Algorithm to Track Criminal

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ABSTRACT
This paper proposes an approach to prevent crime by applying a well-defined algorithm. The proposed algorithm makes use of a mathematical expression which calculates the probability of a criminal doing a crime in a particular area based on the previous records. The algorithm updates the probability over time and makes use of two major factors of crime, area of crime and rate of crime for calculating the probability of a criminal doing crime in future.

General Terms
Predictive analysis, Probability, Distributed computing, Database

Keywords
Crime Sector, Database, Crime Prevention, Criminal, Crime probability

1. INTRODUCTION
The crime in the world is ever increasing and so the police record. While studying the crime done by a particular, specific patterns on which a particular criminal executes the crime can be defined. Two of the common pattern can be derived from the area of crime in which criminal does the crime and the rate at which crime is done by a particular criminal.

Crime prevention is a concept that has been applied in a number of different ways to the problem of crime: it has been used to refer to both activities (e.g. crime prevention programs and/or strategies) and outcomes (e.g. lower levels of crime in communities and/or lower levels of offending/re-offending by individuals) [1].

Taking these two parameters, an expression has been derived through which the probability of a particular criminal doing a crime in a particular area can be calculated. This will enable the police to crack the crime and track the criminal in less time. The algorithm is so designed that the probability of a criminal will increase exponentially initially if the crime is done for the first time and will increase ever, if so he or she continues to do the crime.

Moreover, the crime probability will decrease over time if the criminal has chosen to quit the crime career but the rate of decrement will be slow and so the criminal will be in radar of police for a longer duration. Maintaining probability of criminals doing crime can act as a support tool for the police department to lower the crime rate by solving the crime in less time and setting example for a fast and better policing approach which may instigate criminals to lower their crime with the fear of getting caught.

2. METHODOLOGY
The steps followed in implementing the algorithm are as follows:

Step 1: The number of months after which database which contains the criminal probability is updated needs to be entered.
Step 2: The criminal's name and his or her father's name is entered.
Step 3: The criminal's identity is matched in the database corresponding which the new probability is to be calculated and updated in the database.
Step 4: If the criminal has done crime in same sector based on the new record entered, the same crime sector value is incremented by 1 in the database else the value remains the same.
Step 5: The algorithm calculating the new probability by making usage of the mathematical expression (defined in the next section) is calculated and written in the database.

The probability update will be scheduled based on the value set by administrator which will take data from all police record and match with central database to update the probability.

The schematic representation is given below.

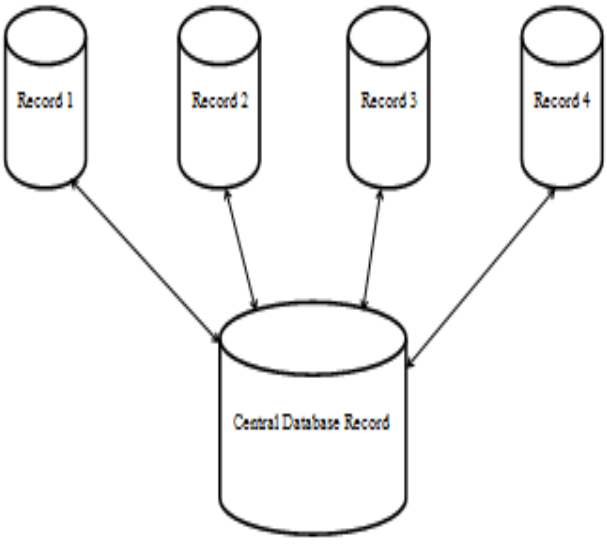

Fig 1: Schema of sync of all record with central database record

The flowchart depicting the flow of algorithm is given below.

