

P3

AN INTERACTIVE DATA VISUALISATION OF CRIME IN INDIA

By Ajinkyaraj More

Guide: Prof. Venkatesh Rajamanickam

Aim

- This project aims to enable an easy way to visualize the crime data of India.
- The higher goal is to enable faster and better decision making by means of data visualization.

Objectives

- Provide richer context
- Give more freedom to user
- Easy to learn and understand
- Simple to grasp visualization and interactions
- People should be able to correlate information
- People should be able to find insights and trends

Possible Users and Use Cases of data

- Police Officers
- Policy Makers
- Urban Planners
- Journalists
- Academicians

Data Sources

- Data Mappings
- Parameters
- File Format
- Limitations

Data Sources

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			FILE NAME			
	Age		Prison inmate population by sex and age-group at the end of the reference year during 2001-2012	STATEUT		YEAR
Convicts	Age		Age - Sex wise Number of convicts by the type of IPC offences at the end of the year during 2001-2012	STATEUT		YEAR
Arrested	Age	WOMEN	Age and sex wise persons arrested under crime against women during 2012.xls	STATEUT		YEAR
Arrested	Age	WOMEN		STATEUT		YEAR
Victim, Registered	Age		Age-group-wise Victims Of (Incest, Other and Total) Rape Cases During 2001-2012.xls	STATEUT		YEAR
Victim	Age		Age-group-wise victims of kidnapping and abduction during 2001-2012.xls	STATEUT		YEAR
Victim	Age		Age-group-wise Victims of murder during 2001-2012.xls	STATEUT		YEAR
Registered			Cases registered and their disposal under Cruelty by Husband or his Relatives during 2001-2012.xls	STATEUT		YEAR
Registered			Cases registered and their disposal under Dowry Deaths during 2001-2012.xls	STATEUT		YEAR
Registered			Cases registered and their disposal under Dowry Prohibition Act during 2001-2012.xls	STATEUT		YEAR
Registered			Cases registered under Special and Local Laws (SLL) crimes during 2001-2012.xls	STATEUT		YEAR
		WOMEN	Cases-Persons held under crime against Women during 2010-2012.xls	STATEUT		YEAR
				STATEUT		YEAR
			Cases-Persons held under crime against Women during 2010-2012.xls	STATEUT		YEAR
		WOMEN		STATEUT		YEAR
All				STATEUT		YEAR
All			Details disposal of cases and arrested persons held under Special and Local Laws (SLL) during 2010-2012.xls	STATEUT		YEAR
All				STATEUT		YEAR
All			Disposal of Cases and Persons held under Indian Penal Code (IPC) crimes during 2010-2012.xls	STATEUT		YEAR
				STATEUT		YEAR
		JUVENILES	Classification of Juveniles Apprehended (Under IPC And SLL) By Attributes During 2001-2012.xls	STATEUT		YEAR
		JUVENILES	Disposal Of Juveniles Apprehended (Under IPC And SLL Crimes) And Sent To Courts During 2001-2012.xls	STATEUT		YEAR
			State per UT-wise details of Incidence, Deaths and Injuries due to Police Firing during 2001-2012.xls	STATEUT		YEAR
Committed			Incidence of crime committed against children under different crime heads during 2001-2012.xls	STATEUT		YEAR
			Motives of murder during 2001-2012.xls	STATEUT		YEAR
Victim			Offenders Relation And Proximity To Rape Victims 2001-2012.xls	STATEUT		YEAR
Arrested			Recidivism Amongst Persons Arrested Under IPC Crimes During 2001-2012.xls	STATEUT		YEAR
Arrested			Persons Arrested In Cognizable Crime Cases Under The Prevention Of Corruption Act and Related Sections Of IPC In States and UTs During 2001-2012	STATEUT		YEAR
			Cognizable Crimes Registered and their disposal By Anti-Corruption And Vigilance Departments of State and UTs Under Prevention Of Corruption Act Of IPC During 20	STATEUT		YEAR
Committed	DISTRICT		District-wise crime under various sections of Indian Penal Code (IPC) crimes during 2001-2012.xls	STATEUT	DISTRICT	YEAR
Committed	DISTRICT	CHILDREN	District-wise crimes committed against Children during 2001-2012.xls	STATEUT	DISTRICT	YEAR
Committed	DISTRICT	SC	District-wise crimes committed against Schedule Caste during 2001-2012.xls	STATEUT	DISTRICT	YEAR
Committed	DISTRICT	ST	District-wise crimes committed against Schedule Tribe during 2001-2012.xls	STATEUT	DISTRICT	YEAR
Committed	DISTRICT	WOMEN	District-wise crimes committed against Women during 2001-2012.xls	STATEUT	DISTRICT	YEAR
Committed		CHILDREN	Incidence of crime committed against Children in India during 2001-2012.xls			
Committed		SC	Incidence of crime committed against Schedule Castes in India during 2001-2012.xls			
Committed		ST	Incidence of crime committed against Schedule Tribes in India during 2001-2012.xls			
Committed		WOMEN	Incidence of crime committed against Women in India during 2001-2012.xls			
			Details of Custodial Deaths during 2001-2012.xls	STATEUT		YEAR
Arrested		CHILDREN	Crime head-wise persons arrested under crime against children during 2001-2012.xls	STATEUT		YEAR
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			Crime head-wise cases reported under Indian Penal Code (IPC) during 2001-2012.xls	STATEUT		YEAR
	Place		Crimes by Place of Occurrence during 2001-2012.xls	STATEUT		YEAR
Registered	Place		Number of Cases Reported And Value Of Property Stolen By Place Of Occurrence During 2001-2012.xls	STATEUT		YEAR
	Property		Cases and their Value Of Property Stolen and Recovered During 2001-2012.xls	STATEUT		YEAR
			Details_of_inmates_escapee_during_the_year 2001-2012	STATEUT		YEAR
Victim			Number_of_women_prisoners_with_children	STATEUT		YEAR
			Recidivism Amongst Persons Arrested Under IPC Crimes During 2001-2012	STATEUT		YEAR
			Rehabilitation of prisoners during 2001-2012	STATEUT		YEAR

Data Sources

- Data Mappings
- Parameters
- File Format
- Limitations

• District • State • Year • Age • Gender	• IPC Crimes • Motives of Murder • Property Dispute, Love Affairs/ Sexual relations , Dowry, Lunacy etc.
• Schedule Tribe • Schedule Cast • Children • Women	• Victim • Committed • Convicted • Person Arrested • Cases Reported • Cases Registered

Data Sources

- Data Mappings
- Parameters
- File Format
- Limitations

	A	B	C	D	E	F	G	H
1	States & Uts	District	Year	Gender	Age Group	Crime Head	No. person arrested	
2	Andhra Pradesh		2001			Infanticide	1	
3	Arunachal Pradesh		2001			Infanticide	0	
4	Assam		2001			Infanticide	0	
5	Bihar		2001			Infanticide	0	
6	Chhattisgarh		2001			Infanticide	7	
7	Goa		2001			Infanticide	0	
8	Gujarat		2001			Infanticide	2	
9	Haryana		2001			Infanticide	0	
10	Himachal Pradesh		2001			Infanticide	0	
11	Jammu and Kashmir		2001			Infanticide	0	
12	Jharkhand		2001			Infanticide	0	
13	Karnataka		2001			Infanticide	6	
14	Kerala		2001			Infanticide	1	
15	Madhya Pradesh		2001			Infanticide	7	
16	Maharashtra		2001			Infanticide	13	
17	Manipur		2001			Infanticide	0	
18	Meghalaya		2001			Infanticide	0	
19	Mizoram		2001			Infanticide	0	
20	Nagaland		2001			Infanticide	0	

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Research

- Existing Data Visualization
- Existing Tools
- Contextual Enquiries
 - Police (2)
 - Editors (2)
 - Social Scientist (1)
 - Professor (1)
 - Architect (1)
 - Students (2)

Research

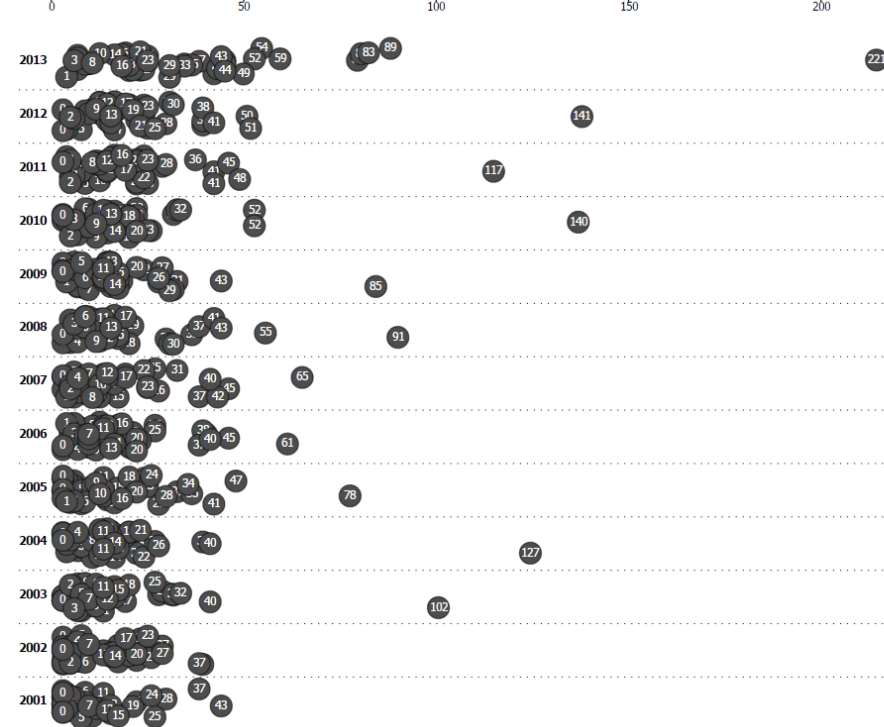
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District wise Incidence - Maharashtra

Click on a State to view the districts positioned by the number of incidents. Refresh to view default settings.

AN AP AR AS BR CG CH DN DD DL GA GJ HR HP JK JH KA KL LD MP MH MN ML MZ NL OD PY PB RJ SK TN TR UP UK WB

Each circle is a District and is positioned based on the number of Child Rape victims in the respective year, the color indicating the State the District is a part of.



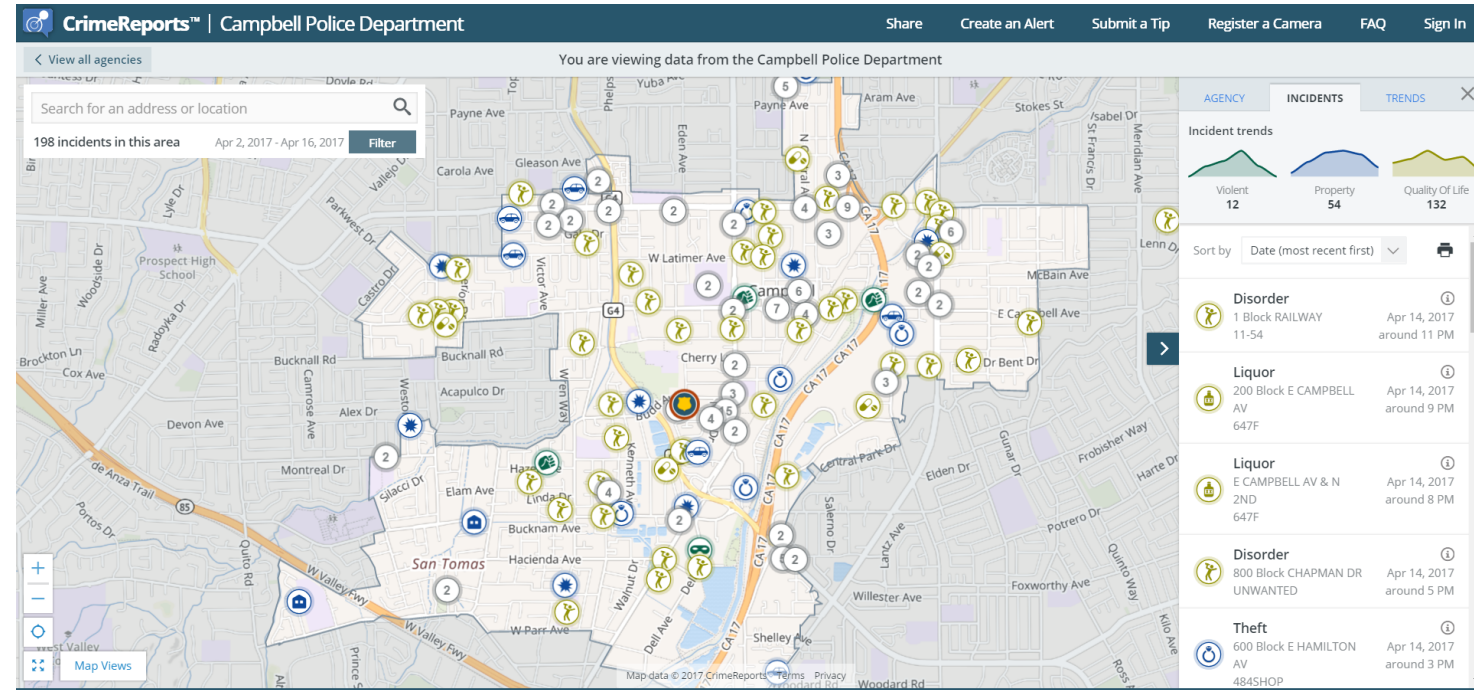
Districts of Maharashtra

Certain districts that are highlighted have insights in the factoid scroller. Hover over any district to highlight. Click to hold. Refresh for default settings.

