

IPC Crime Rate Prediction using Tableau

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Abstract—Crime exists in India in various forms such as Murder, Kidnapping, Burglary, Rape, Dowry deaths, Human trafficking, etc. These crimes have been perpetrated in India for a long time and exhibit a variety of statistical patterns. NCRB publishes crime statistics once a year (National Crime Records Bureau). Researchers, on the other hand, do not make effective use of this information. There are a variety of data analysis techniques available for extracting useful information from databases and using it to combat crime in India. The major goal of this research study is to give a comprehensive picture of the various sorts of crimes that occur in India, as well as to look at overall trends in crime and crime rates. The number of cases that are solved is also examined in this research. According to the research, Bihar has the highest crime rate.

Index Terms—IPC crimes, Crime Rate, Crimes against juvenile, Crimes against women, Cruelty on women, Assault on women, Dowry Deaths, Kidnaping and Abduction of women and girls, Rape, trend analysis, prediction of crime.

I. INTRODUCTION

India is a large country with many different societies. In any community, peace is one of the most important requirements of human beings. Economic development, and thus overall economic development, is heavily reliant on a peaceful environment, i.e., the lack of violence. Criminality is a global issue that has a major negative externality on a society's quality of life. Despite the fact that the definition of crime varies by country, violent crimes always constitute a major threat to capability that could otherwise improve one's quality of life. In many ways, crime lowers one's quality of life. It restricts movement, obstructing access to potential career and educational opportunities, and discourages asset accumulation. The rapid rise in developing country crime rates has sparked significant public concern about personal and property protection. Academics and policymakers in certain countries are paying greater attention to issues of crime, violence, and victimisation than traditional economic problems. There is no stated basis for any kind of illness that could lead to criminal activity. In general, a person's criminal activities are caused by society, cultural elements, various family systems, political pressures, and law enforcement. Murder, abduction, burglary, rape, dowry deaths, human trafficking, and other forms of crime abound in India. India may be dealing with a major disadvantage in the form of corruption. Indian society has its own distinct personality, and the rise of crime in India must be viewed in light of this. In emerging countries like India, reducing crime rates is critical. The number of crimes committed in India exceeds the number of crimes committed in industrialized countries. The goal of this article is to look at the many sorts of crime that have occurred in India over the last twelve years, from 2001 to 2012, and to look at the overall trends so that these crimes can be prevented in the future.

II. METHODOLOGY AND THE DATA SOURCES

The present paper is concerned with increasing in IPC Crime Rates in India with three major components such as (a) Crime against juvenile, (b) Crime against women and (c) Other IPC crimes.

The descriptions of the above three components are presented in Table 1 below:

Table I: Description of the Five Components of IPC Crimes in India

Components of IPC Crimes	Descriptions
Juvenile Crimes	Juveniles arrested State wise, Disposal of Juveniles Arrested based on six levels, Comparing Juveniles arrested based on their sex, education and family background.
Crime against Women	Assault on Women with Intent to Outrage Her Modesty, Cruelty by Husband or His Relatives, Dowry Deaths, Kidnapping and Abduction of Women and Girls, Rape Cases.
Other IPC Crimes	Stolen Property Cases, Value of Stolen Property Cases, Comparing various theft cases like: Dacoity, Robbery, Burglary, Theft, Criminal Breach of Trust, Other stolen property cases, Auto theft, etc. State wise murder cases, Age wise murder cases, attempt to murder cases, Causing Death by Negligence cases, Trial of murder crimes by court.

Analysis and Predictive models have been made by using Tableau. Forecasting of increasing trends of Total IPC Crimes have been done for each State in India, Predictions of Crime Rate of next 5 years have been done for all the components of Crimes taken in present paper.

For gauging the trend of Crime against women forecasting models with using both Year to Year Growth Rate (YTY)¹ as well as Compound Annual Growth Rate (CAGR)² have been employed from [1].

Many different parameters such as Calculated Fields, Parameters, in-built Tableau functions like: Sum, Average, Median, Count, Count (Distinct), Minimum, Maximum, Percentile, Standard Deviation, Variance. Also using table calculations like: Running Total, Difference, Percent Difference, Percentage of Total, Rank, Percentile, Moving Average, YTD Total, Compound Growth Rate, Year Over Year Growth, YTD Growth have been used in analysis of all the components.