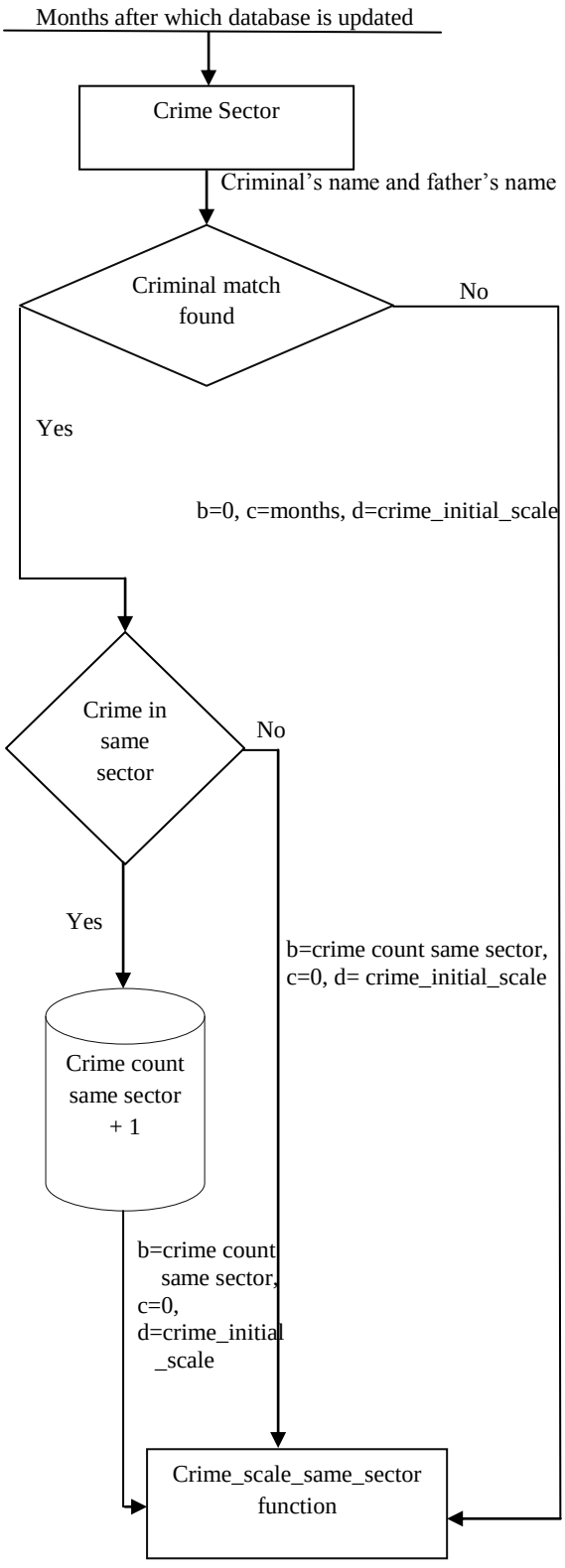

Fig 2: Update_Crime_Probability() function flowchart

3. EXPRESSION TO CALCULATE CRIME PROBABILITY

The below expression defined explains calculation of a criminal doing a particular type of crime specific to an area.

x = 6.23*crime_same_sector;

y = crime_not_done_months * 0.6;

scale = x - sqrt(y) + 0.3;

scale_order = tan inverse (scale)

scale_final_order = scale_order + scale_initial_order

If (scale_final_order < 0)

then scale_final_order = 0.0

In above flowchart,

b = crime_same_sector, which is the scale which should be increased 10 times if the criminal has done the crime in the same sector again. So basically, the count gets increased. The probability gets increased of doing the crime in same sector as that area could be the criminal's most easy accessible and favorite crime area.

Hence value of **x** is computed by using above logic.

x = 6.23*crime_same_sector
c = crime_not_done_in_months, which is nothing but the value of number of months after which database of crime record is getting updated which updates the crime scale.

For criminals, value of c passed is 0,

For criminals who have not done crime in passed given months or year (say, 6 months or 2 year) whenever the database is updated.

c= months.

y= c*0.6
Value of y is 1/10 times the value of x

It is because the rate of doing crime should be more than the rate with which the probability should decrease. Hence y is computed on $1/10^{th}$ scale.

Scale = x – sqrt(y) + 0.3
The value of scale will be positive if the criminal has done crime in between given months and the scale will be of higher value whereas if the criminal has not done crime in past given months, value of scale will be negative but the scale mod value will not be much, since the probability of doing crime should decrease slowly over time.

scale_order = tan inverse(scale)
Compute the scale value on tan inverse graph. Since, value of y for a particular x has maxima and a minimal, so tan inverse graph is chosen. Moreover, for a small change in x, there is a significant change in y which denotes that if a criminal has done crime for the first time the probability of doing next crime will be high since it is psychological in nature of a criminal.

scale_final_order = scale_order + scale_initial_order
And hence the final value which is returned is written in the database.