AHMEDNAGAR AKOLA AMRAVATI COMM. AMRAVATI RURAL AURANGABAD COMM. AURANGABAD RURAL BEED BHANDARA BULDHANA CHANDRAPUR DHULE GADCHIROLI GONDIA HINGOLI JALGAON JALNA KOLHAPUR LATUR MUMBAI MUMBAI COMM. MUMBAI RLY. NAGPUR COMM. NAGPUR RLY. NAGPUR RURAL NANDED NANDURBAR NASIK COMM. NASIK RURAL NAVI MUMBAI OSMANABAD PARBHANI PUNE COMM. PUNE RLY. PUNE RURAL RAIGAD RATNAGIRI SANGLI SATARA SINDHUDURG SOLAPUR COMM. SOLAPUR RURAL THANE COMM. THANE RURAL WARDHA WASHIM YAVATMAL

Research

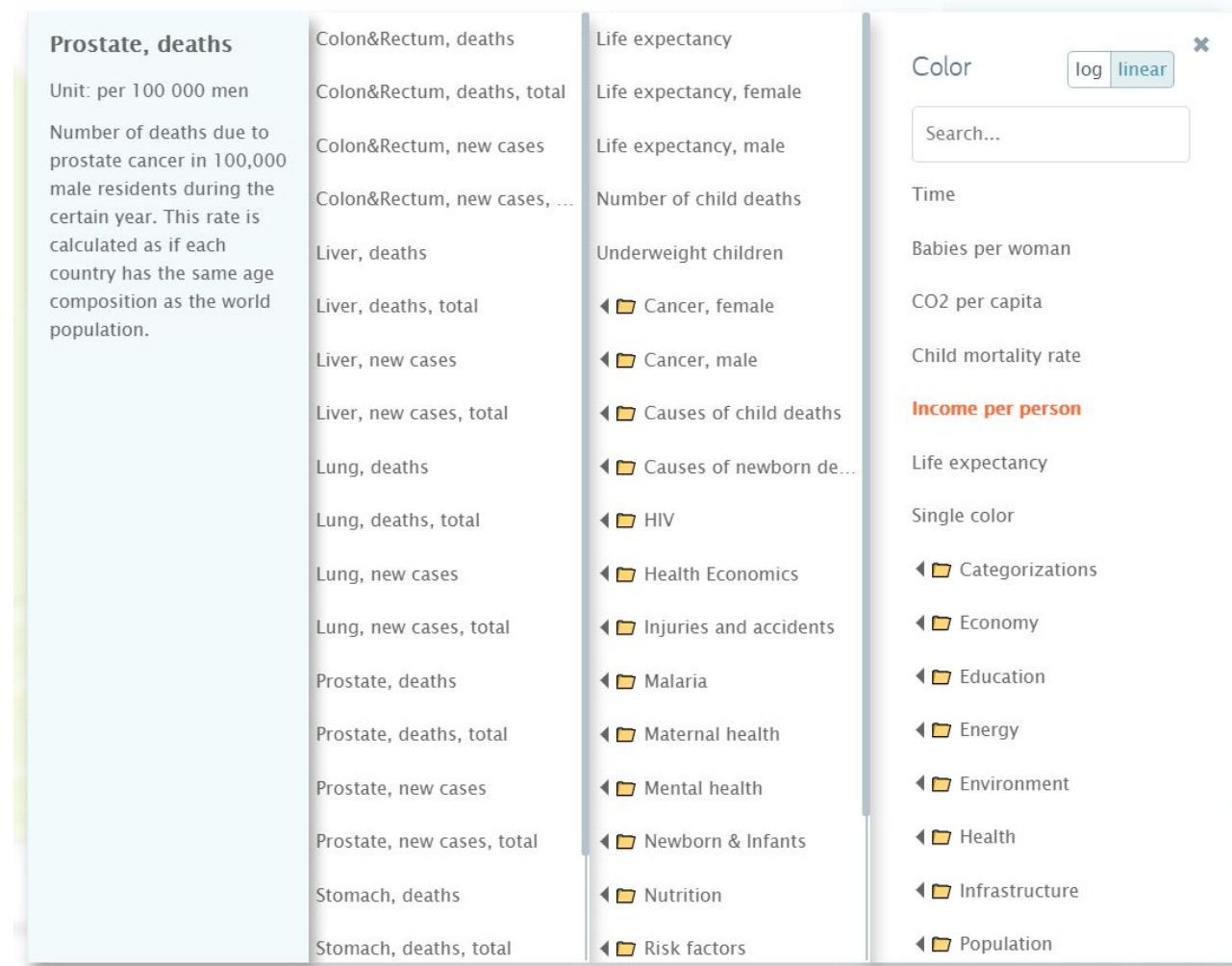
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Crime Report US

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			Rehabilitation of prisoners during 2001-2012	STATEUT		YEAR

Insights

- Police officers rarely use data visualization tool
- Half of the data stored in registered and need to be digitalize
- People spends most of the time for digging data
- People are more interested to see their regional data than other data. eg. Maharashtra's user will first check Maharashtra's crime data
- Online and offline stored data is in raw format

Design Goals

- Provide comparison between all crimes
- Provide comparison between all states
- Co-relation between data
- Provide explorable insights
- Provide affecting factors
- Need of search option for crime and state

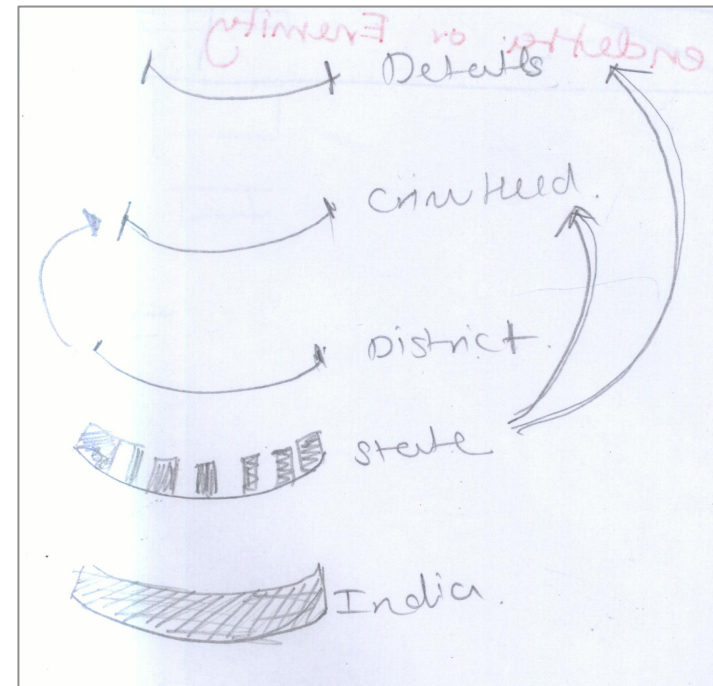
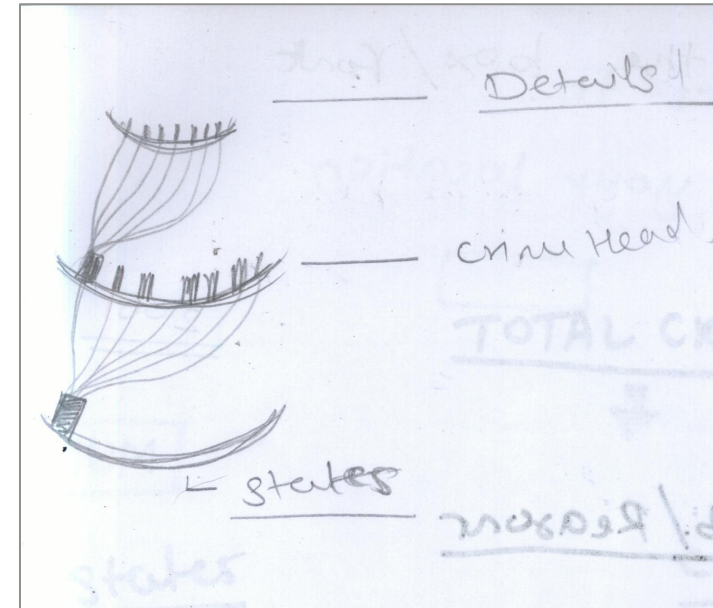
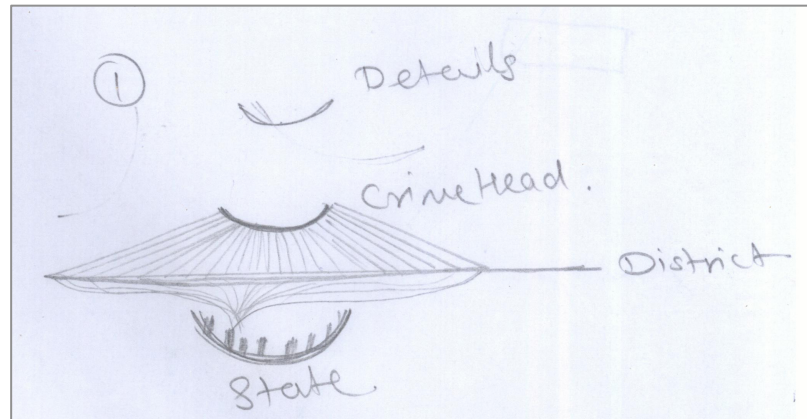
So on...

