

Analyzing Criminal Behavior

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Abstract— Criminal behavior is an important area of research to prevent crime. For the study large amount of data is required to arrive at some conclusive results. This paper deals with new ideas of data analysis of such huge volume of data. The data here is first filtered to retain only the useful data and then analysis is done. Genetic algorithm with fuzzy logic has been used to determine soft and hardcore criminals and possibility of a soft-core criminal turning into a hardcore criminal by considering parameters like background, education, modus operandi, number of cases, weapon used [1-3].

Keywords— Criminal, Criminal behaviors, Data mining, Soft core criminal, Hard core criminal, Genetic algorithm, Fuzzy logic

INTRODUCTION

It is always a challenge to design an algorithm to run smoothly on large amount of data. Criminal database is one such example as crime rate is growing day by day and new methods are being adopted by the criminals to commit crimes; it is difficult to analyze the data and do predictions. To accomplish our task we applied data mining techniques with genetic algorithm to filter out and retain just the required data [4] [5]. Certain attributes of the Criminals like background, education, modus operandi etc. were considered to arrive at the conclusion whether a soft-core criminal would convert into a hardcore criminal [6] [7].

Soft core criminal, for the study, is one who commits a soft-crime like robbery; pick pocketing etc. a hard core criminal [8] is one who commits heinous crime like murderer, rape.

The analysis the criminal data we considering here different attributes take one by one to detect the similar pattern between them in criminal, age of criminal in which they doing a crime, gender of the criminal, current location of the criminal to do a crime, Education of the criminal, Modus-operandi of the criminal, Which weapon used to commit the crime, number of cases they have charged to the criminal, Reasons to commit a crime these are the attribute consider to get the similar pattern between the criminal [9].

Crime is major problem for everyone. Crime analysis is a way in which we analyze what are the factors to come to do a crime so today crime database available in vast amount in the database we have necessary to extract only knowledge able data from criminal data base for this Data mining techniques have greater advantage in this fields [10].

Crime analysis need data mining technique, this is an iterative process of extracting knowledge hidden from large volumes of raw data [11] [12].

Data mining involves the use of sophisticated data analysis tools to discover formerly undiscovered, valid patterns and relationships in large data sets. Therefore, data mining contain of more than collecting and managing data, it also includes analysis and prediction. The main advantage to use data mining with crime analysis is: too much data but too small knowledgeable, and a need to extract useful information from the data and to interpret the data. [13]

1. THE PROPOSAL OF CRIME ANALYSIS

To present the proposal of criminal data here we consider the large amount of data taken from internet to analyses the seminal pattern between the criminal and get result that the soft core criminal can become a hard core criminal in future. [14]

General Algorithm of Proposal Model

Input : Raw of crime data from internet [15] [16].

Output: a model design in which you put the detail of soft core criminal and get result it might possible he become a hard criminal in future.

These are steps to taken account consider the proposal:-

1. **Understanding the crime domain**, this taken the related to the prior knowledge and goals of the crime detection and prediction [15] [16].

2. **Extracting the target dataset**, here in this we consider the following attribute so that consider these attribute detect the similar pattern using genetic algorithm they are the age of criminal to commit crime, the modus operandi to commit crime, education of criminal, reason to crime, the weapon used to commit a crime [16].

3. **Collect attribute values of criminal database**, we consider here are name of criminal, age, location, education, gender, modus-operandi, reason for crime, weapon used, and number of cases of criminal [14].

4. **Store the data**; we store each attribute value in database so that we have the large database of criminal with useful database value use in this proposed system.

5. **Further divide the attribute in category**, in this we further divide the each attribute in different category so that divide the criminals category soft core and hardcore take one by one we have get the data they are[16]:

Criminal Name: define each criminal name

Age: divide the age further three categories

1. Age below 18
2. Age between 18 to 60
3. Age above 60

Criminal education: education of criminal divide in six categories

1. Illiterate: no study
2. Primary: up to fifth
3. Secondary: up to tenth
4. Senior secondary: up to twelfth
5. Graduate : up to graduate
6. Masters: above graduate

Number of cases: here in this we divide the cases that are against the criminal in court divide in four parts

1. One case: only one case
2. 2-3 case: between 2-3 cases
3. 3-5: case: between 3-5 cases
4. >5 case: greater than cases 5

Weapon used: this define the weapon used when he done a crime this divide in four categories

1. Gun
2. Bomb
3. Knife
4. Fire

6. **Count the categories of each attribute**: in this we fetch the data from data base to calculate each category this gives the maximum criminal lie in which category by the help of data mining we analyses the data

7. **Analyzing the data**: we design the attribute and get each category value now use these value we divide the criminal in four categories they are:

1. Soft core criminal
2. Soft core criminal moving towards hard core

- 3. Hard core criminal
- 4. Completely hard core criminal

8. Compare the new criminal data with data analysis: compare the data with data analysis and divide the criminal in which category he belongs to

9. Check criminal can become hardcore: enter the details of any criminal compare the details of it to the analysis data and get result in which category the criminal it was.