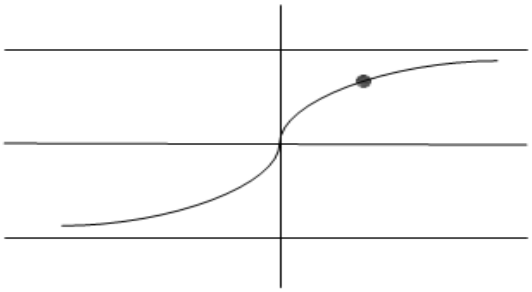

Fig 3: Tan inverse graph

The value on the tan inverse graph shows the trend by which the probability of a criminal doing a crime increases or decreases over time. The trend which marks the value changes are:

i) Rate of doing crime by a criminal.

ii) Crime done in specific areas.

These factors decide whether a particular criminal would have done the crime in a particular sector based on the probability which is calculated by the above mathematical expression.

4. APPLICATION

- The above defined approach is put in simpler format but it can be put to use in tracking many different things. It can be replace the exhaustive GPS technology for monitoring the location of vehicles by transport agencies. The approach would prove to be cost effective since it does not require much energy in transmitting large bandwidth signals as in the case of GPS technology and since less bandwidth is used so lesser traffic and hence cheaper means of locating vehicles.

- Also, as already mentioned, it can be put to use by the police department to keep track of criminals and by using predictive analysis approach, provide a list of criminals to the police to make their hard work easy in a sense to crack the case. Moreover, it can help to prevent from many crimes to happen since it can help the police to track the victim.

5. METHOD TO FIND CRIMINAL FOR SPECIFIC TYPE CRIME DONE IN SPECIFIC AREA

One main difficulty hindering crime detection [2] and reporting is the need of common platform between the police and public in order to exchange the useful information.

The criminal data is fetched from the central criminal database maintained which can serve to track the most probable criminal in no time and will help the police department in tracking down the criminal in no time and would help to reduce the effort taken.

The most probable criminal who might have done the crime is fetched and all the related information is get to further process it either to nearby police department or for further analysis. The flowchart for the methodology followed is given below.

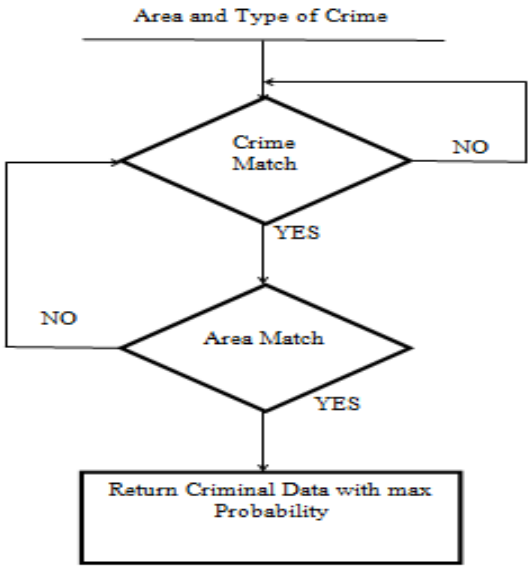

Fig 4: Flowchart to find most probable criminal

Normally, the criminal with maximum probability calculated on basis of mathematical expression defined in previous section would be the most probable criminal who might have committed the crime.

6. CONCLUSION

Further work can be done on this algorithm by making the expression derived as the base and implementing large scale distributed network on it for tracking criminals, applying big data perspective for connecting global level criminal record and maintaining a large scale crime detection software. There can be many types on crime which can further be more fragmented into subdivisions based on the type of crime done in a particular area and more fragmentation can be done by further investigating which area is more prone to which type of crime and posing the algorithm to use that type of data.

Various crime type associations with criminal can be set in database as follows:

Table 1. Sample data from tool developed maintained in Central database

Criminal Name	Area (Sector) of Crime	Crime Type
Jacob	04, 54, 12, 15, 09	Assault, Pistol, Rape
Saeed Ahmad	12, 07, 08	Murder, Serial Killing
Akram	86, 07	Robbery
Amit	02, 91, 34	Battery, Kidnapping

7. FUTURE SCOPE

In future work, more associations can be added which can provide more subtle rules to precise the criminal. Moreover, rules can also be added and some rule engine tool can be integrated wherein administrator may be able to define customized set of rules to predict the criminals over a region based on the rules defined and database with the administrator.

In all, the expression defined by means of this paper would help in faster policing [7] and would help the humanity in reducing the crime rate and efficient criminal tracking and crime case processing. Big data approach can also be used to track large scale data wherein a centralized unit would be able to maintain criminal list and predict possible criminal which will enhance the policing and centralize the whole policing architecture.

8. ACKNOWLEDGMENTS

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9. REFERENCES

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