Ideation

- A series of visualization on insights
 - Ask questions (Gamification)
- Data analytics tool
- Data analytics tool + Visualization on insights

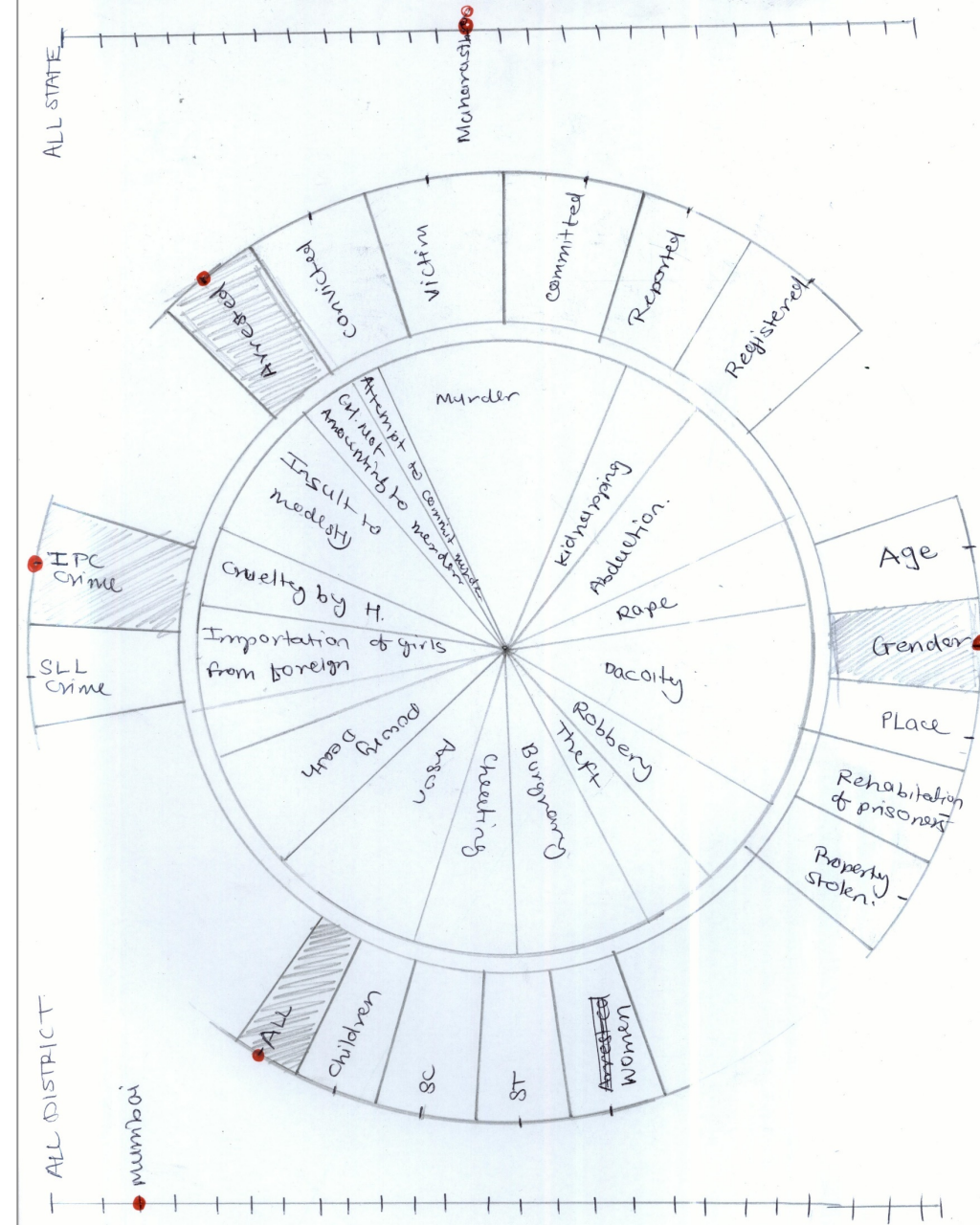
Ideation

- Symmetric tree diagram

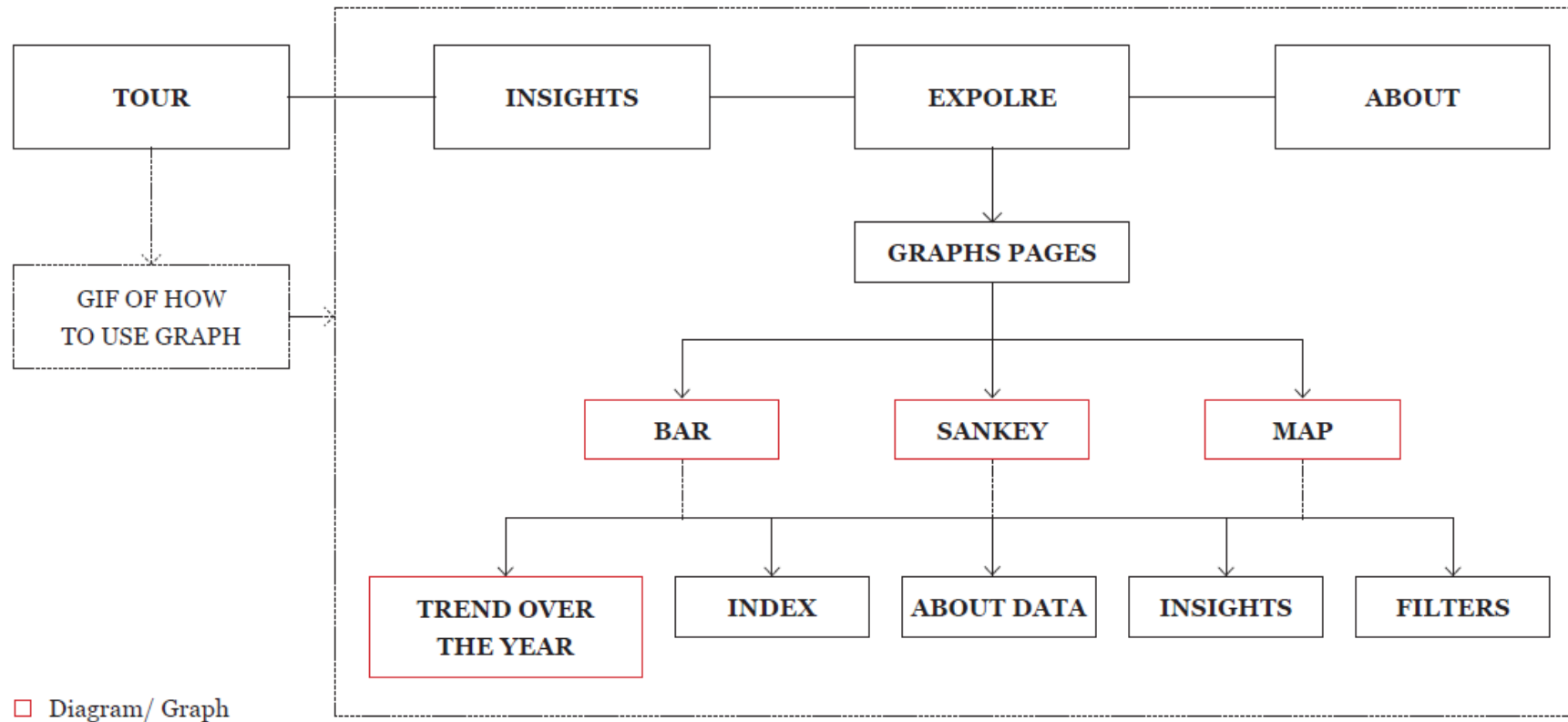


Ideation

- Circular tree diagram



Information Architecture



Final Design

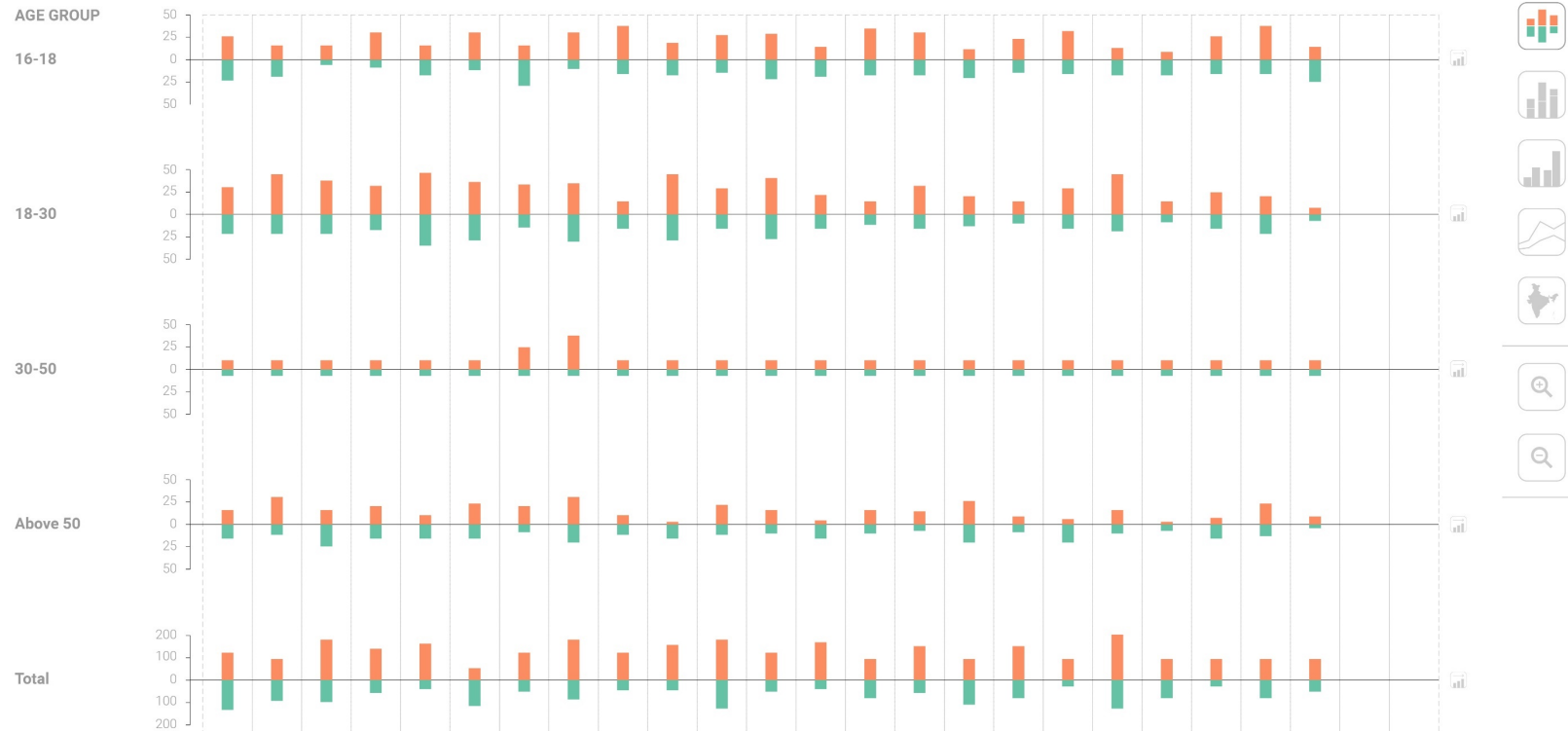
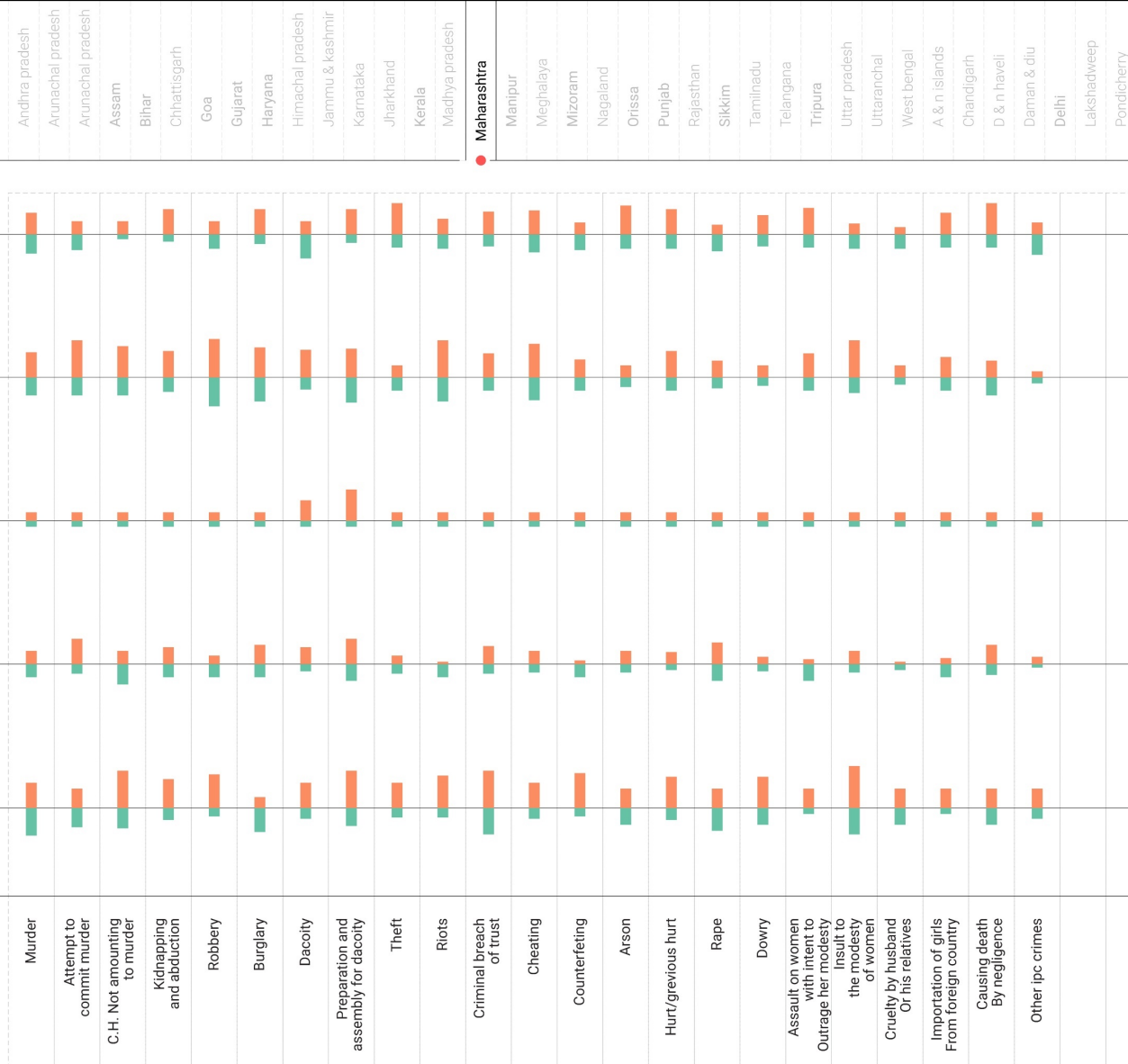
Convicts Per Lakh 

