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Crime Forecasting in India

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ABSTRACT

Since British rule, India has kept track of crime. Today, the Home Affairs Ministry directs the National Crime Records Bureau to compile annual statistics. Crime rates are rising as the country develops and grows, necessitating analysis. The goal of this study is to identify trends in crime over time in order to forecast future developments and improve the nation's crime rate. To identify trends in crime records, the study employs a variety of exploratory techniques. Additionally, it displays data with its various features and attempts to predict future trends using machine learning. The goal of the study is to provide a more comprehensive understanding of crime to law enforcement, policymakers, local police, and other stakeholders. They can use this information to develop safety measures for society.

Keywords: Crime, National Crime Records Bureau, Crime Trends, Data Visualization, Machine Learning.

I. INTRODUCTION

The law defines crimes as actions or behaviors it forbids and punishes. This covers a broad spectrum of deeds that break society's rules and specific laws. Crimes range from stealing and breaking in to sexual assault fleeing accident scenes, killing, and acts of terror. We measure crime rates by the number of reported offenses per 100,000 people in a year. Many things shape these rates, like poverty, joblessness, and how strict the police are. Some countries see a lot of crime such as Venezuela (82.10), Papua New Guinea (80.40), and South Africa (75.50). Others, like Switzerland (21.62) and Japan (21.62), have much less.
The 2024 Crime Index puts India at 83rd place scoring 44.3 for crime and 55.7 for safety. As India's economy grows each year, the total amount of crime happening all the time in different states and territories, following various patterns, keeps going up day by day. To tackle the growing crime rate, we need to analyze crime patterns over time. This will help predict future crimes and trends lowering India's crime index.

This study aims to examine and forecast crimes in various Indian States and Union Territories. Crimes in India range from minor offenses like traffic violations to major incidents such as the 26/11 terrorist attack and horrific sexual assault cases. , a big jump in crime rates has been observed following the COVID-19 outbreak called Coronavirus.
For Crime Analysis and Crime Prediction research, the dataset we have used is downloaded from ncrb.gov.in, which is the official website of the NCRB- National Crime Records Bureau. NCRB is an Indian government agency that comes under the Ministry of Home Affairs, and its responsibilities include gathering, examining, and publishing the data of crimes that occurred nationwide, also offers valuable insight

into criminal justice matters. The collected dataset contains the IPC Crimes (Crime Head-wise & State/UT-wise) for the year 2017
-2022(excluding 2018 and 2020). The dataset contained attributes like Offences affecting the Human Body, Offences against the State, Offences against Public Tranquillity, Offences against Property, Offences Relating to Documents & Property Marks, Miscellaneous IPC Crimes, Other IPC Crimes, and Total Cognizable IPC Crimes for each year. Also, it contained the No. Of Incidences/Cases, No. of Victims & Crime Rate per lakh population for each state and UT.

The statistics that we have utilized for our forecast are a sum total of 42,99,256 no. of cases which were registered from 2017-2022 (excluding 2018 and 2020), that impacted the Human body. Also, we have done Exploratory Data Analysis for some chosen crimes i.e., Causing Death by Negligence (Sec.304-A IPC), Assault on Women with Intent to Outrage her Modesty (Total), and Kidnapping and Abduction (Total) since these categories are again divided into various crimes. Also, for Murder (Sec. 302 IPC) and Rape (Sec.376IPC)/

Crime analysis entails scientific examination of crime and crime behavioral patterns, trends, and hotspots performed employing different analytic tools, statistical analysis, data visualization, and crime mapping to investigate crime information to determine patterns. Crime forecasting entails applying data analysis (10), statistical modeling, Machine learning methods, and predictive analytics to make predictions about the future

trends in crime, thereby identifying high-risk areas or subjects and allocating priorities to law enforcement resources. Hence, this study can assist in augmenting the roles and functions of law enforcement, community-oriented programs, and technological interventions against crimes (11).

II. REVIEW OF LITERATURE

The study focuses on the in-depth examination and prediction of crime patterns in India using exploratory data analysis and machine learning approaches. The goal is to use a range of algorithms to accurately predict crime statistics. The study aims to find significant trends, correlations, and understandings of the features and dynamics of crimes in different states and union territories by compiling crime statistics from the NCRB's website and then analyzing and forecasting the data. Numerous scientific publications have been cited. Bandekar et al. [2020] employed a range of predictive modeling techniques, including Decision Trees, Classification, Support Vector Machines (SVM), KNN Classification, Regression, K-means clustering, Density-Based Clustering, Random Forests, and others, to forecast crime patterns and trends, group crime incidents, etc.

Jha et al. [2020] forecasted and analyzed crime patterns in India using the Box-Jenkins method. Two million recordings from the past decade were used. They used the ARMA (Autoregressive Moving Average) model for stationary time series and the ARIMA (Autoregressive Integrated Moving Average) model for non-stationary series, which is typical for crime data.

Kuar et al. [2021] used data mining techniques, including mining law associations and groups, to examine data crimes in India in order to assist government law enforcement in making choices.

The information we used for our study and forecast include 42,99,256 total incidents that affected the human body and were reported between 2017 and 2022 (excluding 2018 and 2020). These include: causing death by negligence (Section 304-A IPC), murder (Section 302 IPC), culpable homicide not amounting to murder (Section 304 IPC), dower deaths (Section 304-B IPC), aiding and abetting suicide (Section 305/306 IPC), attempt to commit murder (Section 307 IPC), attempt to commit culpable homicide (Section 308 IPC), attempt to commit suicide (Section 309 IPC), wrongful restrainment/confinement (Section 341 to 348 IPC), assault on women with intent to offend her modesty (Total), and human trafficking (U/S 370).

Miscarriage, Infanticide, Abandonment and Foeticide (Sections 313 to 318 IPC), Simple and Grievous Injury, Abduction and Kidnapping (Total), Prostitution Sales and Purchases (Section 372 IPC), Trafficking Person Exploitation (Section 370A IPC), Rape (Section 376 IPC), Assault to Commit Rape (Section 376/511 IPC), and Unnatural Offenses (Section 377 IPC). However, the amounts for a number of crimes falling under these categories

include: Kidnapping and Abduction (Total), Assault on Women with Intent to Outrage Her Modesty (Total), Hurt (Simple + Grievous), and Causing Death by Negligence (Sec.304-A IPC).

Author(s) & Year	Objective	Techniques/Methods Used	Data Description	Key Findings/Focus
Bandekar et al. (2020)	Predict crime patterns and trends, and group crime incidents	Decision Trees, Classification, SVM, KNN Classification, Regression, K-means Clustering, Density-Based Clustering, Random Forests	Crime data used to model and predict patterns	Successfully applied multiple ML algorithms to identify trends and clusters in crime data.
Jha et al. (2020)	Analyze and forecast crime trends in India	Box-Jenkins Method, ARIMA (for non-stationary series), ARMA (for stationary time series)	Two million records spanning 10 years	ARIMA and ARMA models proved effective in forecasting crime time series data.
Kuar et al. (2021)	Assist government and law enforcement in decision-making	Data Mining, Law Association Mining	Crime data from India	Extracted meaningful patterns and associations from crime data to aid policymaking.
Present Study	Analyze and forecast crime trends in India using EDA and ML	Exploratory Data Analysis (EDA), Machine Learning algorithms	42,99,256 crime incidences (2017–2022 excluding 2018 and 2020), focused on crimes impacting the human body	Identified crime trends across different states/UTs; used historical data to forecast and derive insights into the dynamics and characteristics of various crimes.