Also, different type of Graph Plots has been used for Data Visualizations such as: text tables, heat maps, highlight tables, geographical maps, pie charts, bar graphs, stacked bar graphs, side by side bar graphs, tree maps, circle views, line graphs, multiple line graphs, area charts, dual combination of bar graphs and line charts, scatter plots, histograms, box and whisker plots, Gantt chart, bullet graphs, packed bubbles chart.

About the data:

Data from the period of 2001-2012 have been collected from The National Crime Record Bureau (NCRB) [<http://ncrb.nic.in/>], The data was collected in different files and with the use of Tableau, Relationships were easily formed between the data. The data consists of over more than 35,000 rows and 120 columns.

III. RESULTS OF ANALYSIS AND PREDICTION

A. IPC Crimes In India

This section discusses the result of analysis and predictions made using Tableau. Firstly, lets discuss the trends of all the IPC Crimes in India from year 2001 to 2012 and forecasting of the same trends for next five years.

The Figure 1 shows that since 2001 to 2012 the total number of IPC Crimes in India are continuously increasing and the Forecasting model shows that for the next five years shows that the crime rates are going to increase more.

Now taking a look at the crime rates of all the States of India. Hence, from Figure 2 we can see that Lakshadweep Islands has the least amount of IPC crimes at 1,486 whereas Madhya Pradesh has the greatest number of IPC crimes at 48,27,540.

Now, let us see and compare the analysis of the state with maximum increasing crime rate and the state with least increasing or decreasing crime rate.

From the Figure 3 we can analyse that crime rates in some states of India like Kerala are going to increase exponentially, more than doubling the crime rates in next 5 years. Whereas, from Figure 4 we can see that crime rates in some states of India like Mizoram are going to decrease slightly in the next 5 years.

B. Juvenile Arrested Cases

This section discusses about the analysis and forecasting of Juvenile Cases in India. We are taking into consider parameters like State wise Juvenile Cases, Disposal of Juvenile after being arrested and comparing Juvenile on the basis of Sex, Education and Family Background.

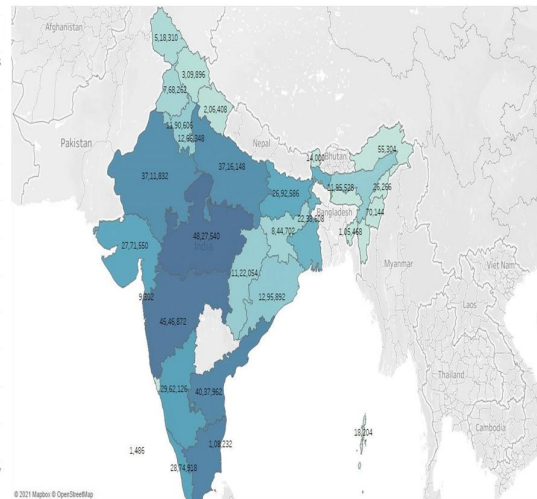
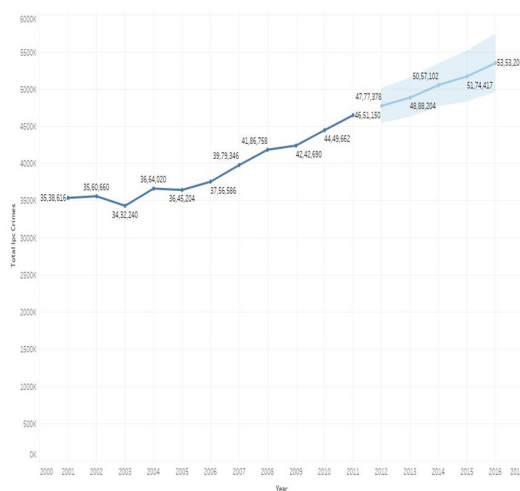


Figure 1: Analysis of trend and forecasting of next 5 years. Figure 2: State wise comparing IPC Crime Rates in India from 2001 – 2012.