Absolutel Number of Convicts 

Female 

Male 

**TOTAL OF
ALL STATES & UTS**

TOTAL OF
ALL IPC CRIMES

Filters

Insights

 $\wedge$

- ☒ Victim
- ☐ Committed
- ☐ Convicted
- ☐ Person Arrested
- ☐ Cases Registered
- ☐ Cases Reported

 $\wedge$

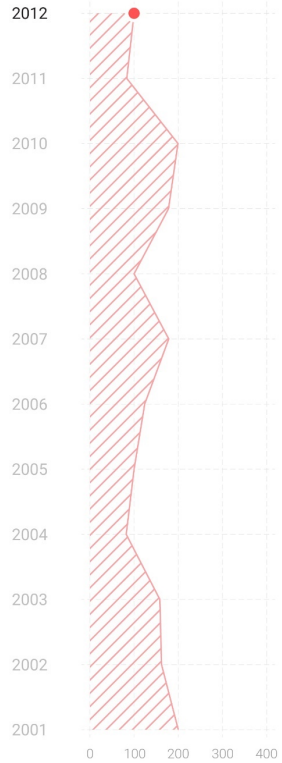
- ☒ All
- ☐ SC
- ☐ ST
- ☐ Children
- ☐ Women

22

About Data: The data refers to State/UT-wise details on total number of cases reported under murder and number of victims of murder by gender. The Age group of victims (both male and female) of murders are classified into 0-10, 10-15, 15-18, 18-30, 30-50, 50 and above.v

TRENDS OVER YEARS

TRENDS OVER YEARS



of Convicts

Female

Male

TOTAL OF ALL STATES & UTS

AGE GROUP

16-18

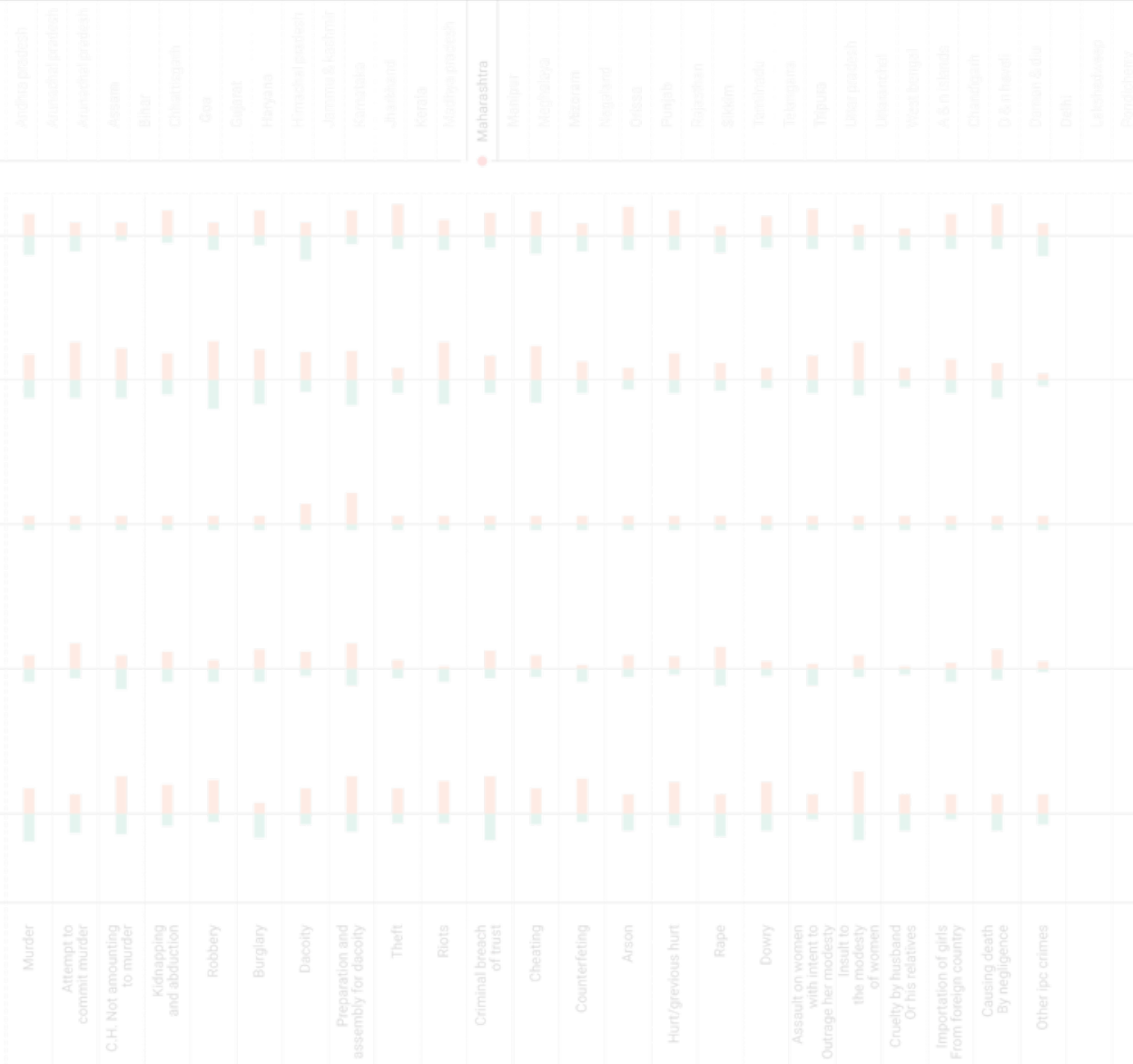
18-30

30-50

Above 50

Total

TOTAL OF ALL IPC CRIMES



Filters

Insights

Category

- ☒ Victim
- ☐ Committed
- ☐ Convicted
- ☐ Person Arrested
- ☐ Cases Registered
- ☐ Cases Reported

Crime Against

- ☒ All
- ☐ SC
- ☐ ST
- ☐ Children
- ☐ Women

Age Group

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TRENDS OVER YEARS



Convicts Per Lakh
Absolutel Number of Convicts

Female
Male

TOTAL OF ALL STATES & UTS																																							
		Andhra pradesh	Arunachal pradesh	Arunachal pradesh	Assam	Bihar	Chhattisgarh	Goa	Gujarat	Haryana	Himachal pradesh	Jammu & kashmir	Karnataka	Jharkhand	Kerala	Madhya pradesh	Maharashtra	Manipur	Meghalaya	Mizoram	Nagaland	Orissa	Punjab	Rajasthan	Sikkim	Tamilnadu	Telangana	Tripura	Uttar pradesh	Uttaranchal	West bengal	A & n islands	Chandigarh	D & n haveli	Daman & diu	Delhi	Lakshadweep	Pondicherry	
AGE GROUP																																							
16-18																																							
18-30																																							
30-50																																							
Above 50																																							
Total																																							
TOTAL OF ALL IPC CRIMES																																							
Murder																																							
Attempt to commit murder																																							
C.H. Not amounting to murder																																							
Kidnapping and abduction																																							
Robbery																																							
Burglary																																							
Dacoity																																							
Preparation and assembly for dacoity																																							
Theft																																							
Riots																																							
Criminal breach of trust																																							
Cheating																																							
Counterfeiting																																							
Arson																																							
Hurt/grievous hurt																																							
Rape																																							
Dowry																																							
Assault on women with intent to outrage her modesty																																							
Insult to the modesty of women																																							
Cruelty by husband Or his relatives																																							
Importation of girls From foreign country																																							
Causing death By negligence																																							
Other ipc crimes																																							

Filters

Insights

Category

Victim

Committed

Convicted

Person Arrested

Cases Registered

Cases Reported

Crime Against

All

SC

ST

Children

Women

Age Group

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TRENDS OVER YEARS



Convicts Per Lakh
Absolutel Number
of Convicts

Female
Male

TOTAL OF
ALL STATES & UTS

AGE GROUP

16-18

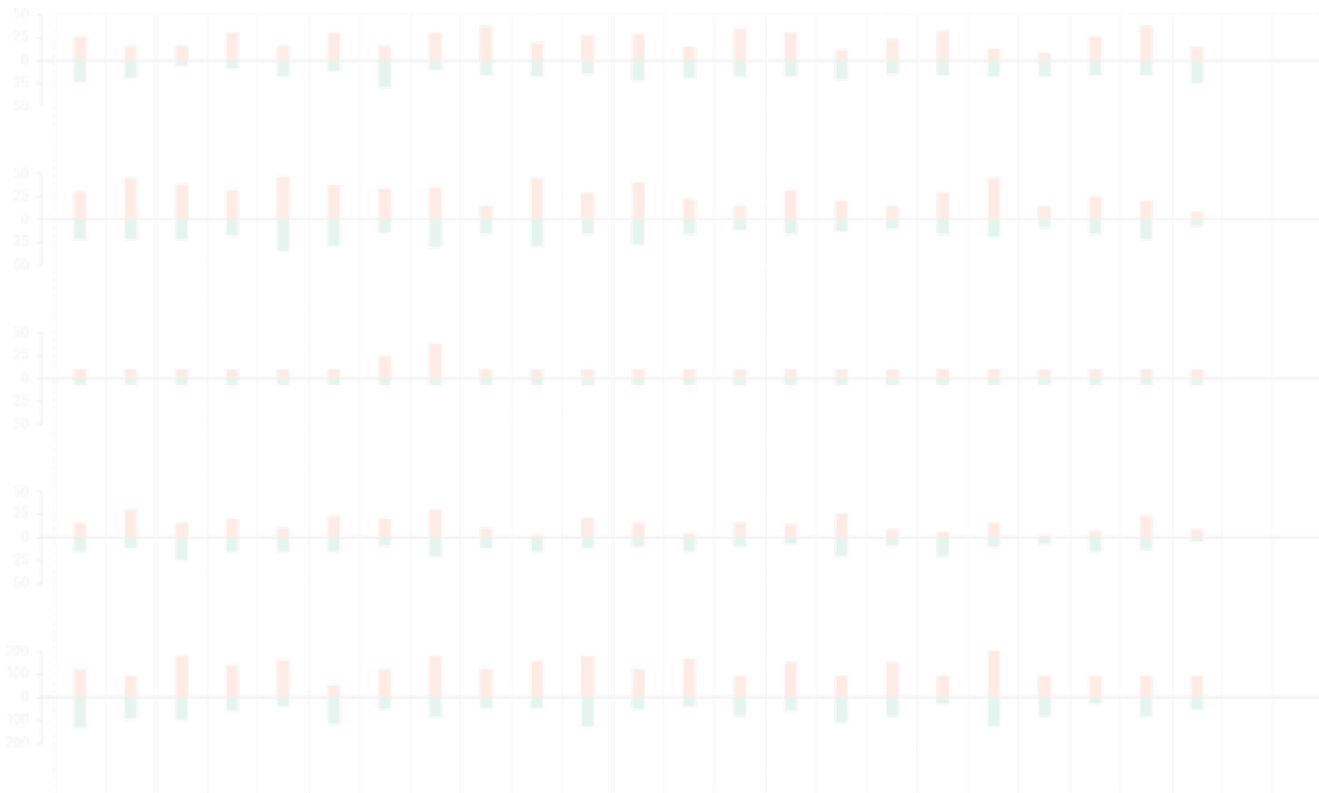
18-30

30-50

Above 50

Total

Andhra pradesh	Arunachal pradesh	Arunachal pradesh	Assam	Bihar	Chhattisgarh	Goa	Gujarat	Haryana	Himachal pradesh	Jammu & kashmir	Karnataka	Kerala	Madhya pradesh	Maharashtra	Manipur	Mizoram	Nagaland	Odisha	Punjab	Rajasthan	Sikkim	Tamilnadu	Telangana	Tripura	Uttar pradesh	Uttarakhand	West bengal	A & n islands	Chandigarh	D & n haveli	Daman & diu	Delhi	Lakshadweep	Pondicherry
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TOTAL OF
ALL IPC CRIMES