III. RESEARCH, METHODOLOGY AND FINDINGS

CRIME ANALYSIS

As was previously said, 42,99,256 occurrences in total are accessible for data analysis and prediction. Therefore, we conducted criminal analyses for a few kinds of crimes that affected people, including causing death by negligence (Section 304-A IPC), assaulting a woman with the intent to offend her modesty (Total), kidnapping and abduction (Total), murder (Section 302 IPC), and rape (Section 376 IPC). Let's first define these offenses using basic language.

Causing Death by Negligence (Sec.304-A IPC)

Any individual who kills another person by reckless or careless actions that do not constitute culpable murder faces a maximum sentence of two years in either type of incarceration, a fine, or both. According to NCRB statistics, Sec. 304-A IPC is included in a wide range of other offenses, as shown in the table. Deaths from medical negligence, deaths from civic bodies' negligence, deaths from road accidents (total), deaths from rail accidents, and deaths from other types of negligence are among the categories of negligence-related deaths.

Assault on Women with Intent to Outrage her Modesty (Section 354 IPC)

Any person who beats or uses illegal force against a woman to disturb her or realizes that such acts will surely lead her to lose her modesty is punished with imprisonment of any duration for not less than one year, up to five years, and a fine. Sec.354 IPC is classified into numerous other offenses as indicated in the table, based on NCRB's figures.

Types of Assault on Women with Intent to Outrage her Modesty: Assault on Women, Sexual Harassment (Total), Assault or use of Criminal Force on women with intent to Disrobe, Voyeurism and Stalking.

Kidnapping and Abduction (Sec.363 IPC)

Anyone who kidnaps a person from India or in lawful custody is liable to up to seven years in either category of jail and a fine. Sec.363 IPC is broken down into numerous other offenses as indicated in the table, as per NCRB's figures.

Kinds of Abduction and Kidnapping: Abduction and Kidnapping, Abduction and Kidnapping for begging, Abduction and Kidnapping with intention to Murder, Kidnapping for ransom, Abduction and Kidnapping of Women with intent to compel her for marriage, Procuration of Minor Girls,
Importation of Foreign Country Girls and Other Abduction & Kidnapping.

Murder(Sec. 302 IPC)

Anyone found guilty of murder faces a life sentence in jail or the death penalty, in addition to a fine.

Rape (Sec.376 IPC)

One form of sexual assault that is committed against a person without that person's consent is rape. Physical force, coercion, misuse of power, or against someone who is unable to give legitimate consent—for example, someone who is unconscious, has an intellectual handicap, or is younger than the legal consent age can all be used to carry out the act.

CORRELATION BETWEEN MURDER (Sec.302 IPC) AND RAPE (Sec.376 IPC)

The degree to which two variables are linearly related-changing together at a constant rate is expressed as a statistical measure, known as Correlation.

The graphs given below demonstrate the relationship between the number of murders and rapes in each state/UT for the years 2021 and 2022.

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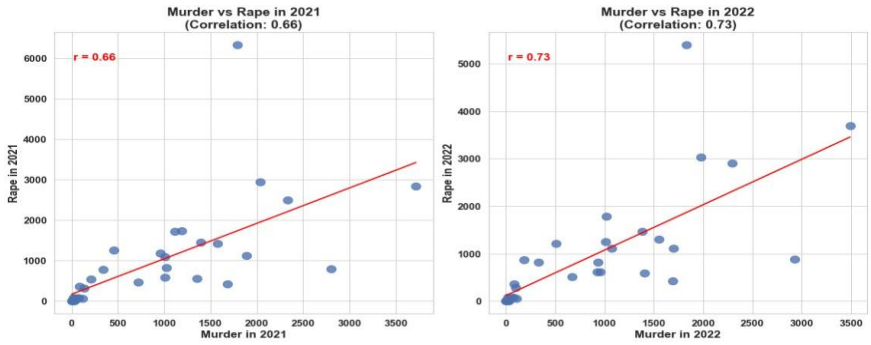

Fig:1

TREND ANALYSIS ON CRIMES FOR PRE-COVID (2017-19) AND POST-COVID (2021-2022)

In this, we have performed trend analysis and reported the Top 10 States/UTs on a few crimes by differentiating pre-COVID and post-COVID data to check whether there is an increase in the number of crimes after COVID-19 or not.

ASSAULT ON WOMEN WITH THE INTENT TO OUTRAGE HER MODESTY

The graphs below illustrate significant insights by comparing the Top 10 States/Union Territories before and after COVID, effectively dividing the data into pre-COVID and post-COVID categories.

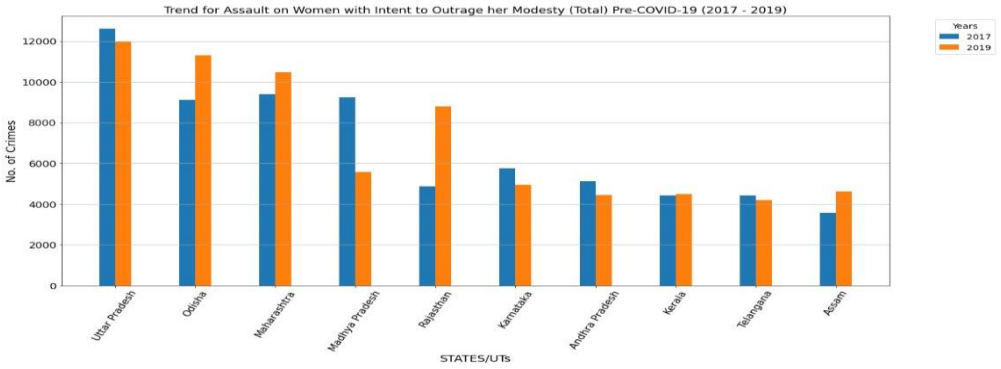

Fig:2 Assault on Women (Total) Pre- Covid-19 (2017-2019)

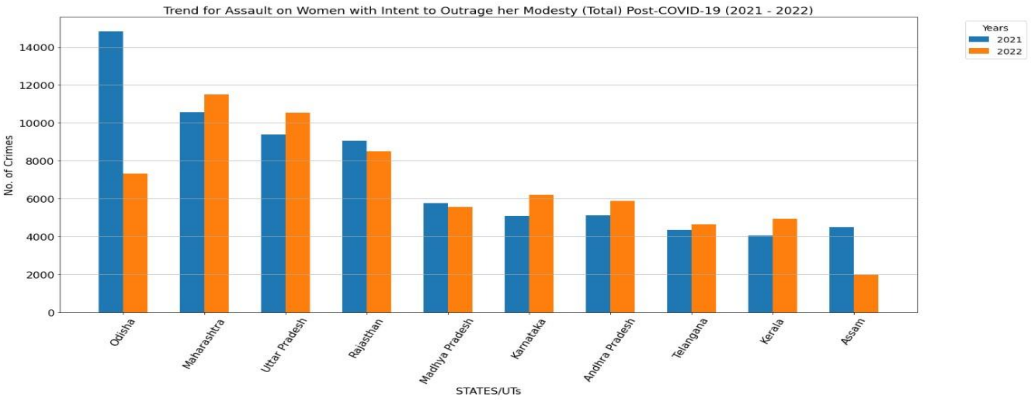

Fig:3 Assault on Women (Total) Post- Covid-19 (2021-2022)