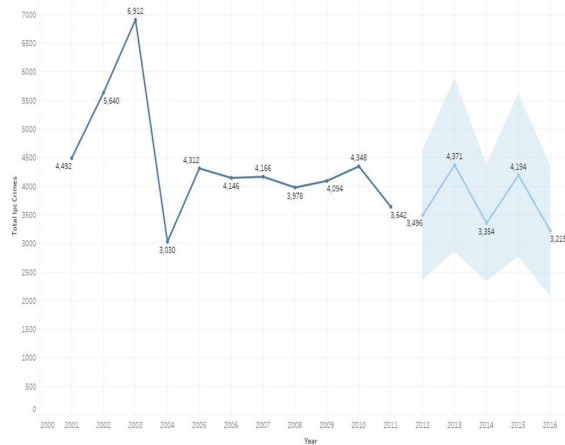
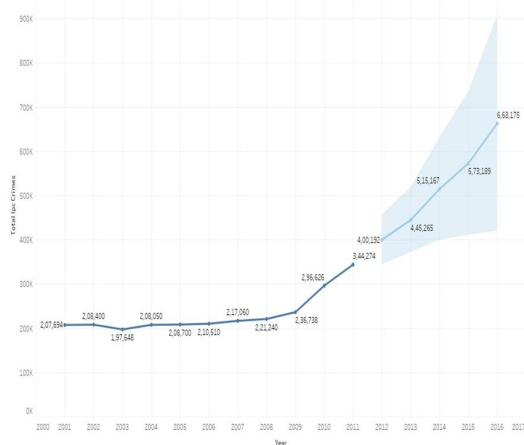


Figure 3: State with the highest increasing crime rate.

Figure 4: State with least increasing or decreasing crime rate.

Firstly, let us analyse the trend of Juveniles arrested over the year between 2001-2010 and then make the prediction model to forecast the crime rates of next 5 years.

From the Figure 5 we can analyse that trend of Juvenile Cases is increasing over the years but also there a slight decrease towards the end. Regardless of the decrease in the graph towards the end, the forecasting model shows that over the next 5 years there is going to be increase in Juvenile Arrested Cases.

Now let's take a look at analysis of State wise Juvenile Arrested Cases. From the Figure 6, we can conclude that Manipur has 0 cases of Juvenile Arrested since 2001-2010 and Madhya Pradesh has 1,32,373 the highest cases of Juvenile Arrested since 2001-2010 in India.

Disposal of Arrested Juvenile

As we have analysed the trend of Juvenile Arrested Cases and seen the forecasting of next five years. Also, analysed the state wise Juvenile Arrested Cases.

Now, Let's discuss about the Disposal of these Juveniles that has been arrested since 2001-2010 in India. Majorly there are 6 ways in which most of the Juvenile are disposed by the Courts these are:

- Juveniles Released on Probation and placed under the care of Parent or Guardian.
- Juveniles Sent to Special Home Care facilities.
- Juveniles Sent home after Advice or Admonition.
- Juveniles Acquitted or otherwise Disposed of.

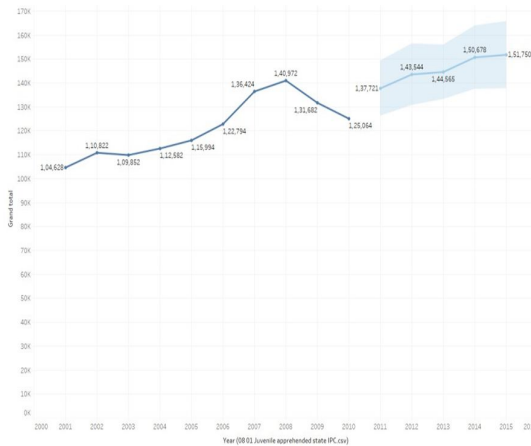


Figure 5: Analysis of trend of Juveniles Arrested and forecasting.