Murder	Attempt to commit murder	C.H. Not amounting to murder	Kidnapping and abduction	Robbery	Burglary	Discoity	Preparation and assembly for discoity	Theft	Riots	Criminal breach of trust	Cheating	Counterfeiting	Arson	Hurt/grievous hurt	Rape	Downy	Assault on women with intent to outrage her modesty	Insult to the modesty of women	Cruelty by husband Or his relatives	Importation of girls From foreign country	Causing death By negligence	Other ipc crimes
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Filters

Insights

Category

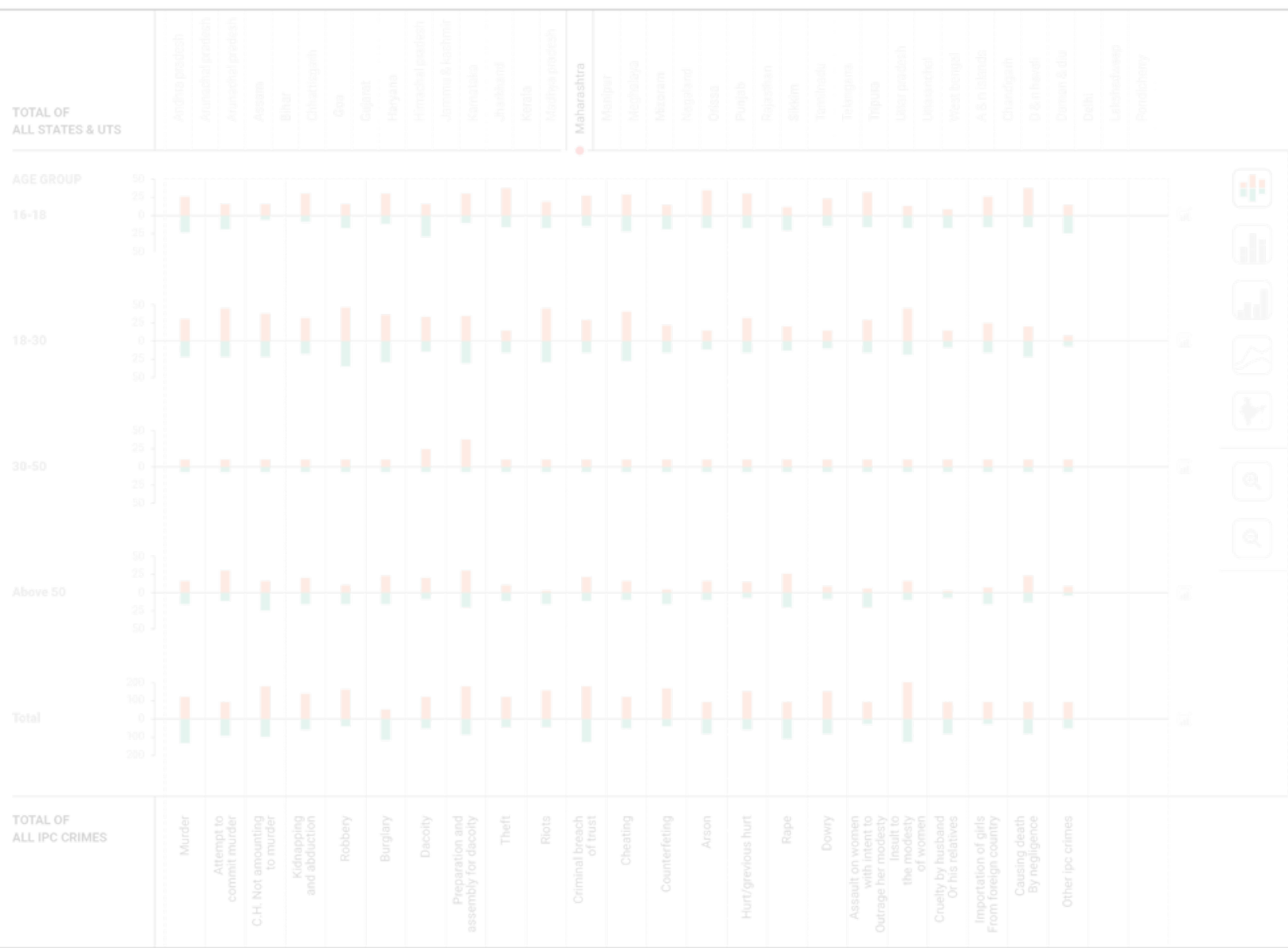
- ☒ Victim
- ☐ Committed
- ☐ Convicted
- ☐ Person Arrested
- ☐ Cases Registered
- ☐ Cases Reported

Crime Against

- ☒ All
- ☐ SC
- ☐ ST
- ☐ Children
- ☐ Women

Age Group

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Filters

Insights

The highest ratio is for insult to the modesty of women (molestation), which would not typically involve many women.

Males below 18 years are the least likely to be involved in crimes against women

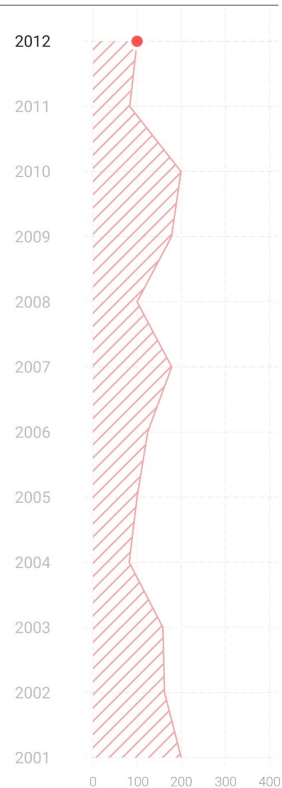
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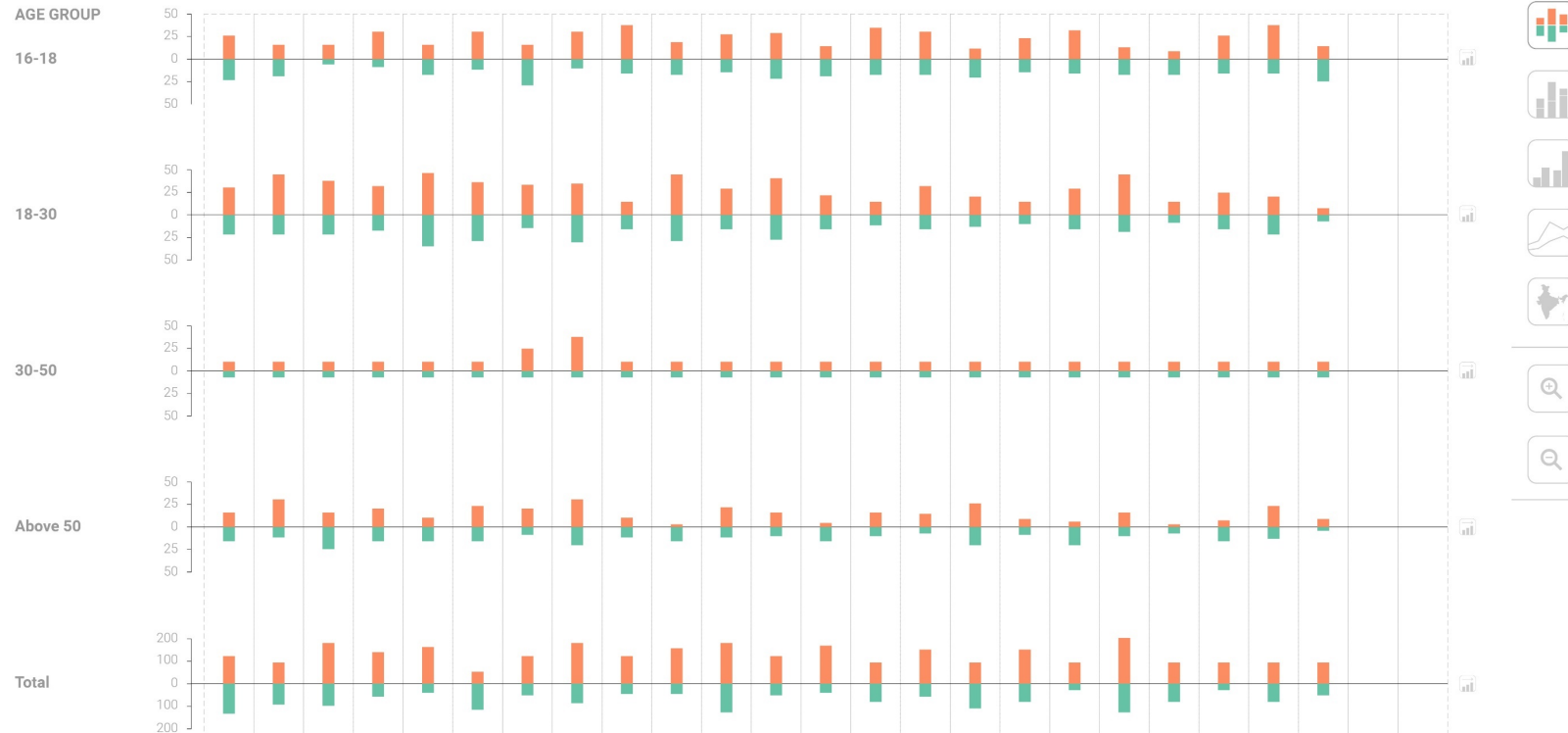
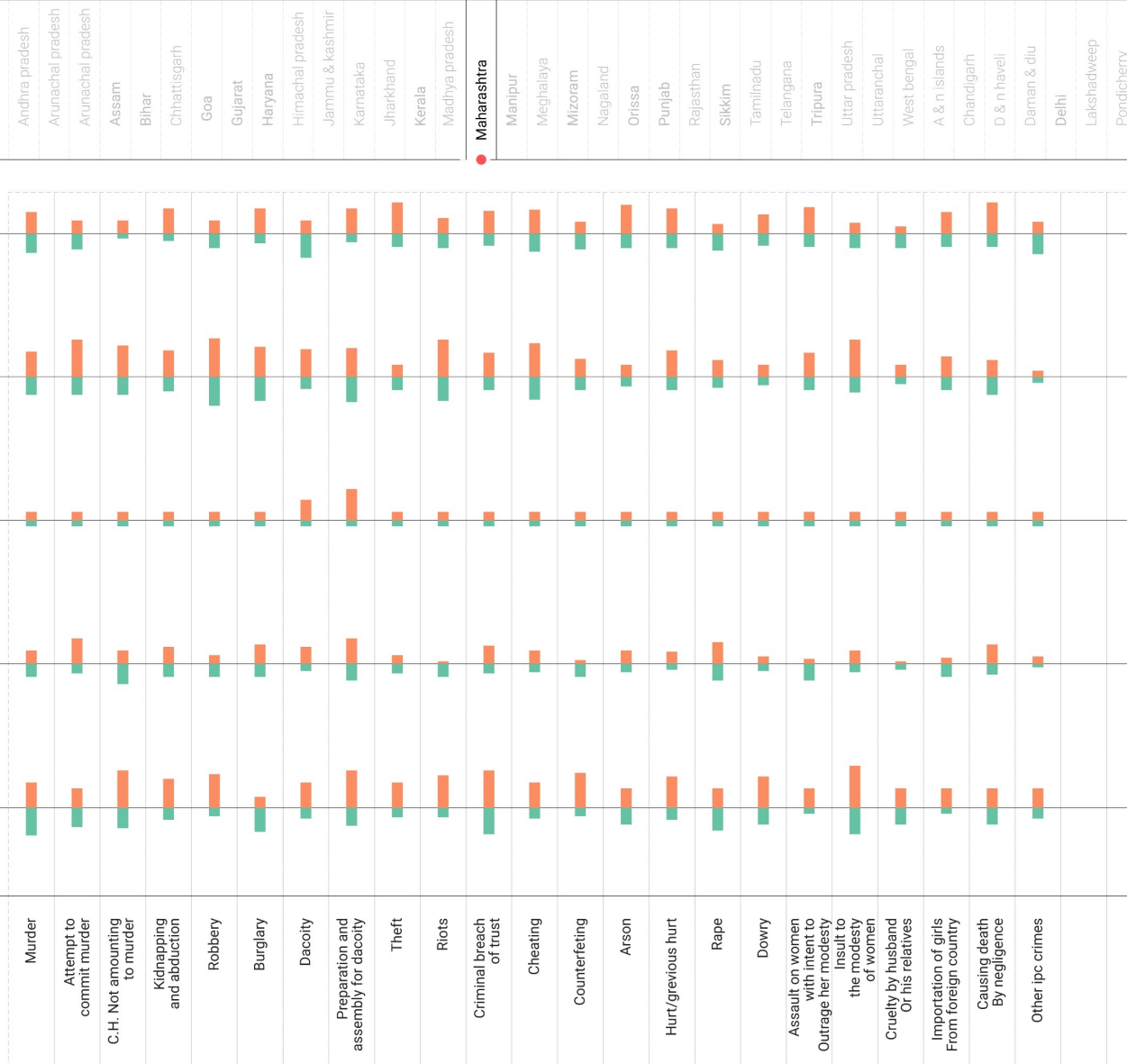
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- Convicts Per Lakh 
- Absolutel Number of Convicts 
- Female 
- Male 