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CAUSING DEATH BY NEGLIGENCE

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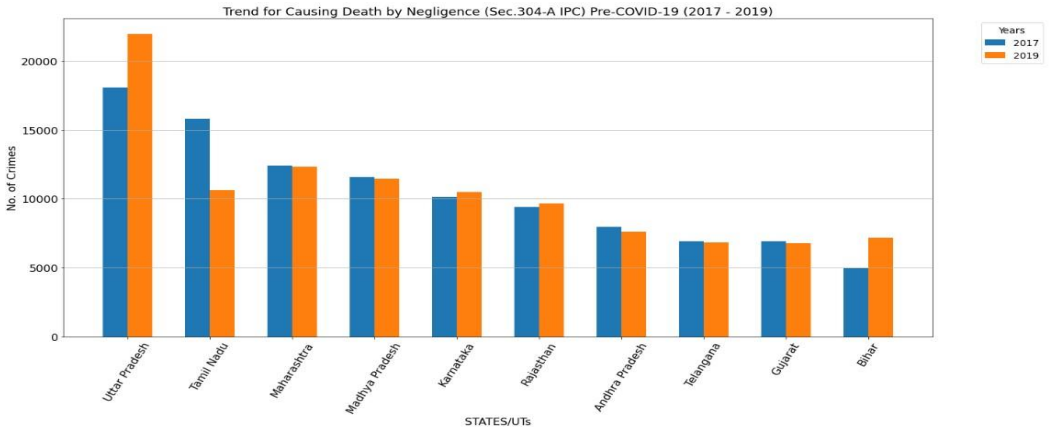

Fig:4 Causing Death by Negligence Pre- Covid-19 (2017-2019)

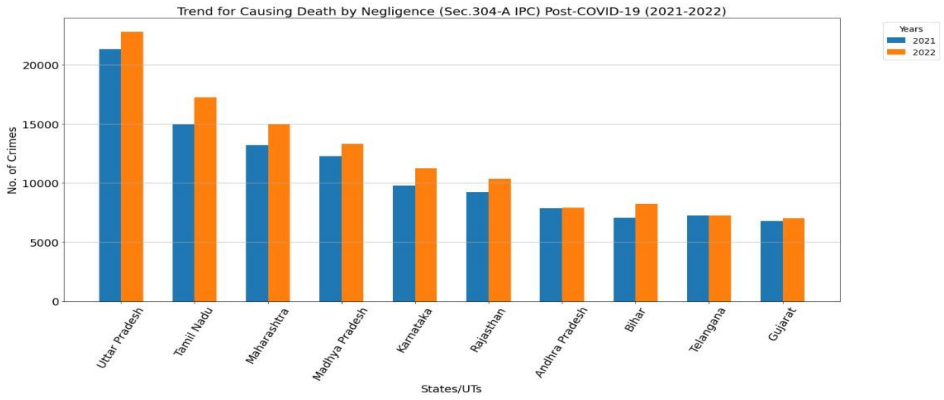

Fig:5 Causing Death by Negligence Post- Covid-19 (2021-2022)

KIDNAPPING AND ABDUCTION

The graphs below illustrate significant insights by comparing the Top 10 States/Union Territories before and after COVID, effectively dividing the data into pre-COVID and post-COVID categories.

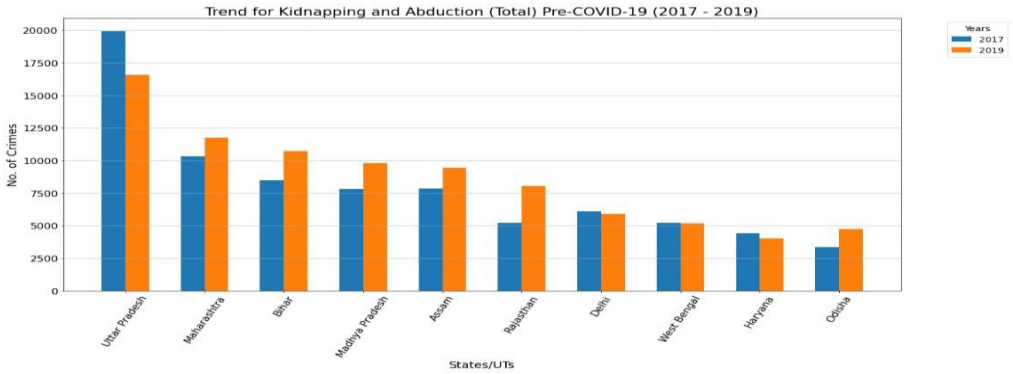

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Fig:6 Kidnapping and Abduction (Total) Pre- Covid-19 (2017-2019)

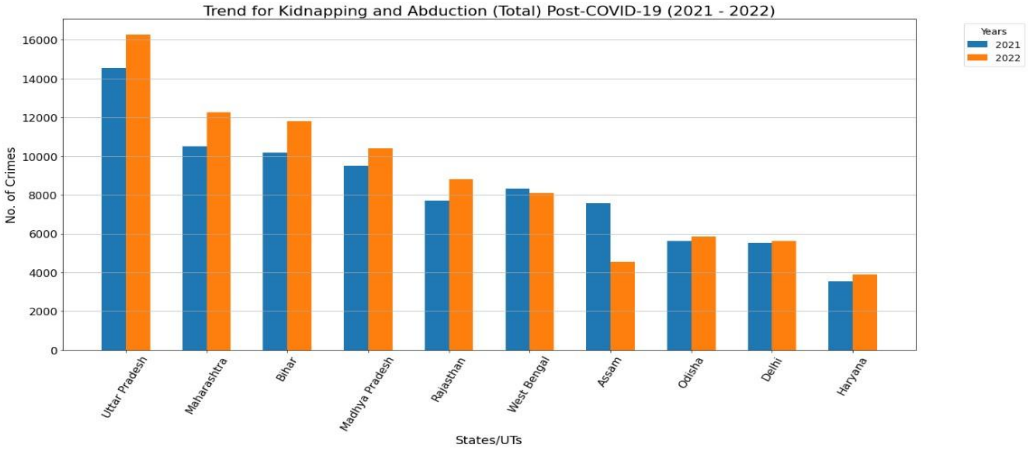

Fig:7 Kidnapping and Abduction (Total) Post- Covid-19 (2021-2022)

DETAILED ANALYSIS ON CRIMES USING HEAT MAPS (Pre vs Post COVID)

In this analysis, we have examined several crimes through the use of a heat map. Like trend analysis, we categorized the detailed data (different types of crimes) into pre-COVID and postCOVID segments and visualized them with a heat map. A heat map is a graphical tool that uses
colors to represent values along two axes, making it easier to interpret complex information.

ASSAULT ON WOMEN WITH INTENT TO OUTRAGE HER MODESTY

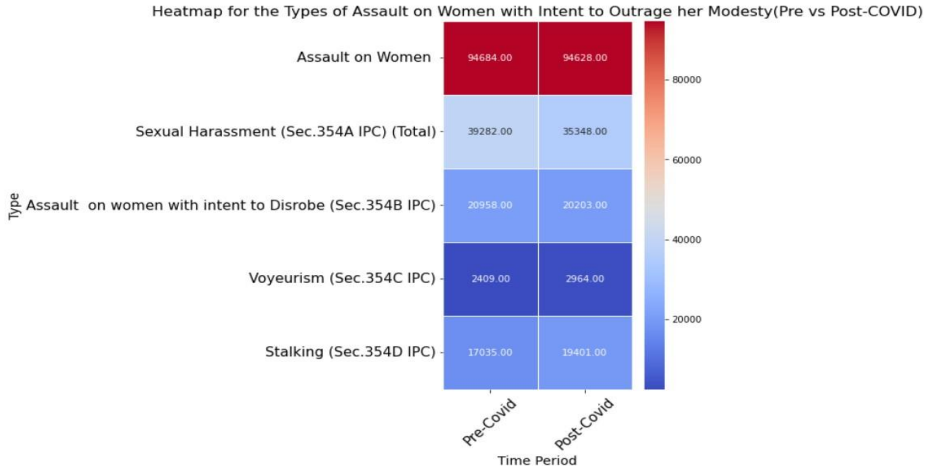

Fig:8 Assault on Women (Heat Map)

The above heat map demonstrates the comparison between different types of assault on women with the intent to outrage their modesty during pre-COVID (2017-19) and post-COVID (2021-22).