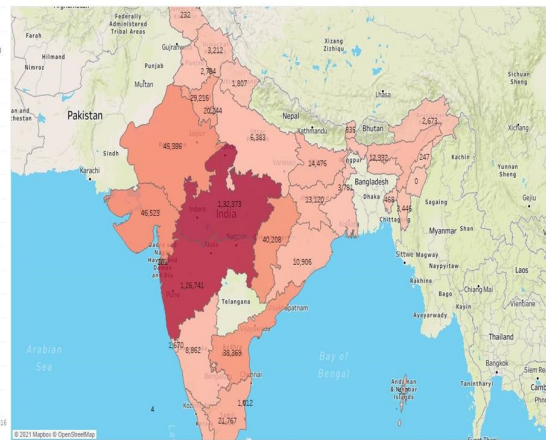


Figure 6: State wise crime rate of Juvenile Arrested Cases

- e) Juveniles released on probation and placed under the care of Fit Institutions.
- f) Juveniles Dealt with Fine.

From the below Figure 7, we can analyse:

Maharashtra has 15,831 the highest rate of Juveniles Released on Probation and placed under the care of Parent or Guardian.

- a) Maharashtra has 9,887 the highest rate of Juveniles Sent to Special Home Care facilities.
- b) Madhya Pradesh has 13,998 the highest rate of Juveniles sent home after Advice or Admonition.
- c) Madhya Pradesh has 4,025 the highest rate of Juveniles Acquitted or otherwise Disposed.
- d) Maharashtra has 3,473 the highest rate of Juveniles released on probation and placed under the care of Fit Institutions.
- e) Madhya Pradesh has 5,182 the highest rate of Juveniles Dealt with Fine.

Let's analyse the Juvenile Arrested on the basis of Sex in India. From the Figure 8, we can analyse that most of the Juvenile in our country are arrested for 5 main reasons such as: Theft, Grievous Hurt, Burglary, Riots, Auto Theft. And mostly 90%* of Juveniles arrested are Boys and only 10%* of them are Girls. Whereas, the ratio of Girls is more in Dowry Deaths and Cruelty by Husband or Relatives.

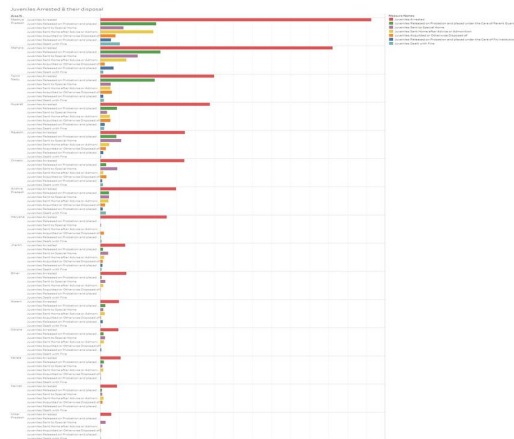


Figure 7: Disposal of Arrested Juvenile

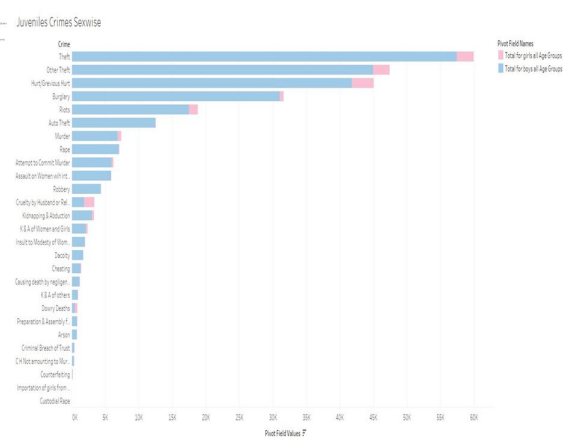


Figure 8: Analysis of Juvenile Arrested on the basis of Sex.

Now, let's analyse the Juvenile Arrested on the basis of Education in India.

From the Figure 9, we can analyse that highest number of Juveniles that are arrested have education up to primary level and the least number of Juveniles have education up to matric or higher secondary and above.

Now, let's analyse the Juvenile Arrested on the basis of Family Background in India.

From the Figure 10, we can analyse that highest number of Juveniles that get arrested are Living with their Parents and the least number of Juveniles that get arrested are Living Homeless.

