

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES PREDICTION AND PREVENTION OF CRIMES USING GEOSPATIAL BIGDATA ANALYTICS

Dr. S. Sivasankar^{*1}, Dr. R Jaganathan² & Dr. D. Surendran³

^{*1}Guest faculty, Department of Geography, University of Madras

²Professor and Head, Department of Geography, University of Madras

³Guest faculty, Department of Geography, University of Madras

ABSTRACT

Crime mapping analysis and prevention is a systematic approach to identifying and analyzing patterns and trends in crime. Recent technology big data has created a revolutionized approach in many domains. Big data and advanced geospatial tools enable to predict regions which have a high probability of crime occurrences and predict crime-prone zones. With the advent of computerized systems, crime data analysts can help the Law enforcement officers intensify the process of solving crimes. As far as Indian policing is concerned, usage of this technology is yet to reach its optimum level. This study intends to provide new understandings for expanding these capacities in order to cut the crime and enhance the public safety measures by using Bigdata Analytics.

Keywords: Big data Analytics, Crime prediction, Crime analysis, Geospatial, and public safety.

I. INTRODUCTION

Bigdata definitions vary with expert's usage of this technology. In the world of the digital era, a system equipped with handling large amounts of the dataset in terms of volume, velocity, and verity is known as Bigdata. Again, the definition of Big data cannot be confined only with the size of dataset rather the efficiency to aggregate and use advanced analytical techniques that eventually creates finished products. These days IOT (Internet of things) create a massive amount of unstructured data in various data formats, these datasets can be processed with lightning speed using advanced Big data analytical techniques from which significant results can be obtained. Numerous practical applications can be done by using Big data analytics like predicting weather forecasting and path directions of cyclone movement, similarly predicting crime incidents and pattern identifications are also feasible. Big data capabilities in digital policing are immense, it enables Law enforcement agencies to access large quantum of crime data and to do advanced sophisticated analysis. For instance patterns of criminal behavior can be tracked using advancement in technology leveraging Law enforcement agencies in better patrolling, better storage and usage of evidence obtained in criminal investigation cases for appropriate analysis. Virtually it may appear that the Police personnel is at the right place at the right time, nevertheless, in reality, computer programming and software tools would predict places and times where crimes may occur. For crime prediction and prevention of crimes, sophisticated tools and analytical techniques are readily available.

II. BIG DATA FOR LAW ENFORCEMENT

Big data has got the caliber of handling various domains and applications effectively. Whereas in Law enforcement it garnered minimal traction. For effective crime prediction and prevention, the crime data needs to be brought under the Bigdata environment and for achieving this, modern control systems need massive data storage capabilities. Presently the Law enforcement agencies collect information from various sources such as crime reports for different types of crimes both properties and violent, incident reports, contact reports, silent dispatch communication, victim complaints, missing persons, evidence collection, forensic lab results, offenders information, spatial behavioral criminal, digital evidence from computer crimes, fingerprints, photos, accident reports, electronic communication, arrest reports, surveillance cameras, patrol vehicle GPS and warrant information. To enrich those previously mentioned, the following functions can be included such as predictive analytics, crime mapping, connected public and private video feeds, social media, open source internet monitoring, drone video, and private

commercial data. This information, when grouped into a structured format and processed further for crime prediction analytics and results, will certainly equip us with a prevention plan. Crime analysis and prevention is a systematic approach for distinguishing and analyzing patterns and crime trends.

Manning (1992) explains about gathering of information by stating: “The police gather primary information or "raw data" that is then processed within policing for crime solving or closing the events to become secondary information. When processed twice, gathered, and formatted, it can move up the organization to become tertiary or "managerial" information”. These forms of information and intelligence (information gathered for anticipated events, rather than gathered in response to an ongoing event) are realized that can interact with police operational strategies (the allocation of resources to obtain a preventive, prospective, or reactive end).

III. GEOSPATIAL TECHNOLOGY AND BIG DATA

Currently, almost 50 percent of the world population has already started using Location-based services. Geospatial data always falls under the Big data category. As per United Nations estimation Initiative on Global Geospatial Information Management, 2.5 quintillion bytes of data are generated every day, and a huge portion of the data is locational information. Furthermore, Google states that about 25 TB of data is being generated every day and a significant portion of the data falls into a spatiotemporal category. This trend is expected to expedite as the world becomes more and more mobile these days. Cloud technologies facilitated plenty of opportunities for advanced analytics of geospatial big data.