10. End

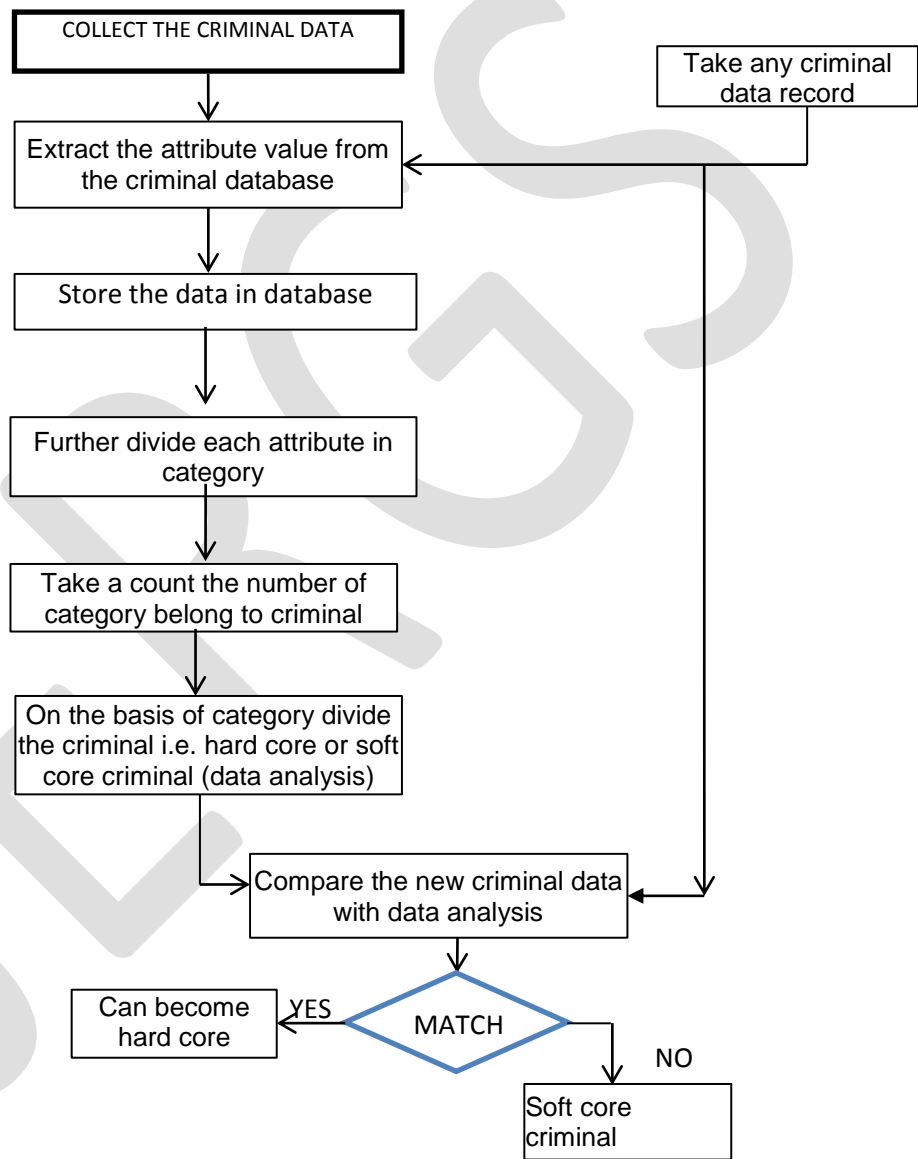


Figure 1: Proposed model of analyzing criminal behaviour

2. METHODS

Analysis of criminal Behavior we collected the large amount of data from internet and collected the different attribute to analyses the data analyses the each attribute and get results the following process occur step by step as below [16]:

2.1 Model Requirements

As input into the criminal data we considering the different variables the algorithm variables are ctr,ctr2 used for increment value hcocre1(i), hcocre2(i), hcocre3(i), hcocre4(i) data store the data