**TOTAL OF
ALL STATES & UTS**

TOTAL OF
ALL IPC CRIMES

Filters

Insights

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- ☒ Victim
- ☐ Committed
- ☐ Convicted
- ☐ Person Arrested
- ☐ Cases Registered
- ☐ Cases Reported

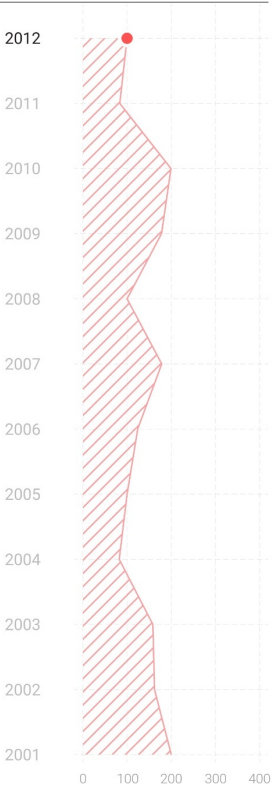
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- ☒ All
- ☐ SC
- ☐ ST
- ☐ Children
- ☐ Women

2

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TRENDS OVER YEARS



Convicts Per Lakh
Absolutel Number
of Convicts
Female
Male

TOTAL OF
ALL STATES & UTS

AGE GROUP

16-18

18-30

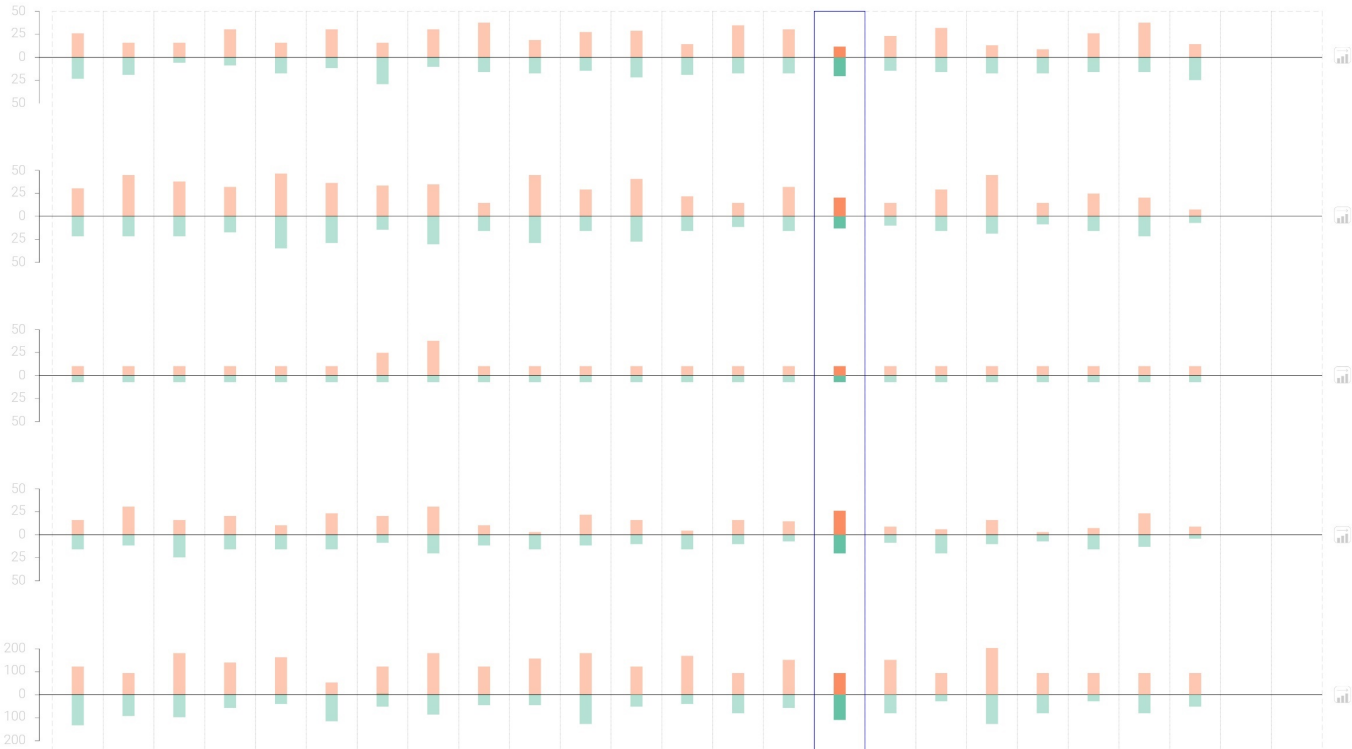
30-50

Above 50

Total

TOTAL OF
ALL IPC CRIMES

Andhra pradesh	Arunachal pradesh	Arunachal pradesh	Assam	Bihar	Chhattisgarh	Goa	Gujarat	Haryana	Himachal pradesh	Jammu & kashmir	Karnataka	Jharkhand	Kerala	Madhya pradesh	Maharashtra	Manipur	Meghalaya	Mizoram	Nagaland	Orissa	Punjab	Rajasthan	Sikkim	Tamilnadu	Telangana	Tripura	Uttar pradesh	Uttaranchal	West bengal	A & n islands	Chandigarh	D & n haveli	Daman & diu	Delhi	Lakshadweep	Pondicherry
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Filters

Insights

Category

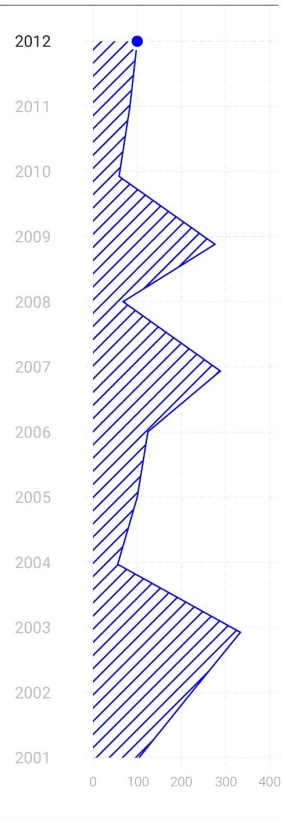
- ☒ Victim
- ☐ Committed
- ☐ Convicted
- ☐ Person Arrested
- ☐ Cases Registered
- ☐ Cases Reported

Crime Against

- ☒ All
- ☐ SC
- ☐ ST
- ☐ Children
- ☐ Women

Age Group

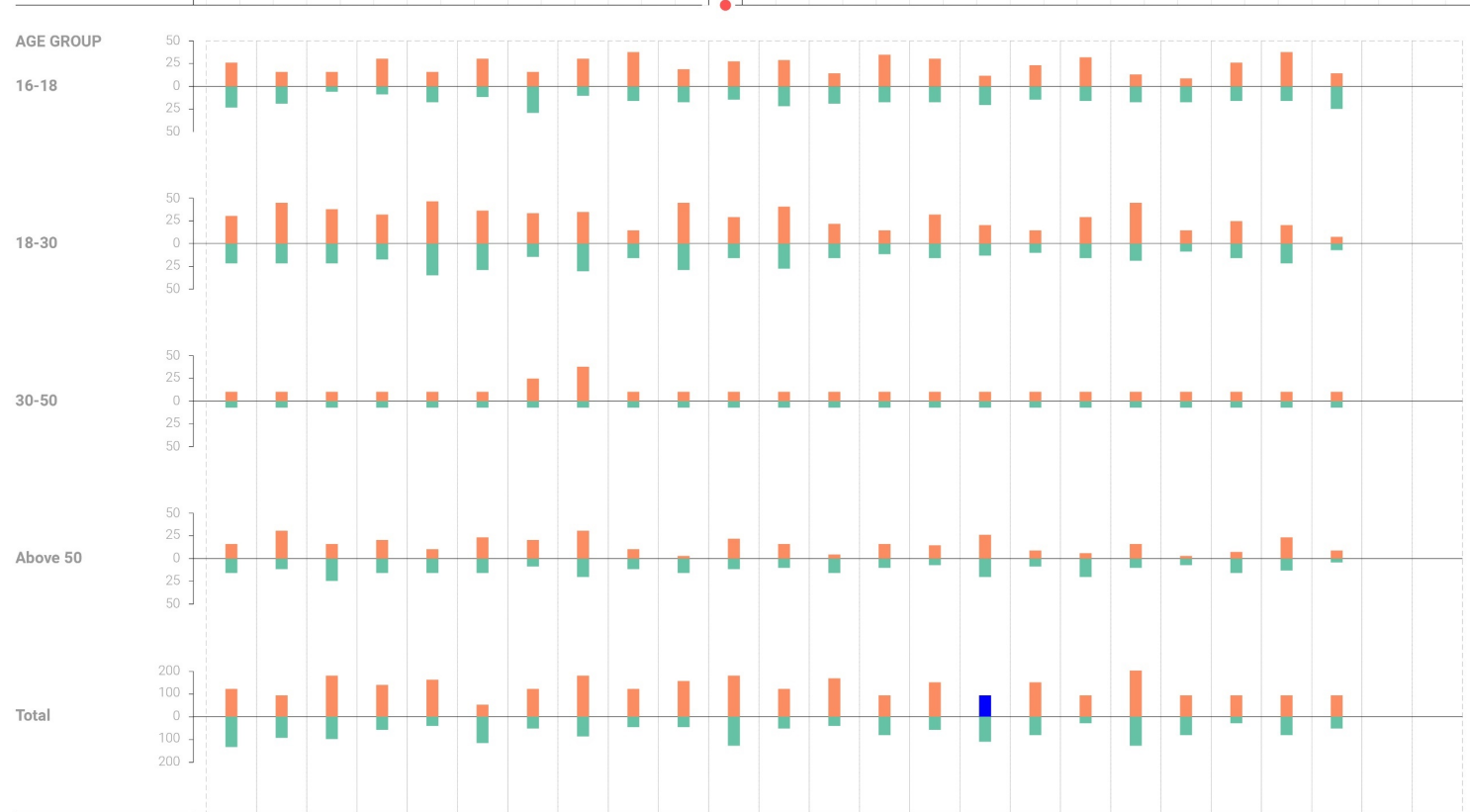
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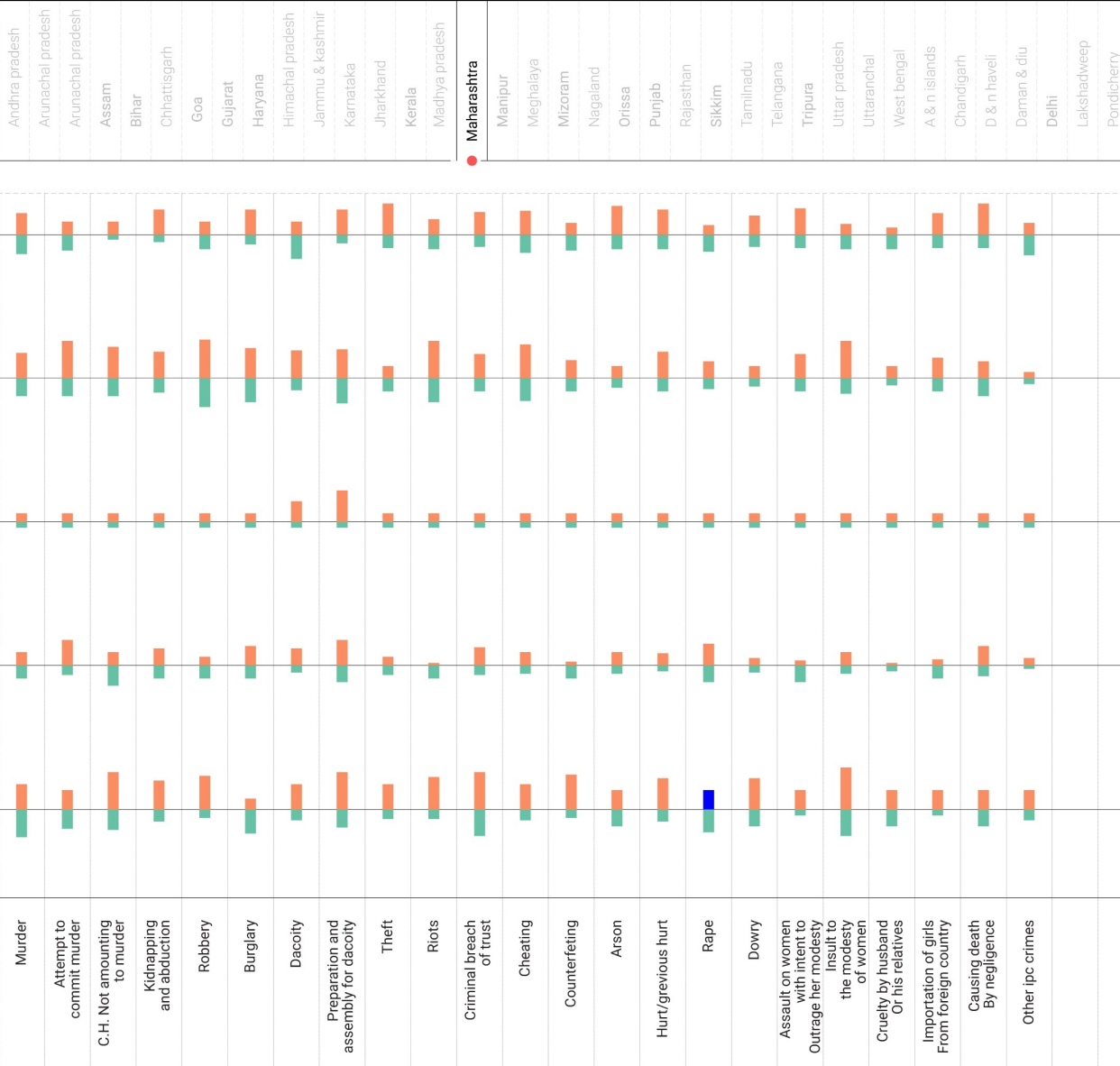
Convicts Per Lakh
Absolutel Number
of Convicts