IV. BIG DATA ANALYTICS FOR CRIME PREDICTION AND PREVENTIONS

Portraying crime incidents and offenders locations in the map are useful for analyzing crime pattern and crime mitigation strategies. However integrating Big Data, Cloud, Artificial intelligence and Machine learning technologies allow us to create a better crime prediction spatial model to pinpoint the location of crime with time. Adding parameters like temporally variant crime data with definite intervals, most of the property crimes could be predicted. Big Data and cloud technology have abilities to process massive quantities of spatial data in the shortest curve and emerge as a new frontier for geospatial analysis.

Big Data technology helps to enhance analytical efficiencies to predict the crimes incidences well in advance. Incorporating Geospatial technology in Big data processing facilitates an in-depth understanding of crime predictive modeling and policy-making in crime detection and preventions. Since spatial analysis support unstructured data in real time, any form of crime report can be analyzed for better output. Probably a large amount of data are pulled out from different sources and given geospatial identity for complete prediction modeling. Storing spatiotemporal data under Bigdata environment enables retrieving information using multiple spatial queries thereby getting enhanced results in detection and prediction.

Prediction of property crimes is much easier compared to violent crimes as the former follows a certain pattern of re-occurrence whereas the latter cannot be predicted because it involves individual emotions and psychological behaviors. Predictive Policing involves four major factors like 1. Who has committed the crime \ victim of the crime, 2 Location of the crime, 3 Analyzing various risk factors, and 4. Event history of crimes. To get the spatial pattern of crime for predictive policing two main factors are essential first one is the location of crime – when and where crimes are recorded and the second one is a detailed history of crime events which is most important in order to have better predictions.

V. WEB-BASED GEOSPATIAL ARCHITECTURE FOR PUBLIC CRIME AWARENESS SYSTEM

Prevention is better than cure so we predict/prevent the crime incidents before it takes place. Keeping this ideology in mind, technical problem statements or objectives need to be created.

Problem statement

Real-time Geospatial Bigdata Analytics (Mobile& Desktop support) crime incidence awareness system needs to be created for the public and police personals.

Solutions

To address the problem statement, following technical support and architectural models need to be designed & executed in real-time with the support of big data analytics.

1. Property crimes are initially noticed by the public and later shared with police for further law enforcement actions. The main intention of developing crime prevention and the predictive system is to create crime awareness among the public and encourage every individual to update the place of crime, type of crime, Crime scene photos, Videos and time of the crime. Hence user-friendly mobile and desktop applications need to be created which facilitate public and police to update/upload the mentioned information in real time along with preemptively uploaded Crime record bureau crime information need for better crime prediction and prevention in real time.
2. Needed Geospatial big data analytics real-time event server for quickly storing, retrieving, searching, and displaying crime hotspots and predicting the places where crime incidences are expected to occur.
3. Server, a second layer in the server is responsible for performing data analytics on the crime data. Hotspot with high, moderate and low risks zones are highly dynamic in nature as per real-time crime data feed. These risks zones need to be relayed on the mobile and desktop applications constantly based on the dynamic nature of Crime events.
4. Various Big data spatial analytic modules need to be created for a dynamic map to see the shifting pattern of hotspots over the space with a variance of High, Moderate and low-risk zones.
5. The third function of the Spatial event server will take care of the algorithm and spatial filter which filters the unwanted data and organizes relevant data. The spatial algorithm would work on analyzing the historical crime events in particular zones, this is considered to be one of the most important functions of crime predictions. These crime prediction zones will help the public and police to formulate proactive measures to combat crimes.