1. **//Algorithm to analyses data**
2. Import data from database
3. **//Detect Frequency of weapons used for crime**
4. for i \leftarrow 1 to max
5. if weapon \leftarrow 'gun'
6. ctr \leftarrow increment by
7. otherwise if weapon \leftarrow 'bomb'
8. ctr2 \leftarrow increment by one
9. otherwise repeated for all the expected weapons
10. end if
11. end for
12. **//Calculate severity of criminal based on number of cases**
13. for I \leftarrow 1 to max
14. if no of crime \leftarrow 1
15. hcocre1(i).data \leftarrow store data
16. otherwise if no of crime \leftarrow between 2 and 3
17. hcocre2(i).data \leftarrow store data
18. otherwise if no of crime \leftarrow between 4 and 5
19. hcocre3(i).data \leftarrow store data
20. otherwise if no of crime \leftarrow greater than 5
21. hcocre4(i).data \leftarrow store data
22. end if
23. end for
24. **// Calculate education level of the criminals**
25. for I \leftarrow 1 to max
26. if education \leftarrow 'illiterate'
27. ill \leftarrow increment by one
28. otherwise calculate for other criminals
29. **// Detect pattern of criminal movement using genetic algorithm**
30. /* based on traveller example matlab */
31. locations \leftarrow read from database
32. distances $\leftarrow \sqrt{(x1 - x2)^2 + (y1 - y2)^2}$
33. FitnessFcn \leftarrow criminal_fitness(x,distances)
34. /* pass calculated parameters to genetic algorithm to get future value*/
35. [x,fval] \leftarrow ga(FitnessFcn,crimes,[],[],[],[],[],[],options)
36. **// Fuzzy Rule Set**
37. **// Calculate Probability of Softcore Criminal converting into type of criminal**
38. Step1. Compare result with
39. for I \leftarrow 1 to 1
40. if education \leftarrow same as of type one criminal
41. if modus operandi \leftarrow same as of type one criminal
42. if weapon used \leftarrow same as of type one criminal
43. prob \leftarrow type1 criminal
44. end if
45. end if

```
46. end if
47. if education ← same as of type two criminal
48. if modus operandi ← same as of type two criminal
49. if weapon used ← same as of type two criminal
50. prob ← type2 criminal
51. end if
52. end if
53. end if
54. end for
55. if education ← same as of type three criminal
56. if modus operandi ← same as of type three criminal
57. if weapon used ← same as of type three criminal
58. prob ← type3 criminal
59. end if
60. end if
61. end if
62. if education ← same as of type four criminal
63. if modus operandi ← same as of type four criminal
64. if weapon used ← same as of type four criminal
65. prob ← type4 criminal
66. end if
67. end if
68. end if
```

Result:

```
69. Type1 → soft core criminal
70. Type2 → soft core criminal moving towards hard core
71. Type3 → hard core criminal
72. Type4 → completely hard core criminal
```

2.2. Collecting the database

Collected the data of criminals we consider here the following attribute from the large amount of raw data of criminal: Name, Age, Location, Education, Modus operandi, No. of cases, Reason to crime.

- Criminal Name: name of the criminal
- Age: age of individual Criminal
- Crime Address: location of the crime
- Criminal Education: status of the criminal.
- Criminal Modus operandi: plan to do a crime.
- Criminal Weapon used: with the help of done a crime
- Criminal Cases: number of crime done by criminal
- Crime reason: understanding towards the crime

Collected the data criminal from the internet this is an raw data contain the detail of each criminal from that raw data we get the attribute values form that data store our data base which was contain the 50 records of data of criminal the data firstly store in the database using workbench then we fetch data in mat file and store in the mat file.

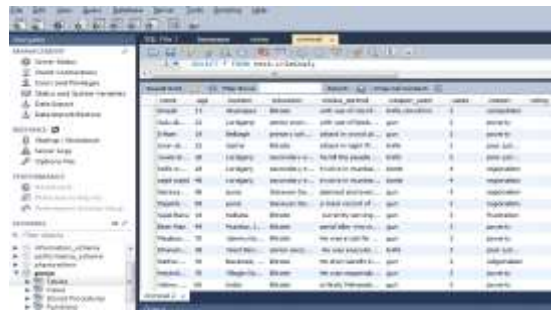


Fig 2.2(a): Database of Criminal data store in work bench consider here attribute values of criminal data

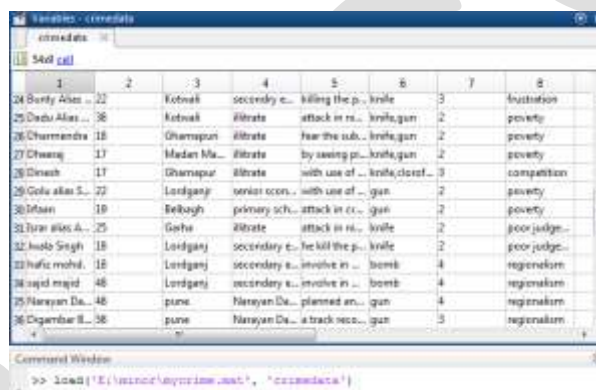


Fig 2.2(b): Store criminal data in mat file

Fig 2.2(b) represent the mat file of the load database of criminal data. The data of criminal is large consider only the attribute values of the data. we used workbench to store data so the futher analysis done. The data collected is current data of the criminals which are collected from different genuine websites and police record data.