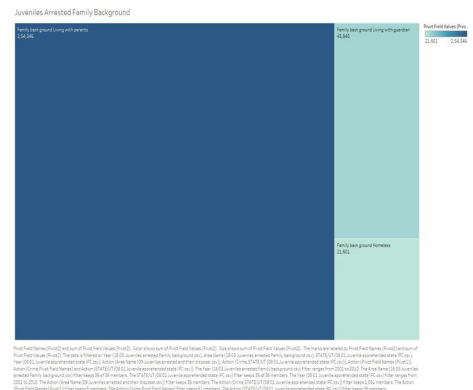
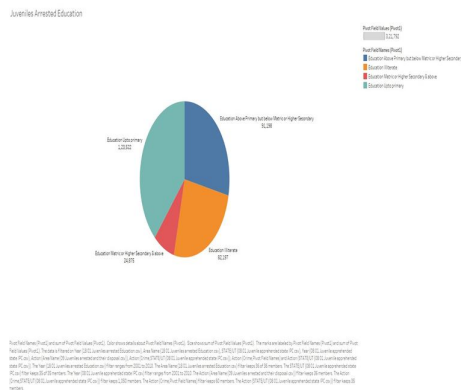


Figure 9: Analysis of Juvenile Arrested on the basis of Education

Figure 10: Analysis of Juvenile Arrested on the basis of Family Background

C. Crime Against Women

India continues to experience crime against women despite the efforts of the government to toughen bills that prosecute men who attempt to rape women and also criminalize offenses like stalking and voyeurism.

The different crimes against women that we are discussing are:

- Assault on women with intent to outrage her modesty.
- Cruelty by Husband or his relatives
- Dowry deaths.
- Kidnapping and Abduction of women and girls.
- Rape

Let us take a look at the different trends of all of these different crime against women.

From Figure 11, we can see that all five crimes against women have nearly the same trend that is increasing over the years and the prediction model applied also shows us that all the 5 crimes against women are going to increase further in the next 5 years.

Now Let's compare the results of the five crimes against women on the basis of states of India and analyses the states that have the highest numbers for these crimes since 2001 to 2012.

From Figure 12, we can analyse that cases of Cruelty by husband or his relatives is much more than cases of other four crimes and cases of Dowry Deaths is least as compared to other four crimes against women.

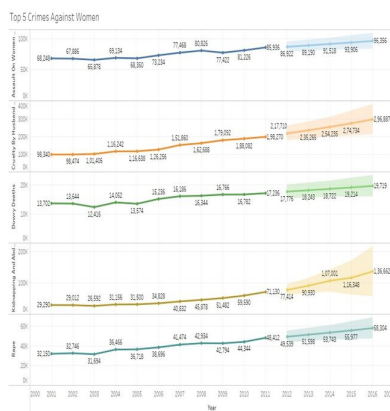


Figure 11: Analysis and Prediction of different crime against women in India

Figure 12: Analysis of fives crime against women using tree-maps and heatmaps

From Table 2 we can also analyse five crimes against women state wise, we can see that most of the crimes against women happen in 3 states of India that are: Madhya Pradesh, Uttar Pradesh and West Bengal. And least number of cases against women are in Lakshadweep.

TABLE II: ANALYSE OF FIVE CRIMES AGAINST WOMEN STATE WISE

Crimes Against Women	Highest Cases	Least Cases
Cruelty by Husband or his relatives	West Bengal	Lakshadweep
Assault on women with intent to outrage her modesty	Madhya Pradesh	Lakshadweep
Kidnapping and Abduction of women and girls	Uttar Pradesh	Lakshadweep
Rape	Madhya Pradesh	Lakshadweep
Dowry Deaths	Uttar Pradesh	Lakshadweep

Now let's compare the results of YOY growth rate and CAGR of five different crimes against women. The relative position of the 35 states is determined based on YOY and CAGR.

In Table 3, we analyse the Performance of the major Indian states with respect to All India in terms of YOY.