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CAUSING DEATH BY NEGLIGENCE

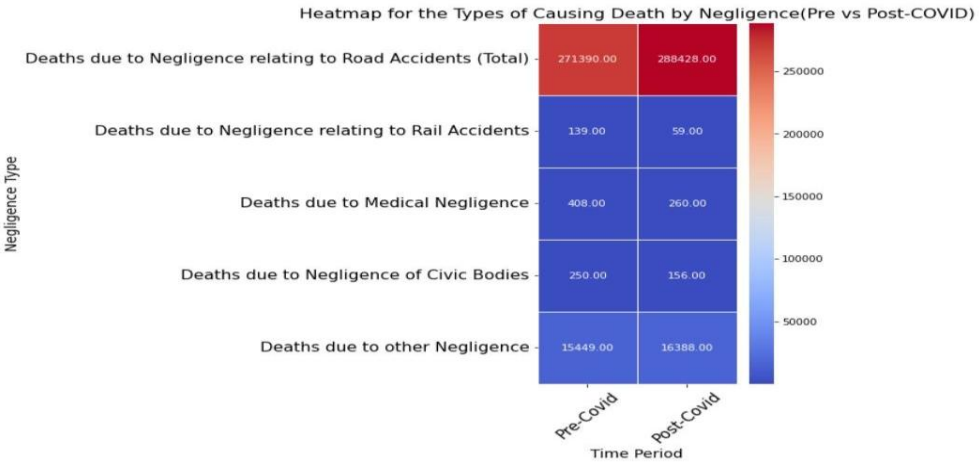

Fig:9 Causing Death by Negligence (Heat Map)

The above heat map demonstrates the comparison between different types of negligence causing death during pre-COVID (2017-19) and post-COVID (2021-22).

KIDNAPPING AND ABDUCTION

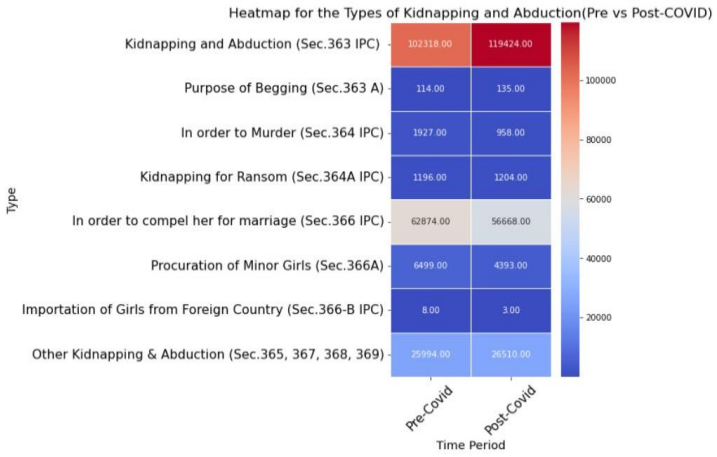

Fig:10 Kidnapping and Abduction (Heat Map)

The heat map demonstrates the comparison between different types of kidnapping and abduction during preCOVID (2017-19) and post-COVID (2021-22

MAPPING CRIME INCIDENTS: INDIAN STATES AND UNION TERRITORIES

This chart has been drawn from Tableau to present the cumulative incidents per State/UT for 2017 to 2022, not including the years 2018 and 2020. Incidents have been displayed using a red color map that consists of three different shades: Dark Red, Orangish Red, and Light Red. Dark Red reflects more incidents, while the minimum incidents have been shown as Light Red.

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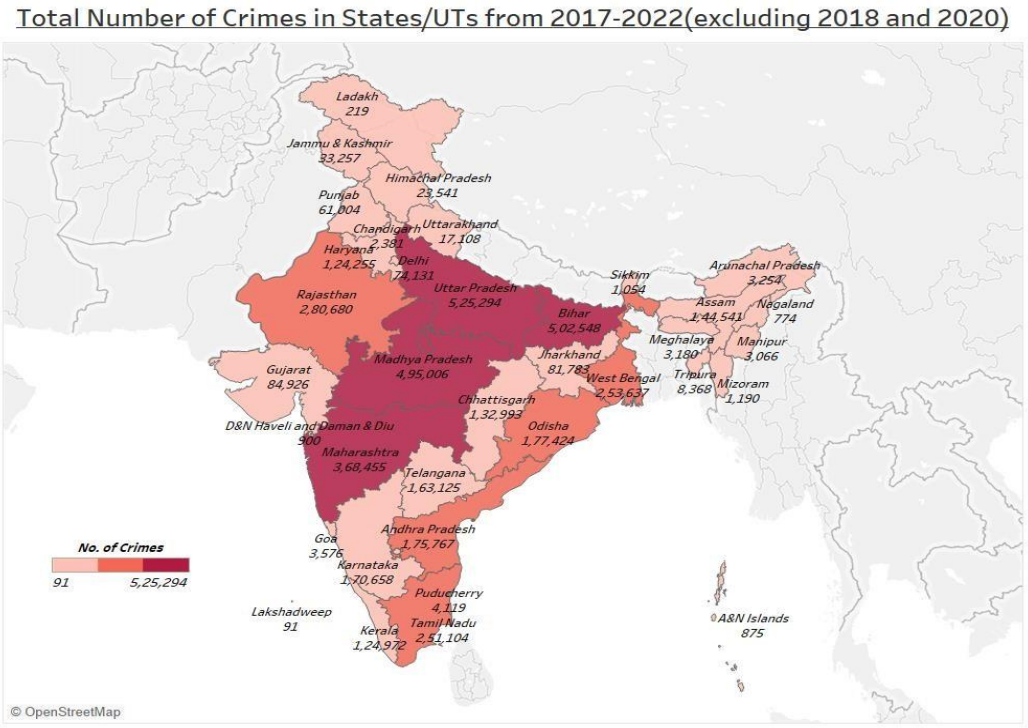

Fig:11

Based on this map, we can classify the States/UTs into various classes like; High-Crime States/UTs (Dark Red), Moderate-Crime States/UTs (Orangish Red), and Low-Crime States/UTs (Light Red).

CRIME PREDICTION

As we have completed the crime analysis section of the research we shall begin with the crime prediction. Crime Prediction is nothing but the analysis of the past crime data to identify the trends and patterns that will further assist in predicting future crime occurrences. It is performed by integrating statistical analysis, machine learning, and data visualization to derive useful insights.

We have employed Linear Regression (Simple Linear Regression) as the forecasting model in our study to predict future crime occurrences for the next five years i.e. 2023 – 2027.

Linear Regression is a statistical and supervised learning algorithm where we create a relationship between a dependent variable and one or more independent variables.

Since we have finished the crime analysis part of the study we will start with the prediction of the crime. Crime Prediction is simply the study of the past crime records to determine the patterns and trends that will further help in predicting future crime incidents. It is carried out by combining statistical analysis, machine learning, and data visualization to obtain useful insights.