Female
Male

**TOTAL OF
ALL STATES & UTS**



**TOTAL OF
ALL IPC CRIMES**



Filters

Insights

Category

- ☒ Victim
- ☐ Committed
- ☐ Convicted
- ☐ Person Arrested
- ☐ Cases Registered
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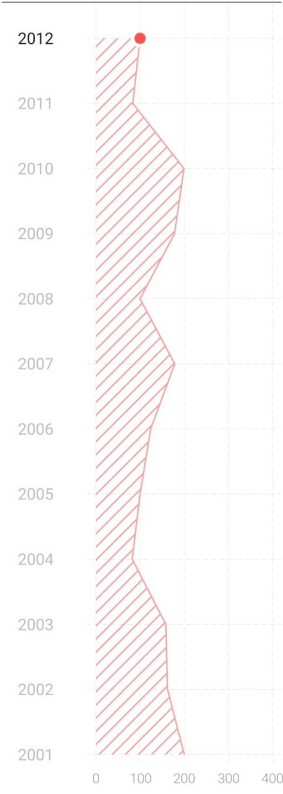
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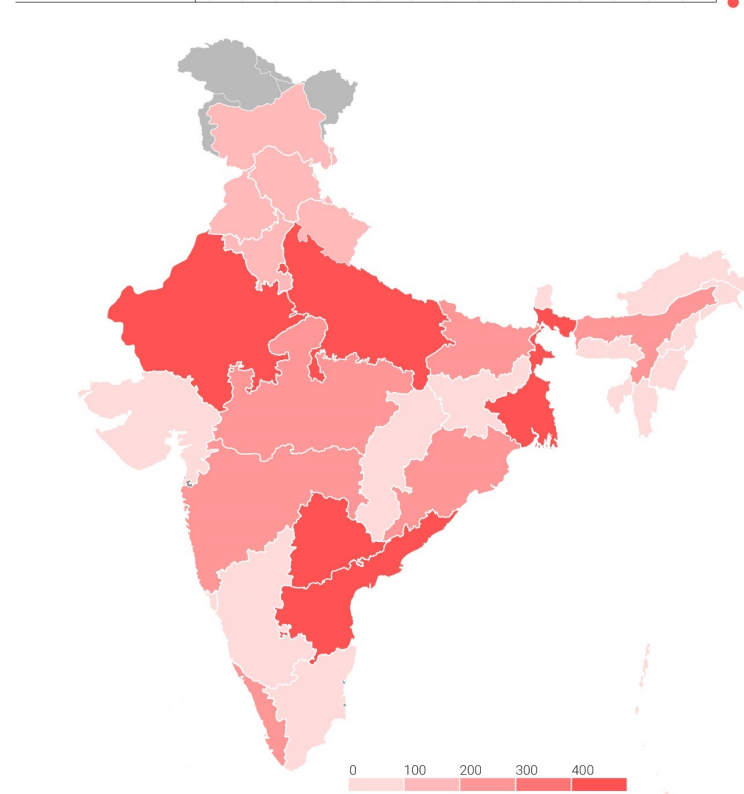
TRENDS OVER YEARS



Convicts Per Lakh

Absolutel Number of Convicts

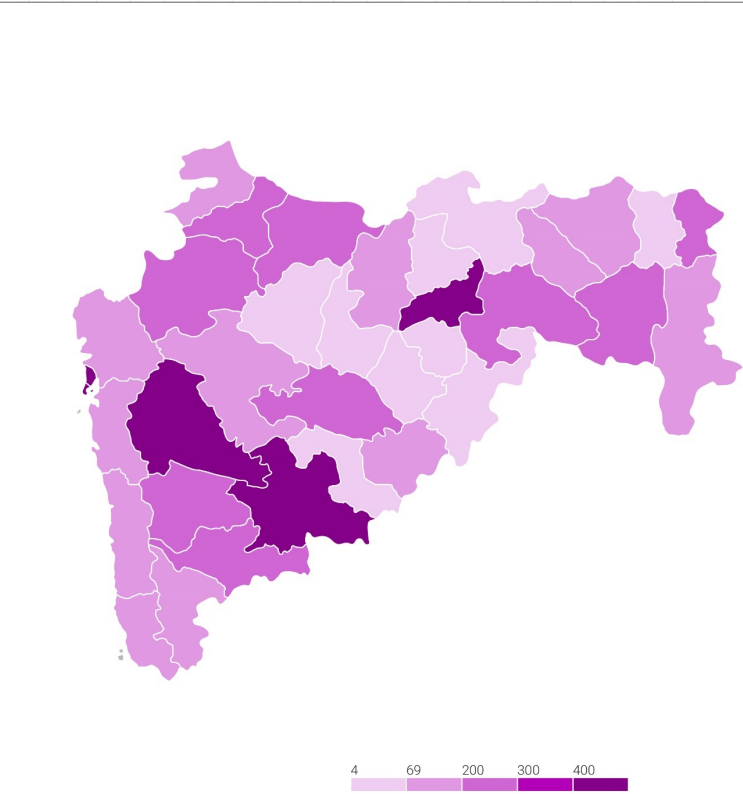
TOTAL OF ALL STATES & UTS



TOTAL OF ALL IPC CRIMES

Andhra pradesh
Arunachal pradesh
Arunachal pradesh
Assam
Bihar
Chhattisgarh
Goa
Gujarat
Haryana
Himachal pradesh
Jammu & kashmir
Karnataka
Jharkhand
Kerala
Madhya pradesh

Maharashtra
Manipur
Meghalaya
Mizoram
Nagaland
Orissa
Punjab
Rajasthan
Sikkim
Tamilnadu
Telangana
Tripura
Uttar pradesh
Uttaranchal
West bengal
A & n islands
Chandigarh
D & n haveli
Daman & diu
Delhi
Lakshadweep
Pondicherry



Murder
Attempt to commit murder
C.H. Not amounting to murder
Kidnapping and abduction
Robbery
Burglary
Dacoity
Preparation and assembly for dacoity
Theft
Riots
Criminal breach of trust
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Arson
Hurt/grievous hurt
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Assault on women with intent to outrage her modesty
Insult to the modesty of women
Cruelty by husband Or his relatives
Importation of girls From foreign country
Causing death By negligence
Other ipc crimes