TABLE III: ANALYSIS USING YOY GROWTH RATE ON FIVE CRIMES AGAINST WOMEN

Crimes Against Women	Good Performing States	Bad Performing States
Cruelty by Husband or his relatives	10 states (A&N, CHH, D&N, D&D, HP, MI, NA, UP, PUN, OD)	25 states (AP, ARP, AS, BI, CH, DEL, GO, GU, HR, J&K, JK, KA, KE, LA, MP, MH, MA, ME, PUD, SI, TN, TRI, UTK, WB, RA)
Assault on women with intent to outrage her modesty	15 states (A&N, ARP, BI, CHH, D&N, D&D, GU, HR, HP, JK, MP, PUD, PUN, RA, TA)	20 states (AP, AS, CH, DEL, GO, J&K, KA, KE, LA, MH, MA, ME, MI, NA, OD, SI, TRI, UP, UTK, WB)
Kidnapping and Abduction of women and girls	3 states (ARP, D&D, RA, LA)	32 states (A&N, AP, AS, BI, CH, CHH, D&N, DEL, GO, GU, HA, HP, J&K, JH, KA, KE, MP, MH, OD, PUD, PUN, SI, TN, TRI, UP, UKH, WB)
Rape	4 states (CHH, D&N, PUD, UP)	All other 31 states
Dowry Deaths	12 States (CHH, DEL, GO, GU, HR, HP, J&K, KA, KE, PUD, PUN, TN)	All other 18 states

In Table 4, we analyse the Performance of the major Indian states with respect to All India in terms of CAGR.

TABLE IV: ANALYSIS USING CAGR ON FIVE CRIMES AGAINST WOMEN

Crimes Against Women	Good Performing States	Bad Performing States
Assault on women with intent to outrage her modesty	10 states (A&N, CHH, D&N, D&D, HP, MI, NA, UP, PUN, OD)	25 states (AP, ARP, AS, BI, CH, DEL, GO, GU, HR, J&K, JK, KA, KE, LA, MP, MH, MA, ME, PUD, SI, TN, TRI, UTK, WB, RA)
Cruelty by Husband or his relatives	15 states (A&N, ARP, BI, CHH, D&N, D&D, GU, HR, HP, JK, MP, PUD, PUN, RA, TA)	20 states (AP, AS, CH, DEL, GO, J&K, KA, KE, LA, MH, MA, ME, MI, NA, OD, SI, TRI, UP, UTK, WB)
Dowry Deaths	3 states (ARP, D&D, RA, LA)	32 states (A&N, AP, AS, BI, CH, CHH, D&N, DEL, GO, GU, HA, HP, J&K, JH, KA, KE, MP, MH, OD, PUD, PUN, SI, TN, TRI, UP, UKH, WB)
Kidnapping and Abduction of women and girls	4 states (CHH, D&N, PUD, UP)	All other 31 states
Rape	12 States (CHH, DEL, GO, GU, HR, HP, J&K, KA, KE, PUD, PUN, TN)	All other 18 states

IV. CONCLUSION

In recent era IPC crimes in Indian is being increasing at an intolerable level. Thus, a portrait of IPC crimes in India can be obtained by determining the relative position of the Indian states. Other than enforcement and punishment, identification of factors which can control crime rate in India may be helpful for controlling crime [2].

Major findings from the present paper can be summarized as follows:

- The growth rate of IPC crimes in India is going to increase even more in the near future. (Majority of states show an increase of double the amount of crime rate in the future whereas some states show a constant increase and decrease in crime rates.)
- In case of crime committed by Juveniles we can see that crime rates are going to increase exponentially. The highest number of cases are from Madhya Pradesh and Maharashtra.

- Majorly in India Juveniles gets Released on Probation and placed under the care of Parent or Guardian.
- 90% of Juvenile committing crimes are boys and rest 10% are girls.
- Majority Juvenile committing crimes have education up to primary level and living with their parents.
- The growth rate of the all five crimes against women showed fluctuating pattern and more or less similar trend.
- For all five crimes against women, comparing YTY growth rate and CAGR we can see that Chandigarh, Delhi, Haryana, Madhya Pradesh, Tripura and Uttar Pradesh are the worst performing and most insecure states for women in India.

It has been viewed by many that a society without crimes and criminals is a heaven. It is therefore essential to find out techniques to prevent crime. The causes of crime are largely related to socioeconomic conditions of a culture. Hence crime can be prevented by preventing the occurrence of juvenile delinquency. If youngsters are prevented from being criminals a great degree of crime can be prevented. The prevention and control of juvenile delinquency is the responsibility of the society, the government and the police. Particularly those juveniles who are orphans, uncared for by their guardians, do not get the opportunity for a stimulating environment, education and proper food, those who have gone astray, or are tempted to go off the beaten track they should be dealt with sympathy and understanding.

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