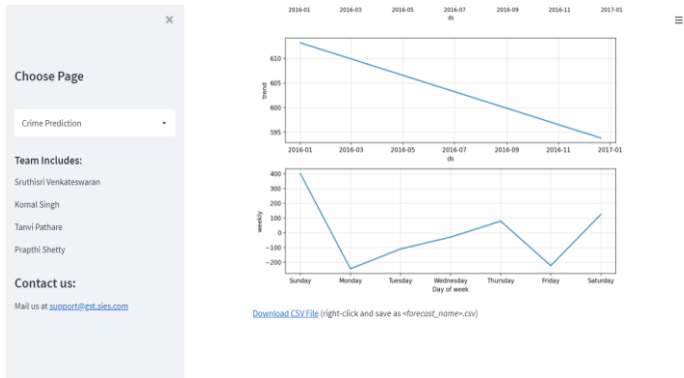

Figure 12 Prediction graphs

12. Download predictions:

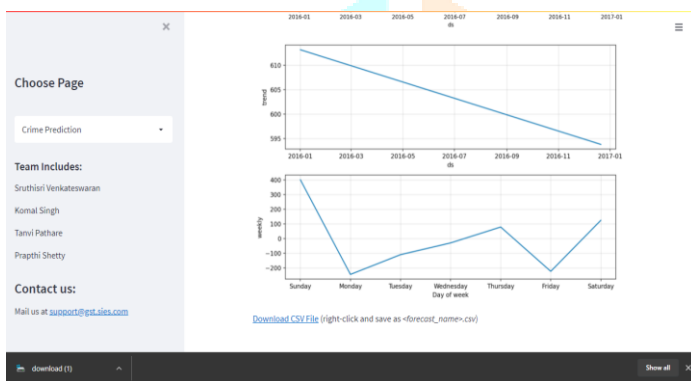By clicking on the 'download .csv file', the user can download the predicted values for future use.

Figure 13 Download predictions

13. Downloaded results:

The downloaded results could be used by the user to maintain record of the prediction for personal use.

	A	B	C	D
1	ds	yhat	yhat_lowe	yhat_upper
2	02-12-2016	372.0388	-630.784	1389.194
3	03-12-2016	719.6792	-323.716	1724.005
4	04-12-2016	995.6568	-16.6936	1940.503
5	05-12-2016	350.9978	-655.677	1386.661
6	06-12-2016	485.3593	-491.991	1525.191
7	07-12-2016	565.4189	-406.59	1445.562
8	08-12-2016	673.5283	-294.427	1805.622
9	09-12-2016	371.6563	-676.605	1346.562
10	10-12-2016	719.2968	-310.339	1774.905
11	11-12-2016	995.2743	3.928678	2022.772
12	12-12-2016	350.6153	-735.987	1333.379
13	13-12-2016	484.9768	-576.478	1532.167
14	14-12-2016	565.0364	-421.262	1575.556
15	15-12-2016	673.1459	-386.109	1729.115
16	16-12-2016	371.2738	-698.029	1468.54
17	17-12-2016	718.9143	-293.693	1701.474
18	18-12-2016	994.8918	-54.2418	2090.84
19	19-12-2016	350.2329	-625.825	1351.849
20	20-12-2016	484.5943	-513.758	1553.157

Figure 14 Downloaded results

14. Precautions:

The precautions page will contain information about area or location-specific preventive measures that can be taken.
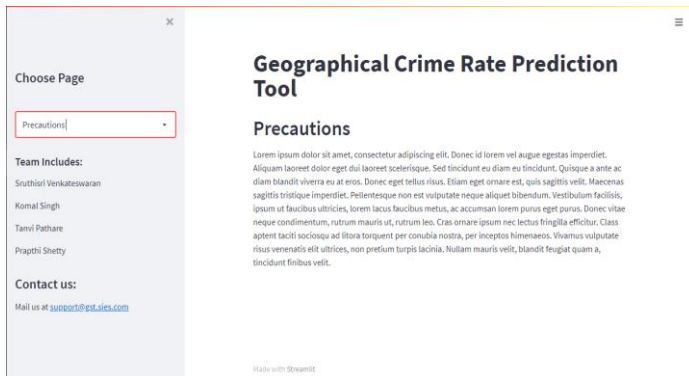

Figure 15 Precaution

V. CONCLUSION

The system focuses on providing predictions based on time. Analysis results are visualized to provide an easy understanding to the user. Precautions to avoid targeted crimes are to be provided in this project.

Users will not only be able to see prediction records but also they will have access to know records on the previous mishappening based on various parameters which not only include a very important factor like time, location, and crime count but also various other factors like resolution status, crime type, etc. Unlike other websites, here users also hold the power to select the number of days of which they wish to see the crime prediction of and can also download the results of the prediction.

To help users understand and operate the website easily without any complications, the system is built in the most simple and user-friendly manner. In case of any complications, user can make user of the user guide which provides the full information about how to work on the website and if they face any complications which are not solved by the user guide they can contact the developer directly using the email id provided in the website.

VI. REFERENCES

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