2.3 Generating Data

Here we analysis the data of criminals we have collected all the required attributes of the criminal store all the attributes in the database now consider each attribute one by one we analyses that data and then we have detect a single pattern to analyses the whole data.

we use different attributes to analyses the data when we analyses each attribute after that we come end result by comparing each attribute of criminal in our result we find out that the soft core criminal can become a hard core criminal.

3. EXPERIMENTAL EVALUATION

In this we have considered attribute one by one and come in to the result. We have get result using the bar graph and pie chart the result we found get detail in brief and compare to other the result here further divides the each attribute in category.

3.1 Weapon used by criminal

Weapon used is an attribute of criminal data which was further divide in the category analyses each category and get the result the number of criminal belong to that category there are the following categories divide the weapon used:

1. Gun
2. Bomb
3. Knife
4. Fire

In fig. 3 we analyses the weapon used by the criminal by the help of pie chart and bar chart we easily show that our estimate data in the form of graphical interface.

Here we count the number of counts the which weapon used the criminal more with the use of looping on the basis we plot a pie chart and graph to show the result maximum number criminal used which weapon to done crime

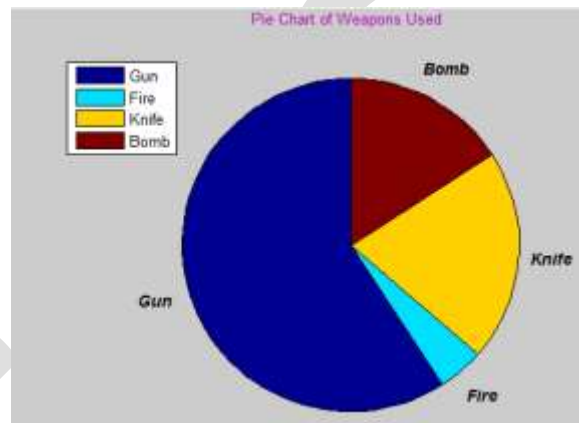


Fig: 3.1(a): Analysis which weapon used by the criminal through pie chart

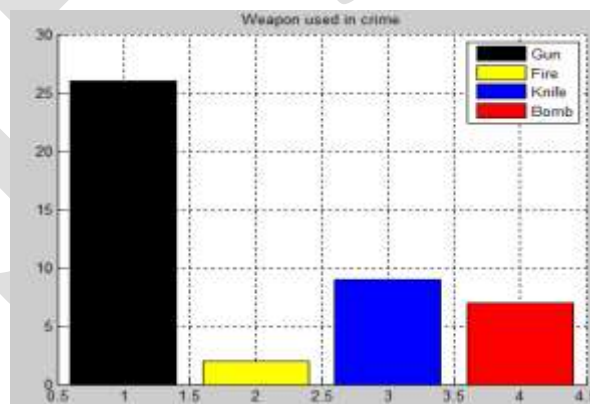


Fig: 3.1(b) Calculate the number of which weapon used by criminal

On the basis of pie chart or bar graph result we get the result the number criminal which weapon used more to done a crime we draw a table for above result

Table 14: Analysis of weapon used by criminal

Weapon used by criminal	Calculate the number of weapon used by the criminal
GUN	28
BOMB	8
KNIFE	10
FIRE	4

The steps used to determine the data are the following:-

- Import data from database
- Divide the weapon data in different category i.e. gun, bomb, knife, fire.
- Calculate the each weapon used by different criminal
- Increment the number weapon used
- Design a bar graph to represent the maximum number of which weapon used

We get the estimate from the graph and table that from the record of database get the details of the criminal and get the estimate results that which weapons priority order.

3.2 Number of cases by criminal

In this we analysis the data of criminal in which the number of cases in criminal mean the number of case are occur to criminal to done crime if it is done one crime there is one case more than one crime the no. of crime he done he no. of cases occur.

In fig. 3.2 cases are analyses of the criminal cases means how many crime done by criminals if criminals done a one crime so we consider him in case1 else so on if the no. of cases maximum of the criminal it means it done that no. of crimes. So we have divide the no. of cases in 4 parts they are:-

- One case: only single crime done by criminal
- 2-3 cases: between 2- 3 crime done by criminal
- 3-5 cases: between 3- 4 crime done by criminal
- >5 cases: Greater than five crimes done by criminal