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Linear Regression is a supervised learning and statistical algorithm in which we establish a relationship

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	STATES / UTs	2023	2024	2025	\
0	Andhra Pradesh	48473.553846	49976.592308	51479.630769	
1	Arunachal Pradesh	704.276923	672.546154	640.815385	
2	Assam	31943.430769	31131.738462	30320.046154	
3	Bihar	154835.830769	166274.138462	177712.446154	
4	Chhattisgarh	42243.492308	45060.915385	47878.338462	

	2026	2027
0	52982.669231	54485.707692
1	609.084615	577.353846
2	29508.353846	28696.661538
3	189150.753846	200589.061538
4	50695.761538	53513.184615

Fig:12 First Five Predicted Values for the year 2023 – 2027

DATA VISUALIZATION OF SOME STATE/

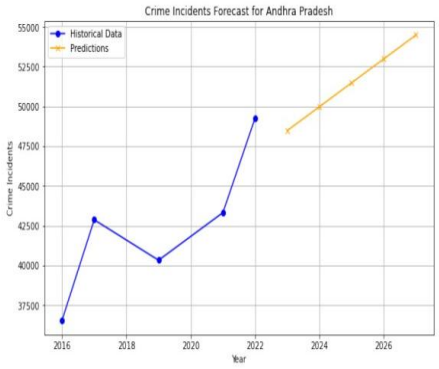


Fig: 13 Previous and Predicted Value of Andhra Pradesh

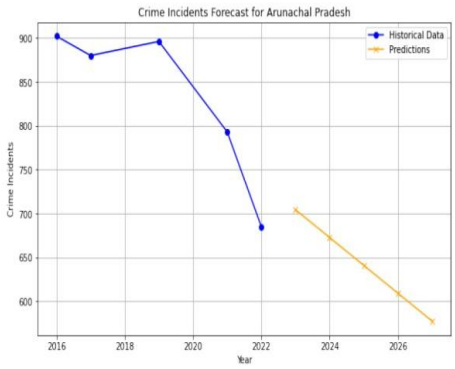


Fig: 14 Previous and Predicted Value of Arunachal Pradesh

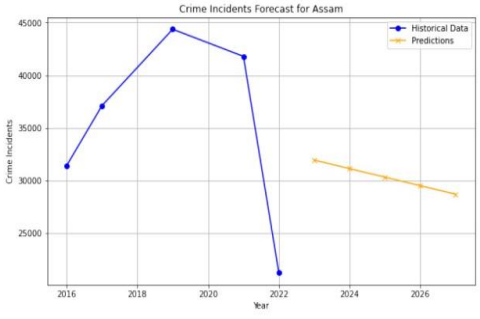


Fig: 15 Previous and Predicted Value of Assam

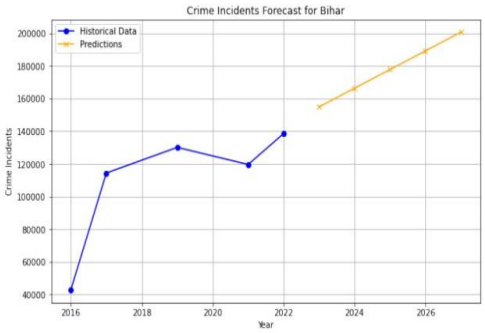
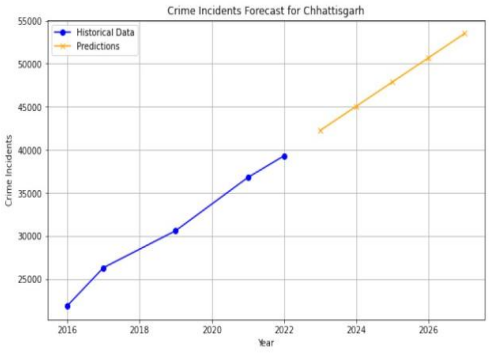


Fig:16 Previous and Predicted Value of Bihar



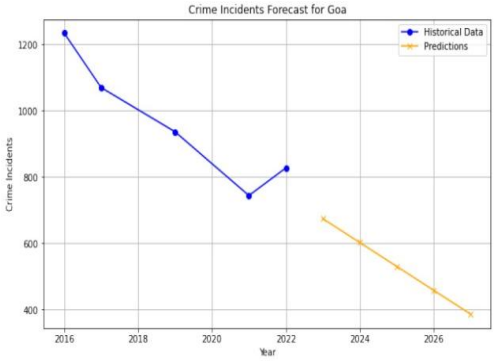


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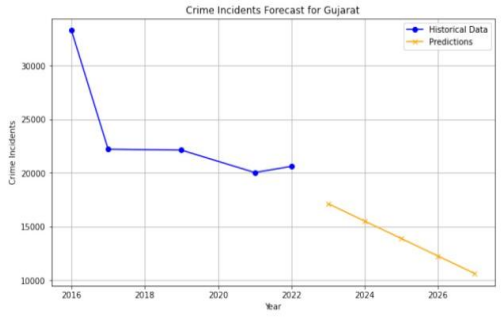
Fig: 17 Previous and Predicted Value of Chhattisgarh

Fig: 18 Previous and Predicted Value of Goa



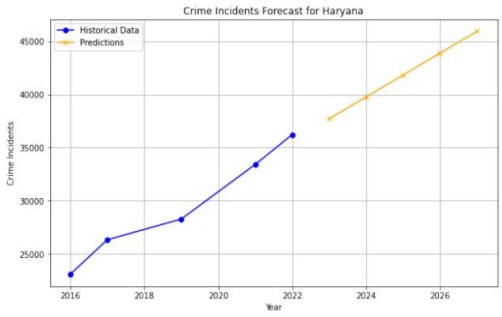
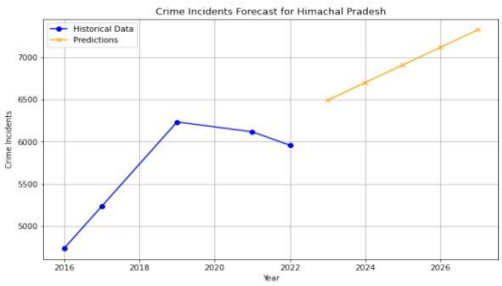


Fig: 19 Previous and Predicted Value of Gujarat

Fig: 20 Previous and Predicted Value of Haryana



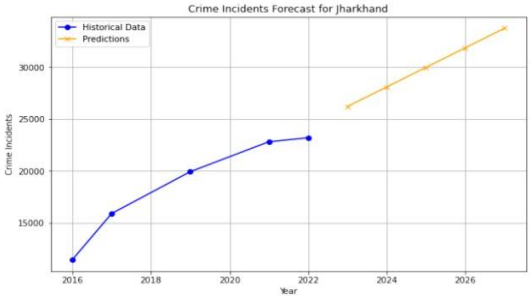
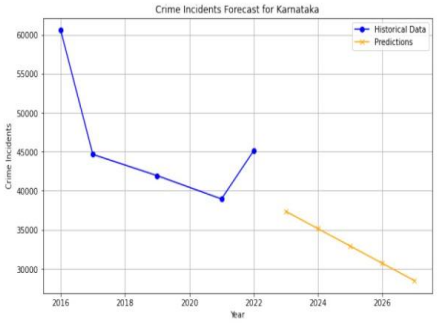


Fig: 21 Previous and Predicted Value of Himachal Pradesh

Fig: 22 Previous and Predicted Value of Jharkhand



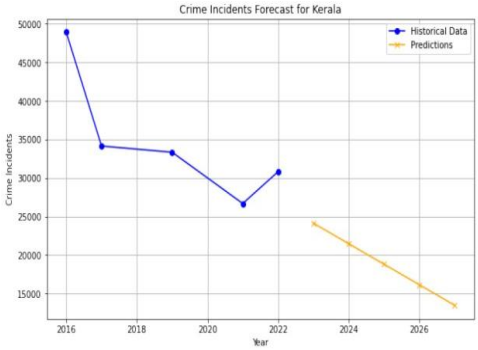
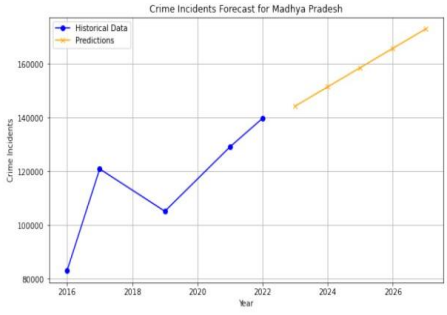