Filters

Insights

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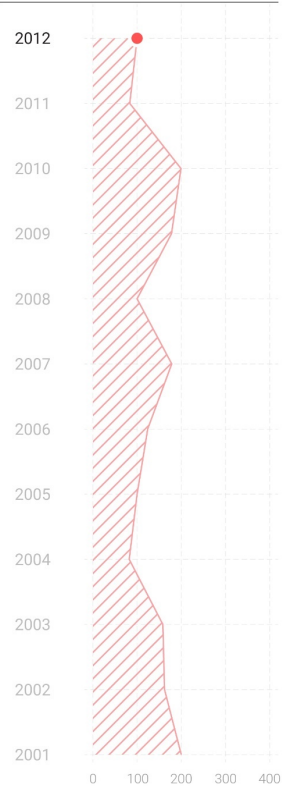
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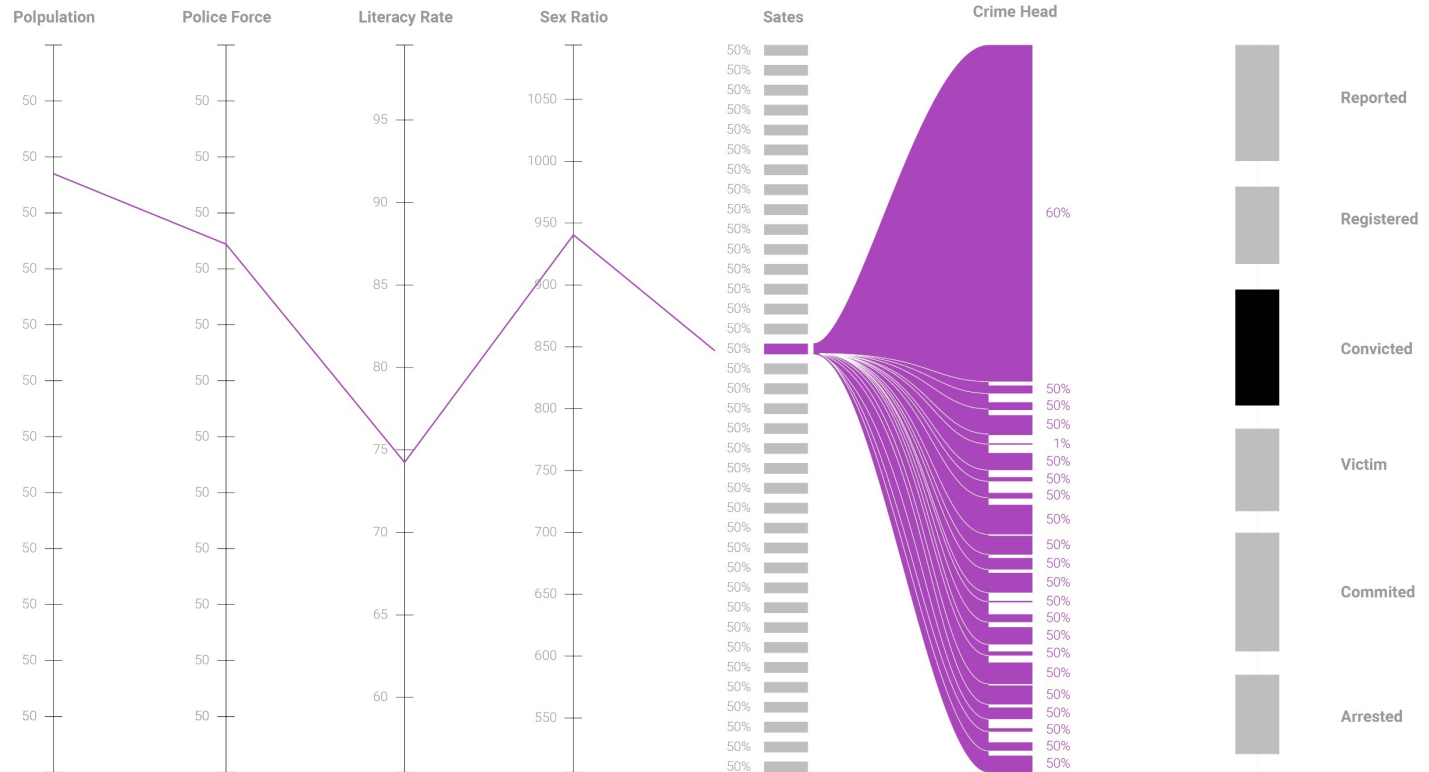
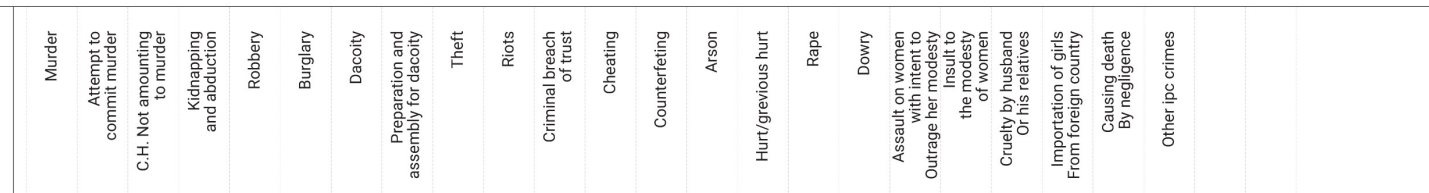
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Convicts Per Lakh ☒

Absolutel Number of Convicts ☐

TOTAL OF
ALL STATES & UTSTOTAL OF
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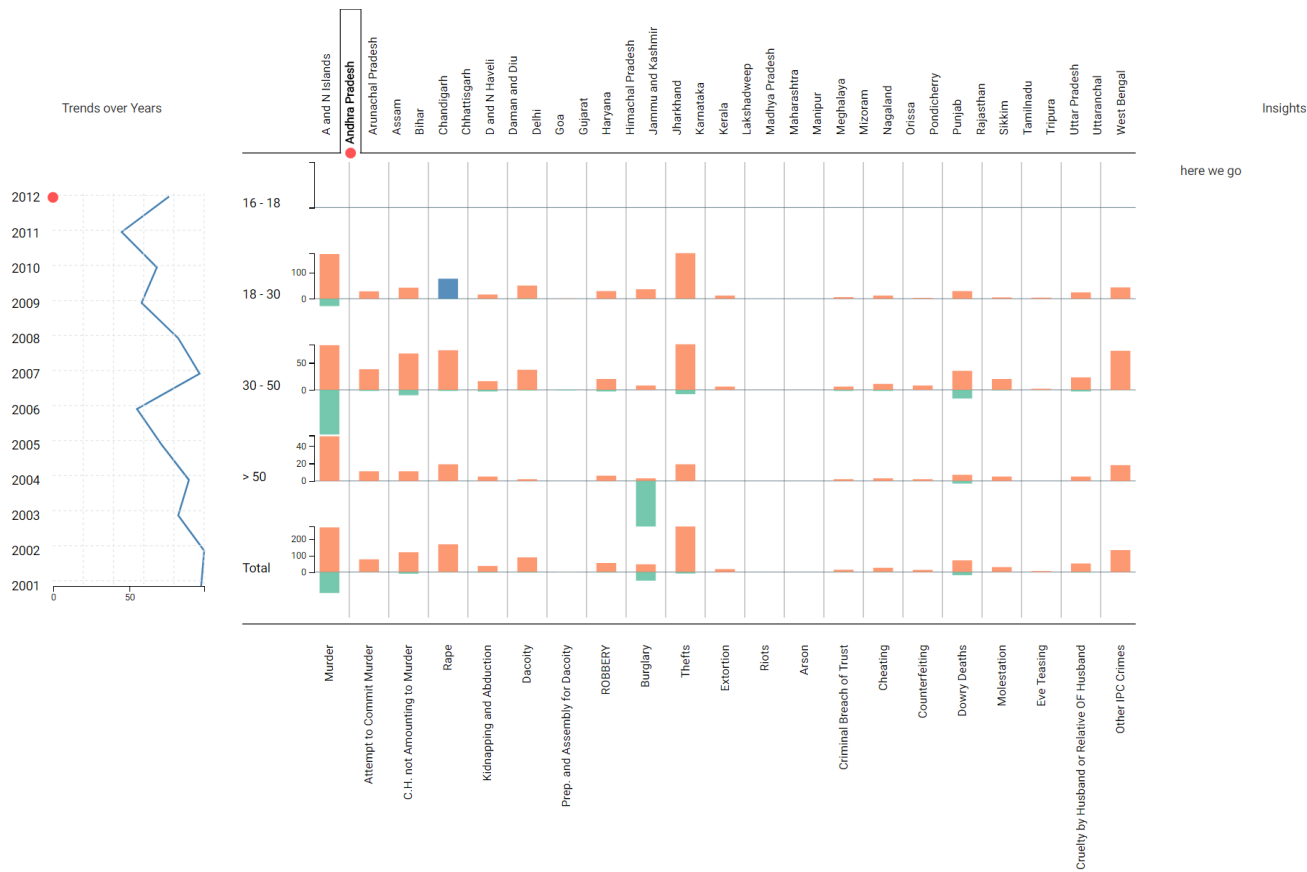
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Prototype



Objective of Evaluation

- Check the find-ability of the datasets
 - Filters
 - Trend
 - Insights
- Check the learnability of the tool

Protocol of Evaluation

- Ask user to explore the data to familiarize the web tool (with think aloud test)
- Ask user, do they need tour of crime data
- To check the find-ability of a web tool, ask task based questions
- First task should be simple, so that they gain confidence
- Base on previous question, increase the complexity of questions to check the learnability
- Questions
 - Which state has most number of burglaries in 2001?
 - Find out Gujarat's Arson trend in 2003
 - In 2012, which age group and which crime has maximum number of convicts in Uttaranchal?
 - Find out the trends of women affected by "Cruelty by Husband or Relative OF Husband" of West Bengal state in 2008
 - Give the list of states which have lowest kidnapping and Abduction in 2011 against women
 - Try to find some insights within 5 min

Findings of Evaluation

Age	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
18-25	Yes	No	No	Yes	Yes	
18-25	Yes	Yes	Yes	Yes	Yes	
18-25	No	No	Yes	Yes	No	Yes
18-25	Yes	No	Yes	Yes	Yes	Yes

Age	Are you familiar with Interactive Visualization?	Appropriate graphs for data set	Is it useful information ?	Did you find?, what you want to find?	Ease of Navigation - Bar Graph	Ease of Navigation - Map	Ease of Navigation - Sankey
18-25	Yes	Not Appropriate	Very useful	Maybe	Very Hard	Easy	Very Hard
18-25	No	Very Appropriate	Very useful	Maybe	Mildly	Easy	Hard
18-25	Yes	Very Appropriate	Mildly	Maybe	Mildly	Easy	Hard
18-25	Yes	Very Appropriate	Very useful	Yes	Easy	Easy	Hard

Findings of Evaluation

- As they started the using visualization users conceptual model improved
- Ease of navigation and understanding user prefer to use Map Diagram – Bar Diagram – Sankey Diagram
- Used graphs are appropriate for data sets
- Given data visualization user found very useful
- User more interested to now gender wise crime details and crime in their states

Feedback

- Try vertical layout for all diagrams
- Give hint for clickable buttons
- Use colour code for Sankey Diagram
- Give check box options for All states and crime
- Show minimum data for comparison
- Make value box: It will show selected data's number of crimes
- Show value while hovering on trend line

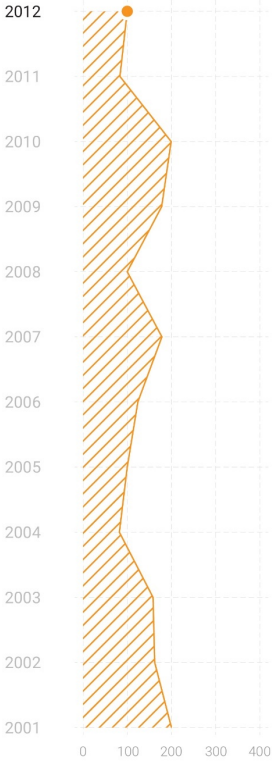
Achieved User Design Goals

Based on user requirements and available data set objectives is decided

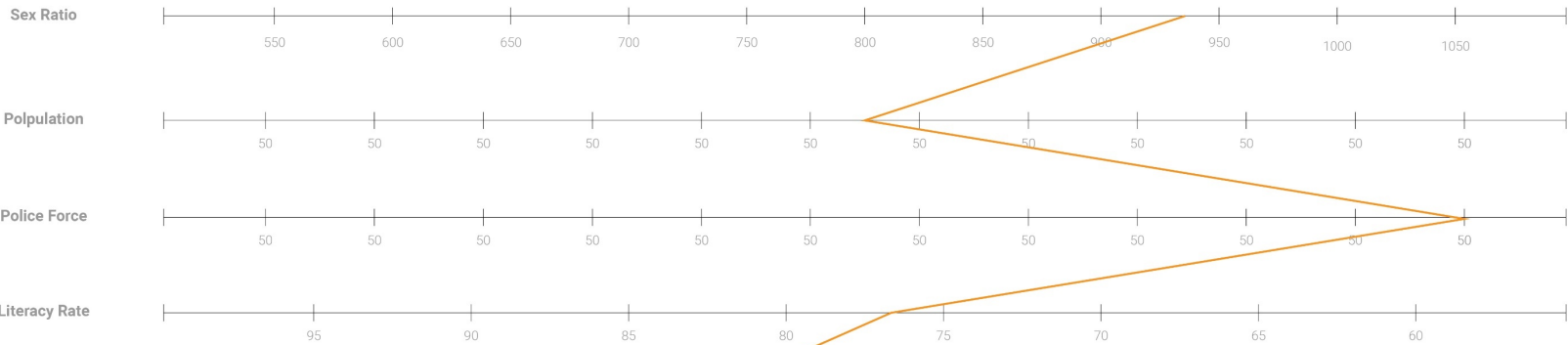
- Show comparison between all crimes
- Show comparison between all states
- Give predefined insights
- Show affecting factors
- Need of Search option for crime and state

Design Updates Based on Feedback

TRENDS OVER YEARS



Actual Numbers ●
% by Population ○



TOTAL OF ALL STATES & UTS

TOTAL OF ALL IPC CRIMES

Murder
Attempt to commit murder
C.H. Not amounting to murder
Kidnapping and abduction
Robbery
Burglary
Dacoity
Preparation and assembly for dacoity
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Future Scope

- Provide external reference link for Insights and findings.
- Give option to add causes and famous crimes incidents.
- Make it crowds sourcing.
- Provide various graph options for each crime data.

Thank You