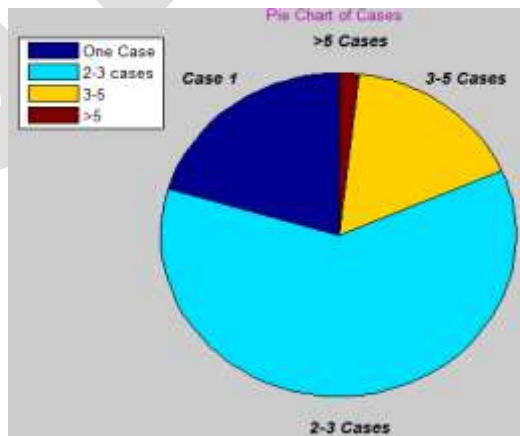


Fig: 3.2(a): Analysis number of cases done by criminal through pie chart

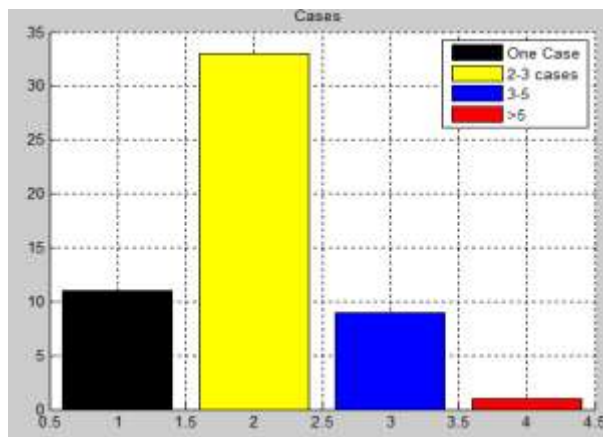


Fig: 3.2(b) Calculate number of cases done by criminal represent through bar graph

Through the bases of data of criminal we estimate the result in the form of table that the no. of crimes or cases occur in the criminal are done.

Table 2: Analysis of number of cases of the criminal

Divide the No. of cases of criminal	Cases done by the criminal
ONE CASE	10
2-3 CASE	30
3-5 CASE	9
>5 CASE	1

The steps used to determine the data are the following:-

- Import data from database
- Divide the number of cases in different category i.e. case one, case between 2-3, case between 3-5, above 5 cases.
- Calculate the each no of crime or cases done by criminal
- Increment the number of cases of the criminal

We get the estimate results by the analysis of number of cases done by the criminal further use the results of criminal and this data helps found results

3.3 Analysis education of the criminal

we have analyses the Education background of the criminals this data help us to define our end result so criminal education is important because it define which background criminals belong in fig: 3.3 we divide the education in different category calculate the number of criminal belong to the which category so we define education in different categories they have seven categories they are:-

- Illiterate: criminals not study
- Primary: criminals study up to primary classes

- Secondary: criminals study up to 10th class
- Senior secondary: criminals study up to 12th class
- Graduate: criminals study up to Graduate
- Masters: criminals study up to masters

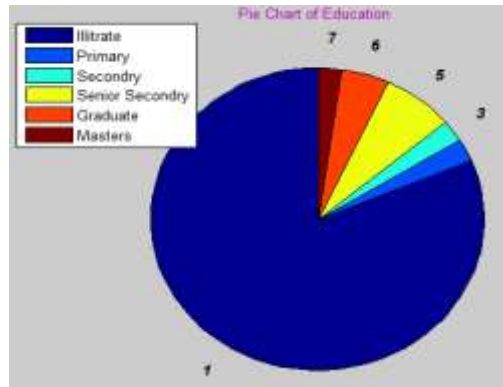


Fig: 3.3: Analysis education of criminal through pie chart

By get the result of the criminal education data we estimate the result to draw the maximum criminal what their education background if they do a crime so by seeing the result we draw a table with the respective results.

Table 3: Analysis of education of the criminal

Education of Criminal	Number of Education
ILLITRATE	35
PRIMARY	2
SECONDARY	2
SENIOR SECONDARY	1
GRADUATE	7
MASTERS	3

The steps used to determine the data are the following:-

- Import data from database
- Divide the education data in different category i.e. illiterate, primary, secondary, senior secondary, graduate, and masters.
- Calculate the each criminal education background
- Increment the number of education mostly criminal done
- Design a pie chart to represent the education of the criminals

We get estimate result in table 3 that mostly criminals are illiterate this data help in further proceeds to get the end results

3.4 Detect pattern of criminal movement using genetic algorithm

In this we get criminal location what was there next location of crime we have data collected of criminal what his exact location and the distance in which he do a crime.

let us take an example a person p he wants to make an p name in the world so he start to make line first then completes the p when he make a line he used 10 gap then we get idea the next target also lie within 10 meter gap for this we collected a large data of criminal location where he do a crime with the help of genetic algorithm we plot a graph of similar pattern.

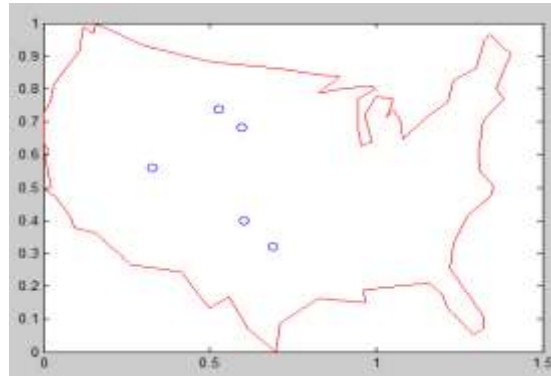


Fig: 3.4(a): shows position of crime done by criminal

In this graph we get the position of criminal in that country and these are the position of one criminal who do a crime based on these location.