Fig: 23 Previous and Predicted Value of Karnataka

Fig: 24 Previous and Predicted Value of Kerala



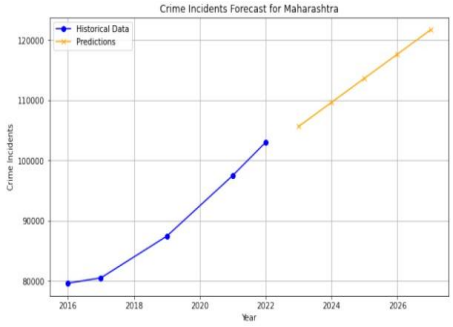


Fig: 25 Previous and Predicted Value of MP

Fig: 26 Previous and Predicted Value of Maharashtra

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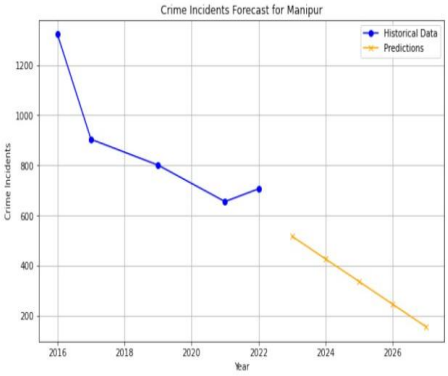


Fig: 27 Previous and Predicted Value of Manipur

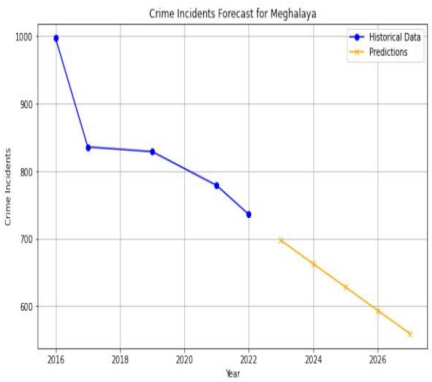


Fig: 28 Previous and Predicted Value of Meghalaya

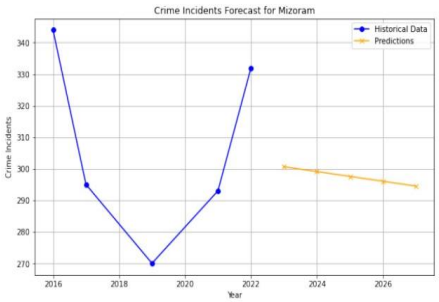


Fig: 29 Previous and Predicted Value of Mizoram

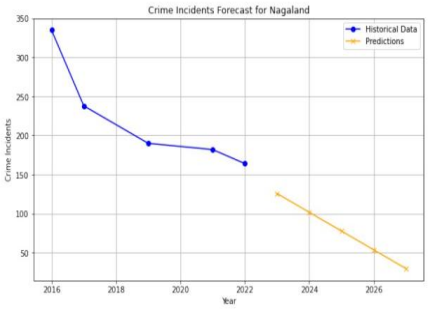


Fig: 30 Previous and Predicted Value of Nagaland

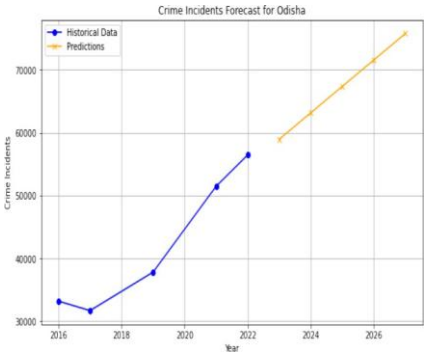


Fig: 31 Previous and Predicted Value of Odisha

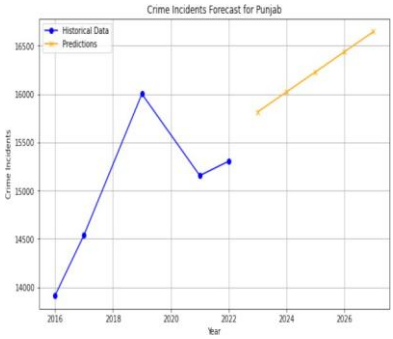
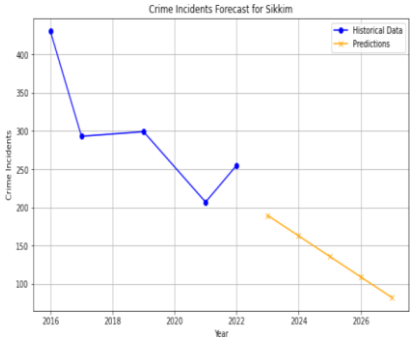


Fig: 32 Previous and Predicted Value of Punjab



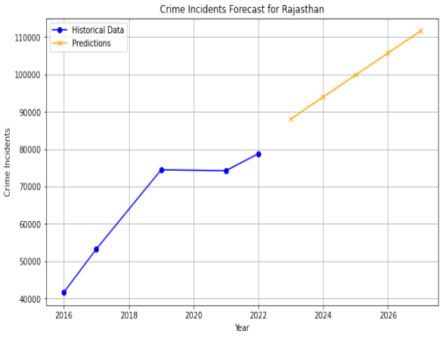


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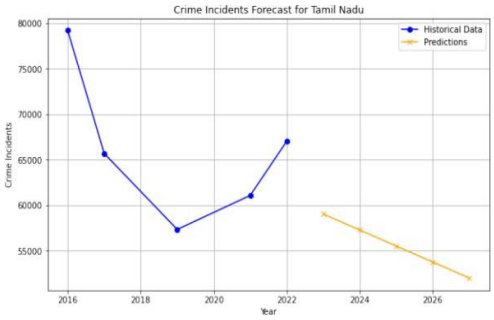
Fig: 34 Previous and Predicted Value of Sikkim

Fig: 33 Previous and Predicted Value of Rajastha



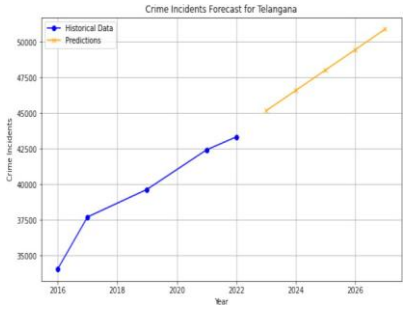


Fig: 35 Previous and Predicted Value of Tamil Nadu

Fig: 36 Previous and Predicted Value of Telangana

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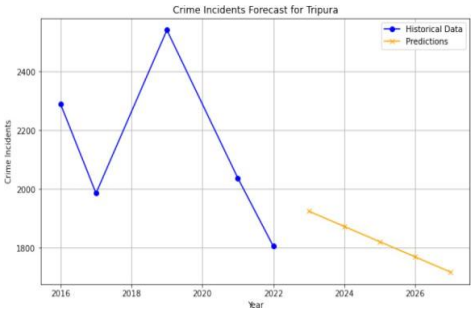