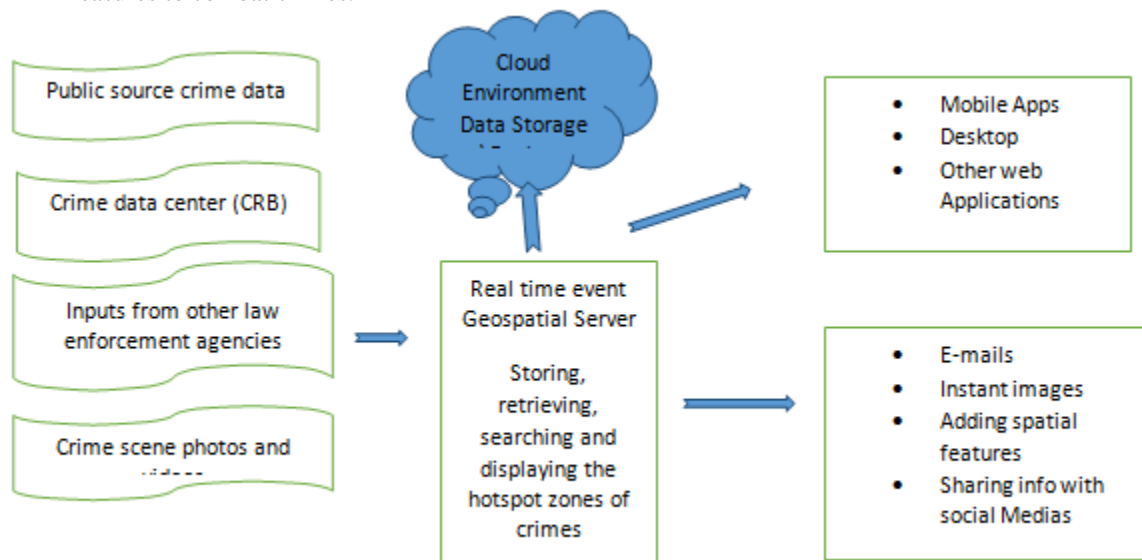


Figure 1

6. Getting the inputs from disparate sources and storing in a cloud environment will be more convenient for real-time applications. Hybrid cloud would be more appropriate for predictive policing and other real-time crime analysis.

7. Once the entire architecture is ready every individual/police personnel can be able to update the above-mentioned crime dataset in real time and simultaneously public and police could be able to see the current trends with three high, moderate and low-risk zones on daily basis. After installing the crime safety app in real time, a commoner before venturing out to a supposedly new place can ensure the safety of self and belongings in a proactive manner. Moreover, the public can ensure the safety of respective places where they reside.

VI. CONCLUSION

As opposed to conventional crime mapping techniques which involved nothing but maps that showcase criminal activities as mere points on them thereby equipping it's users with nothing more than a general knowledge of getting to know about crime prevalent areas, the latest advancements in the likes of Big Data have made their way atop in no time particularly due to the one and only reason being Real-time .Since technology continues to evolve constantly it would be silly to assume that they are utilized only for good deeds, Lawbreakers and History Sheeters are of late getting tech savvy which enables them to change their modus operandi and positions frequently to avoid being under Police radar where the application of static maps prove to be utterly useless. As per the saying "Old habits die hard", though Criminals change their localities they tend to do what they do no matter where they are and that is where the concept of Big data analytics we discussed comes into play. One can make wonders in scheming innovative patrolling and policing techniques by making use of location-based big data say for example. Geotagged Crime scene photographs and incorporating necessary technical utilities such as a Cloud environment and a powerful Server where the former as discussed acts as a repository for storing data irrespective of its relevance in current analysis while the latter provides analytical capabilities so as to retrieve useful information from data that is stored in masse .As myriads of data are generated daily we cannot afford to let go of them as they need to be organized to give problem-oriented solutions. Crime rates are getting increased alarmingly it is high time for us to look for new ways to predict and prevent them at the earliest about which this paper focuses to insist upon.

REFERENCES

1. Paul J Brantingham and Patricia L Brantingham (eds), *Environmental Criminology* (Beverly Hills, CA: Sage, 1981).
2. Manning, P. K. (1992). *Information technologies and the police. Crime & Just.*, 15, 349
3. Waller, M., & Fawcett, S. (2013). *Data Science, Predictive Analytics, and Big Data: A Revolution That Will Transform Supply Chain Design and Management. Journal of Business Logistics*, 2013, 34(2): 77–84.
4. John Villasenor, *Brookings Institute, Recording Everything: Digital Storage As An Enabler Of Authoritarian Governments I* (Dec. 14, 2011).
5. <https://www.nij.gov/topics/technology/maps/pages/welcome.aspx>
6. <https://www.gislounge.com/empowering-gis-big-data/>
7. <https://www.geospatialworld.net/blogs/how-gis-ensures-public-safety/>
8. <https://www.esri.com/videos/watch?v=5113&isLegacy=true&title=Get%20Started%20with%20Predictive%20Policing%20Using%20Esri%27s%20Crime%20Analysis%20Toolbox>
9. <https://www.esri.com/en-us/industries/public-safety/solutions/law-enforcement>
10. <http://www.cxotoday.com/story/using-big-data-analytics-to-predict-crime-patterns/>
11. <https://www.esri.com/~media/Files/Pdfs/library/whitepapers/pdfs/gis-for-real-time-crime-centers.pdf>
12. https://www.researchgate.net/publication/280722606_Crime_Analysis_and_Prediction_Using_Data_Mining