Now we have join these location and get the distance between them in what distance he make a next target.

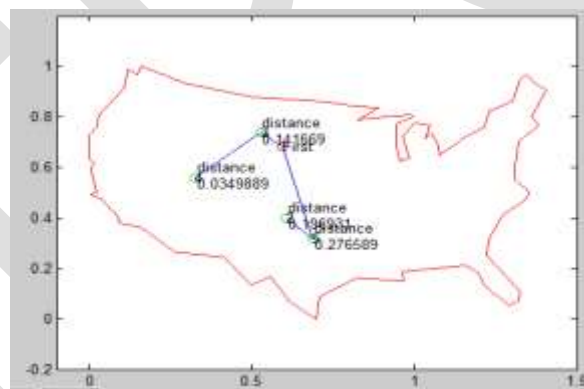


Fig: 3.4(b): Connect all the position of crime which was done by the criminal

Here we connect all the connectors in which criminal done crime now using the genetic method which find the similar pattern between the graph we get the net position where he done a crime

The steps used to determine the data are the following:-

- Import data from database
- The data contain the location of crime where a single person done a crime in different location
- We get the points which shows on graph which shows different places where he done a crime
- In the next graph we calculate the distance between them and also connect the points in graph
- By using this data and the genetic algorithm we draw a graph which shows the next position where he might done a crime

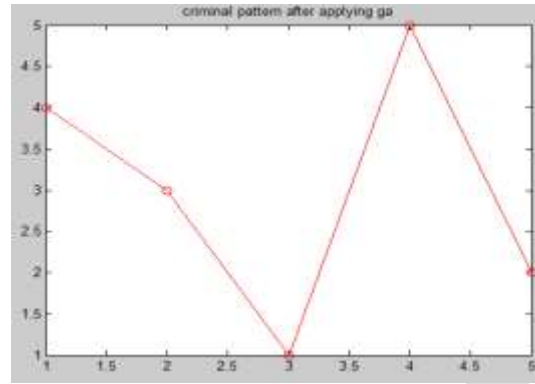


Fig: 3.4(c): This graph shows the next position of crime location of criminal

4. RESULT

We have analysis all the attributes one by one now we consider all the attributes apply the algorithm and find the result that the can a soft core criminal become a hard core criminal in future so we apply the algorithm and get four results that what is the possibility of soft core criminal become a which type of hard core criminal in future their four types are:-

- Type1 → soft core criminal
- Type2 → soft core criminal moving towards hard core
- Type3 → hard core criminal
- Type4 → completely hard core criminal

Certain steps are taken to get the result of Calculate Probability of Soft core criminal converting into type of criminal steps are:-

1. Import all the data analysis done is prior
2. We have calculate the data that maximum criminal belongs to which category
3. Here we not compare only with one category butt all the category
4. If no match with the analysis data or less attribute match called soft core criminal
5. If 2-3 data of attribute are match with data analysis attribute of criminal called soft core criminal moving towards hard core
6. If 3-4 attribute match called hard core criminal might be in future
7. If all the data match it is an completely hard core criminal might be in future

For this we design a model in which read data button read data from database which already store in matlab in mat files then we have proposed model which we discuss prior then we have a button of new criminal data in this we enter the detail of new criminal.

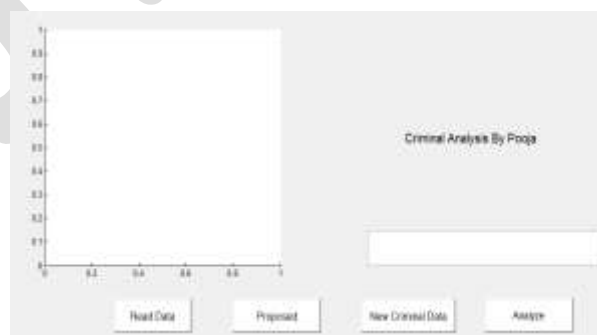
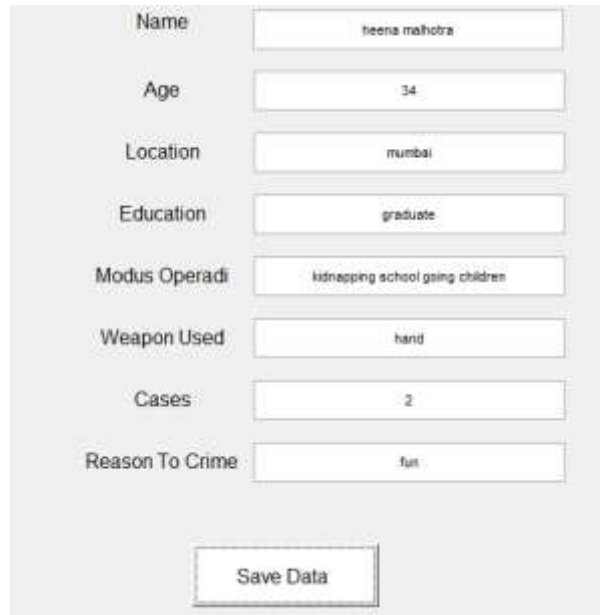