Fig: 37 Previous and Predicted Value of Tripura

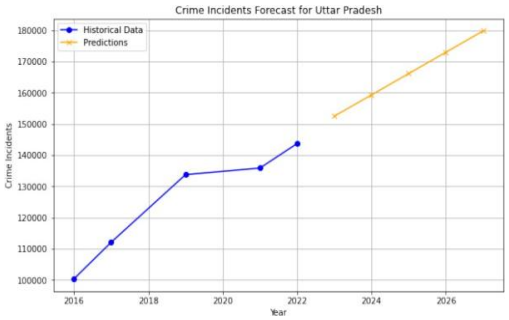

Fig: 38 Previous and Predicted Value of UP

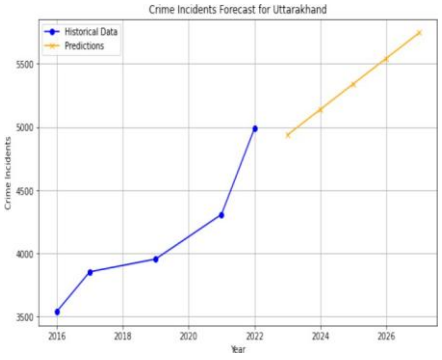

Fig: 39 Previous and Predicted Value of Uttarakhand

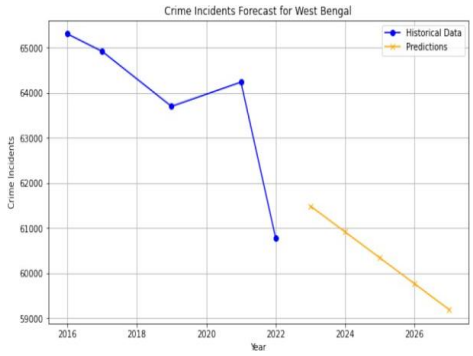

Fig: 40 Previous and Predicted Value of West Bengal

Fig: 41 Previous and Predicted Value of A&N Islands

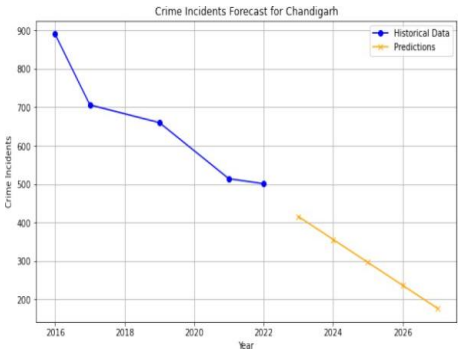

Fig: 42 Previous and Predicted Value of Chandigarh

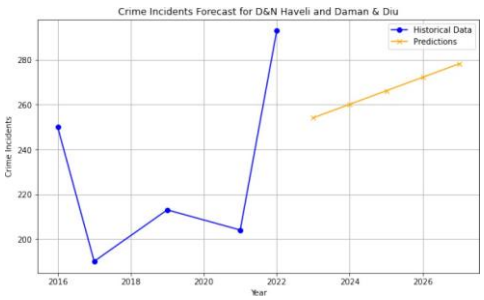

Fig: 43 Previous and Predicted Value of Dadar & Nagar Haveli and Daman and diu

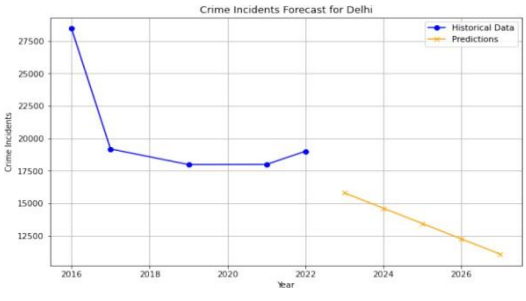

Fig: 44 Previous and Predicted Value of Delhi

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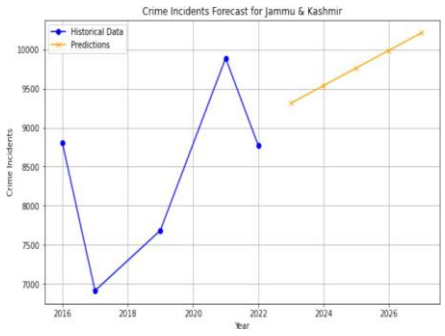

Fig: 45 Previous and Predicted Value of J&K

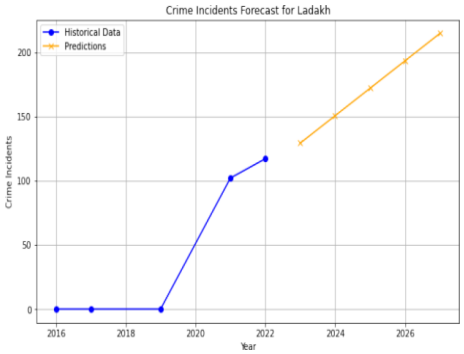

Fig: 46 Previous and Predicted Value of Ladakh

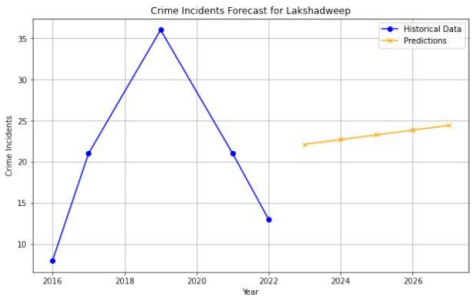

Fig: 47 Previous and Predicted Value of Lakshadweep

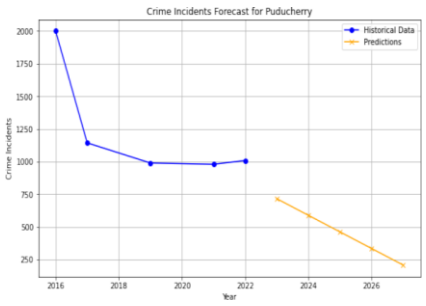

Fig: 48 Previous and Predicted Value of Puducherry

RESULTS AND OUTCOMES

Since, now we are done with crime analysis and crime prediction we can discuss all the results and outcomes which we have concluded.

CRIME ANALYSIS (Fig: 1 to 10)

Numerous trends have been found in the crime data analysis and related visualizations (Fig. 1 to Fig. 10) for various crime categories both before and after the COVID-19 epidemic.

According to Fig. 1, which examines the relationship between rape (Section 376 IPC) and murder (Section 302 IPC) instances, there was a higher connection in 2022 (0.73) than in 2021 (0.66). This implies that rape cases are more likely to be reported in states or Union Territories with higher homicide rates. This conclusion is further supported by the regression line's positive slope, which shows a direct correlation between the two variables [1]. Figures 2 and 3 show cases of attack on women before and after COVID (2017–2019 and 2021–2022, respectively). States with the largest number of infections prior to the pandemic were Maharashtra, Odisha, Rajasthan, and Uttar Pradesh. In Maharashtra, Odisha, and Rajasthan, assault cases have somewhat increased after COVID-19, however in Uttar Pradesh, they have decreased. But the pandemic doesn't seem to be directly responsible for any significant change [2]. Figures 4 and 5, which show the number of deaths from neglect before and after COVID-19, show variations in states such as Madhya Pradesh, Rajasthan, Maharashtra, Tamil Nadu, and Uttar Pradesh. Throughout both time periods, these areas continuously reported greater rates of deaths

attributable to negligence [3]. Cases of kidnapping and abduction, as seen in Figures 6 and 7, also show variations before and after COVID. There has been a slight decrease in the total number of cases since the epidemic, despite the fact that states like Uttar Pradesh, Maharashtra, and Bihar have continued to record significant numbers of these infections [4]. We found low overall variation between pre- and post-pandemic data in Fig. 8 (Assault on Women Heat Map). Certain categories, however, displayed clear trends: voyeurism and stalking rose—possibly as a result of increased online engagement—while sexual harassment and desire to disrobe decreased after COVID, probably as a result of fewer in-person encounters [5].

Road accident deaths have increased after COVID, which is consistent with the recovery of mobility, according to Fig. 9 (Causing Death by Negligence Heat Map). However, deaths from medical malpractice, railway accidents, and municipal body failures decreased, most likely as a result of stricter post-pandemic restrictions [6]. Lastly, a variety of modifications are depicted in Fig. 10 (Kidnapping and Abduction Heat Map). Crimes like kidnapping for forced marriage and procuration of minor girls decreased during COVID, while kidnapping for ransom, begging, and other kinds increased—possibly reflecting socioeconomic decline. Stricter law enforcement, less travel, and greater knowledge could all be responsible for this [7].