Fig: 4: Represent the model of analyzing criminal behavior

Now by click the button of new data we have another window open in which we enter the detail of the criminal which shows which type of criminal it was in future

4.1 Enter the detail of new criminal data record 1

We enter the detail of new criminal and analyses that in future it will become a hard core or it remain soft core criminal we enter the detail of one criminal enter only the attribute value of criminal than save the value in mat file.



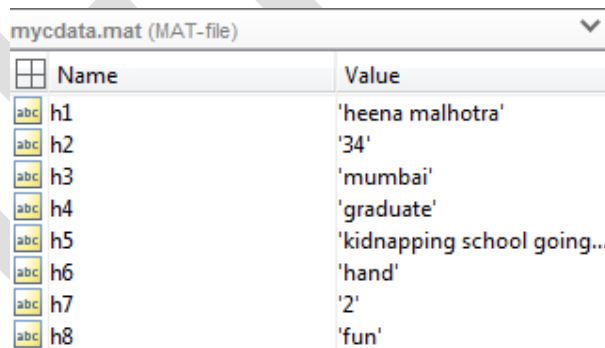
The screenshot shows a web-based form with the following fields and values:

Name	heena malhotra
Age	34
Location	mumbai
Education	graduate
Modus Operandi	kidnapping school going children
Weapon Used	hand
Cases	2
Reason To Crime	fun

At the bottom of the form is a button labeled "Save Data".

Fig 4.1(a): Enter the detail of new criminal data record1

We have enter the new criminal data of record 1 and save file in mat file for further analysis of data.



The screenshot shows a MATLAB workspace window titled "mycdata.mat (MAT-file)". It contains a table with the following data:

	Name	Value
abc	h1	'heena malhotra'
abc	h2	'34'
abc	h3	'mumbai'
abc	h4	'graduate'
abc	h5	'kidnapping school going...
abc	h6	'hand'
abc	h7	'2'
abc	h8	'fun'

Fig 4.1(b): Save the detail of new criminal data record1in mat file

4.1.1 Analyze the record 1 new criminal data

Now by click the button of analyze we get the result whether it is hard core criminal or soft core criminal.

Name	heera walutra
Age	34
Location	india
Education	graduate
Modus Operandi	stealing minor para vehicle
Weapon Used	hand
Cases	2
Reason To Crime	tu

Save Data

Criminal Analysis By Poopa

Softcore Criminal

New Criminal Data Analysis

Fig: 4.1.1(a): Analysis of record 1 data of new criminal

We get here we see this data are shows that this criminal are little chances to become a hard core criminal we have the statement this is a command prompt.

```
>> myCriminalProject
HEERA WALUTRA is still a softcore criminal
>> |
```

Fig: 4.1.1(b): Analysis of record 1 data of new criminal in Command Prompt

4.2 Enter the detail of new criminal data record 2

We enter the detail of new criminal and analyses that in future it will become a hard core or it remain soft core criminal we enter the detail of one criminal enter only the attribute value of criminal than save the value in mat file.

Name	abu salem
Age	54
Location	harthand
Education	illrate
Modus Operandi	murder the person for money
Weapon Used	gun
Cases	2
Reason To Crime	poverty

Save Data

Fig 4.2(a): Enter the detail of new criminal data record2

We have enter the new criminal data of record 2 and save file in mat file for further analysis of data.

mycdata.mat (MAT-file)		
	Name	Value
abc	h1	'abu salem'
abc	h2	'54'
abc	h3	'jharkhand'
abc	h4	'illiterate'
abc	h5	'murder the person for m...
abc	h6	'gun'
abc	h7	'2'
abc	h8	'poverty'

Fig 4.2(b): Save the detail of new criminal data record 2 in mat file

4.2.1 Analyze the record 2 new criminal data

Now by click the button of analyze we get the result whether it is hard core criminal or soft core criminal

Fig: 4.2.1(b): Analysis of record 2 data of new criminal

We get here we see this data are shows that this criminal are greater chances to become a hard core criminal we have the statement this is a command prompt.

```

Command Window
abu salem hardcore criminal ..
>>
    
```

Fig: 4.1.1(b): Analysis of record 2 data of new criminal in Command Prompt

4.3 Compare the data of record 1 and record 2

Here we have two record i.e. record 1 which is record of the criminal there is less chances he became a hard core criminal and we have record 2 criminal which has more chances become a hard core criminal we get the result by analyzing the criminal behavior that maximum attribute matches with the data analysis it shows it has more chances to become a hard core criminal

```

Command Window
shena malhotra is still a softcore criminal
abu salem hardcore criminal ..
>>
    
```

Fig: 4.3(b): Compare record 1 and record 2 data

CONCLUSION

This research explores a new method to understand and analyze behavior of criminals. Several data of criminals was collected from genuine sources; the data was stored in graph database for its effective analysis. Sub graph of criminal database was used to reduced data so as to achieve efficient results; optimization is performed in the behavior analysis. We have achieved greater accuracy using fuzzy logic for comparison of new criminal data with the stored data. Thus the objective of the dissertation is achieved and the criminal behavior is analyzed.