CRIME MAPPING (Fig:11)

From the Crime Mapping (Fig:11), We have derived some results along with their reasons, such as: High-Crime States/UTs are Uttar Pradesh, Bihar, Madhya Pradesh, and Maharashtra because the number of cases between 2017 and 2022 varies from 525K – 368K respectively. All these states account for the highest percentage of the overall number of crimes reported in the nation.
Moderate-Crime States/UTs are Rajasthan, West Bengal, Tamil Nadu, Odisha, and Andhra Pradesh since the incidents between 2017 to 2022 vary between 280K – 175K respectively.
Whereas, Low-Crime States/UTs are Karnataka, Telangana, Assam, Chhattisgarh, Kerala, Haryana, Gujarat, Jharkhand, Punjab, Himachal Pradesh, Uttarakhand, Tripura, Goa, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Sikkim, Nagaland and all union territories because the incidents from 2017 to 2022 vary between 170K – 91.
The reasons, why most of the states have more crime occurrences and some states/union territories have fewer crime occurrences are as follows:

REASONS FOR HIGH–CRIME INCIDENCES:

1. Large Population Density and Socio-Economic Challenges:

UP, Bihar, and Maharashtra have the most crime occurrences due to population density and socioeconomic issues.
UP and Bihar are the most populated states of the nation with approximately 200 and 125 million population respectively, which suffer from all socio-economic problems like poverty, unemployment, and underdevelopment particularly in the state's rural sector due to which most of the population cannot acquire the access of quality education, health care, and employment facilities, creating a cycle leading towards criminality. Whereas, Maharashtra, particularly in Mumbai which is the financial capital of the nation, makes it financially stronger than UP and Bihar. But still, the gap between the upper class and lower class in Maharashtra brings frustration, social/ communal tensions, and regional disparities, in some areas causing gang violence, political clashes, and other types of crimes against humans.

2. Social Inequalities and Marginalized Population:

Scheduled Castes (SCs), Scheduled Tribes (STs), Other Backward Classes (OBCs), and economically backward classes are among the marginalized groups that consider several Indian states to be their homeland. As a result, they frequently experience caste violence, communal strife, and exploitation. About 21% of SCs in Uttar Pradesh are victims of caste-violence, and economic inequality encourages criminal activity in these communities. Tribal land issues affect 16.7% of SCs and 21% of STSs (the largest ST population in the nation) in Madhya Pradesh. Dalits and tribal populations also face exploitation, prejudice, and violence. Similar disparities exist in other states, such as Rajasthan, West Bengal, and Odisha, which regrettably lead to an increase in criminal activity.

3. Weak Law Enforcement and Judicial Backlogs:

There are some states in India with under-staffed police forces, corruption and political influence, poor deterrence, slow justice, etc., which are the few causes of increased crime incidents. States such as; Uttar Pradesh, with the biggest police forces and most judicial backlogs in the nation, encounter the challenges of handling the massive crimes and slowing the justice. In Bihar, there is insufficiency because the workload of the police officers becomes too much causing inefficiency and corruption, while Bihar's legal system is too slow, as a result, the criminals become unpunished for years together. Likewise, there are other states like

Rajasthan, West Bengal, and Odisha, also experience such types of inequalities that unfortunately raise incidents of crime.

REASONS FOR LOW–CRIME INCIDENCES:

1. Strong Law Enforcement and Urban Control:

There are states/union territories in India with effective law enforcement, surveillance and rapid response, Proactive crime prevention, etc., which offer a safer environment leading to fewer crime incidents. States/Union Territories such as; Delhi, which has a huge, well-equipped police force with specialized units to assist in preventing serious crimes. Delhi also has various community policing programs such as Meri Dilli, Meri Police, etc., as well. While in Gujarat, the police are well-equipped, with specialized units, trained personnel, and up-to-date equipment, assisting in prevention as well as detection of crime.

2. Low Population Density and Community Cohesion:

India has low population density states/union territories with deep-rooted community bonds, Traditional

Conflict Resolution system, etc., thus less crime incidents. Examples of such states include; Sikkim, which is

India's second highest population state, lowers the city crime incidents experienced by highly populated states. Secondly, the community members of Sikkim render social support to one another as well as identity given to a culture which leads to a lesser number of crime cases like murder and assault. Likewise, in Mizoram investments have been made in community policing development.

3. Human Development and Welfare:

There are Indian States with an emphasis on education, healthcare, work, and welfare that enable the individual to enjoy a quality of life in secure environments. Particularly, Kerela is one such state that provides a quality of life through policies of human development and welfare which lead to minimal crime occurrences.

CRIME PREDICTION

From Crime Prediction (Fig:12 to Fig:48), we have observed that there are various states and union territories where we can notice growth for all 5 years (2023-2027) in the number of crime cases post-2022. Andhra Pradesh (Fig:13), Assam (Fig:15), Bihar (Fig:16), Chhattisgarh (Fig:17), Haryana (Fig:20),
Himachal Pradesh (Fig:21), Jharkhand (Fig:22), Madhya Pradesh (Fig:25), Maharashtra (Fig:26), Odisha (Fig:31), Punjab (Fig:32), Rajasthan (Fig:33), Telangana (Fig:36), Uttar Pradesh (Fig:38), Uttarakhand (Fig:39), Jammu & Kashmir (Fig:45), Ladakh (Fig:46), and Lakshadweep (Fig:47) are the union territories and states that have an increase in the number of crime incidents post-2022.
Whereas other states and union territories such as Arunachal Pradesh (Fig:14), Goa (Fig:18), Gujarat (Fig:19), Karnataka (Fig:23), Kerala (Fig:24), Manipur (Fig:27), Meghalaya (Fig:28), Mizoram (Fig:29), Nagaland (Fig:30), Sikkim (Fig:34), Tamil Nadu (Fig:35), Tripura (Fig:37), West Bengal (Fig:40), Andaman & Nicobar Islands (Fig:41), Chandigarh (Fig:42), Dadar & Nagar Haveli and Daman & Diu (Fig:43), Delhi (Fig:44), and Puducherry(Fig:48) exhibit reduction in the count of crime occurrences after 2022.

Use of Simulation software PYTHON

Python is a general-purpose, high-level language which is simple to read and understand. It is widely used in many applications such as, data analysis, machine learning, etc.
For end-to-end crime analysis and forecasting with Python, you can use a suite of libraries for different facets of data processing, statistical computing, machine learning, and data visualization. Some prominent libraries are given below:

Data Handling and Manipulation

1. Pandas: For data manipulation and analysis. It provides data structures and functions needed to work with structured data.
2. NumPy: For numerical operations and array manipulations.

Data Visualization

1. Matplotlib: For creating static, animated, and interactive visualizations in Python.
2. Seaborn: Built on top of Matplotlib, Seaborn provides a high-level interface for drawing attractive and informative statistical graphics.

Machine Learning and Prediction

1. Scikit-Learn: For general machine learning algorithms and tools. It includes algorithms for classification, regression, clustering, and more. From Scikit-learn, we have used sklearn.linear_model for the Linear Regression model.

MICROSOFT EXCEL

Microsoft Excel is a comprehensive program that allows users to organize, analyze, and analyze data. and visual information.

TABLEAU

Tableau is a powerful data and business tool that helps users create interactive data and share dashboards.

Simplifies data analysis and allows users to meaningfully search, visualize, and understand data.

VI. CONCLUSION

Using the NCRB dataset, this study has attempted to perform crime analysis and prediction. We performed trend analysis, correlation analysis, and in-depth analysis using a heat map in crime analysis. In order to carry out comprehensive research that can significantly aid in public security and safety through actionable intelligence for policy making and law enforcement initiatives, we have also performed crime prediction using a linear regression model. This crime research study's ultimate goal is to reduce crime rates in the country and improve the efficiency of India's efforts to prevent and regulate crime.

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