In future the analysis can be done adding more parameters like behavior and handwriting patterns.

REFERENCES:

- [1] VandeMoere, A., "Time-varying data visualization using information flockingBoids", In IEEE Symposium on Information Visualization 2004 (Austin, TX: IEEE), pp. 97-104
- [2] Nath S. V., "Crime Pattern Detection Using Data Mining", Proceedings of the 2006 IEEE/WIC/ACM international conference on Web Intelligence and Intelligent Agent Technology , 41- 44, 2006
- [3] Yan J. , Liu N., Yang Q., Zhang B., Cheng Q., Chen Z., "Mining Adaptive Ratio Rules from Distributed Data Sources", Data Mining and Knowledge Discovery, 12, 249–273, 2006, 2005 Springer Science+Business Media, Inc. Manufactured in the United States. [IVSL]
- [4] E.S. McCord, G.H. Ratcliffe, R.M. Garcia, and R.B. Taylor, "Nonresidential crime attractors and generators elevate perceived crime and incivilities," Journal of Research in Crime and Delinquency, vol.44(3), pp. 295-320, 2007
- [5] E.S. McCord, and G.H. Ratcliffe, "A micro-spatial analysis of the demographic and criminogenic environment of drug markets in Philadelphia," Austrian and New Zealand Journal of Criminology, vol.40(1), pp. 43-63, 2007
- [6] R.K. Rai, M. Balmer, M. Rieser, V.S. Vaze, S. Schonfelder and K.W. Axhausen, "Capturing human activity spaces-new geometries," Transportation Research Record, vol. 2021, pp. 7080, 2007
- [7] Natalia Iwanski, Richard Frank, VahidDabbaghian, Andrew Reid and Patricia Brantingham, "Analyzing an Offender's Journey to Crime: A Criminal Movement Model (CriMM)", 978-0-7695-4406-9/11 \$26.00 © 2011 IEEE DOI 10.1109/EISIC.2011.13
- [8] S.D. Johnson and K.J. Bowers, "Permeability and burglary risk: are cul-de- sacs safer?" Journal of Quantitative Criminology, vol. 26 pp. 89-111, 2010
- [9] R. Frank, V. Dabbaghian, S.K. Singh, A.A. Reid, J. Cinnamon and P.L. Brantingham, "Power of criminal attractors: modeling the pull of activity nodes," Journal of Artificial Societies and Simulation, vol 14(1), p.6, 2011
- [10] Malathi. A and Baboo S. S., "Enhanced Algorithms to Identify Change in Crime Patterns", International Journal of Combinatorial Optimization Problems and Informatics, Vol. 2, No.3, Sep-Dec, 2011, pp. 32-38, ISSN: 2007-1558
- [11] Malathi. A and Baboo S. S., "Enhanced Algorithms to Identify Change in Crime Patterns", International Journal of Combinatorial Optimization Problems and Informatics, Vol. 2, No.3, Sep-Dec, 2011, pp. 32-38, ISSN: 2007-1558
- [12] Malathi. A , Baboo S. S. and Anbarasi A., " An intelligent Analysis of a City Crime Data Using Data Mining", 2011 International Conference on Information and Electronics Engineering, IPCSIT vol.6 (2011) © (2011) IACSIT Press, Singapore
- [13] Sathyaraj S. R., Thangavelu A., Balasubramanian S., Sridhar R., Chandran M. and Prashanthi M. D., "Clustered Spatial Association Rule To Explore Large Volumes Of Georeferenced Crime To Crime Data", 3rd International Conference On Cartography And Gis 15-20 June, 2010, Nessebar, Bulgaria
- [14] Chen N. and Wang Y., "Prediction of Series Criminals: An Approach Based on Modeling", 2010 International Conference on Computational and Information Sciences
- [15] Yu C.H., Ward M. W., Morabito M., and Ding W., "Crime Forecasting Using Data Mining Techniques", 2011 11th IEEE International Conference on Data Mining Workshops
- [16] Emad K. Jabar, Soukaena H. Hashem, and Enas M. Hessian, "Propose Data Mining AR-GA Model to Advance Crime analysis", IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, p- ISSN: 2278-8727Volume 14, Issue 5 (Sep. - Oct. 2013), PP 38-45
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