Proactive Policing in the Trinidad and Tobago Police Service (TTPS) using "Big Data"

Andre Norton
Trinidad & Tobago Police Service[TTPS]
Port-of-Spain
Trinidad West Indies

ABSTRACT

The aim of this paper is to provide evidence to support the use of "Big Data" as a viable option for achieving proactive policing within the Trinidad and Tobago Police Service (TTPS). In today's information technology environment, "big data" has become the buzz wordandcontinues to be a topic of much discussion and hype. The use of big data is shifting decision making practices in all sectors of society to which law enforcement belongs and the resulting revolution brought about by its useprovides a fertile environment for enhancing proactive policing as a means of gaining competitive advantage over the criminal element. Trend and pattern analyses derived from big datacan provide the ideal criminal profile. Big data analytics makes it possible to track threats and potential attacks by online monitoringof communication between persons of interest. By finding ways to integrate all of its disparate data sources and analyzing it in the aggregate may lead the TTPS to discoverthat the benefits are real.

General Terms

Decision making, quantitative information, focused attention, modern technologies, criminals.

Keywords

Big data, big dataanalytics, disparate data sources, business intelligence, specialized queries, unstructured information, hotspots policing.

1. INTRODUCTION

The phenomenon, known as "Big Data" [1], is changing the way most organizations operate today. The manner in which the private sector have benefitted from big data analytics in terms of its impact and usage, justifies a case for its implementation in law enforcement.

Trinidad and Tobago is a multi-ethnic, multi-religious developing country situated in the southern Caribbean with an estimated population size of 1.3 million people [2]. The primary law enforcement agency is the Trinidad and Tobago Police Service (TTPS). Over the past five (5) years, increased crime has causednational debate and continuous international attention and travel advisories [3].Despite having achieved some degree of success at reducing crimes in some jurisdictions, the country's homicide rateremains a major challenge for the organization. In addition to a high murder rate per-capita, detection rates for murders and other serious crimes remains abysmal. In Trinidad and Tobago, criminals are slowly increasing their competencies and criminal networks by leveraging the use of modern technologies in order to further their nefarious aims.

On the flip-side to this emergingtrendis the opportunity for the TTPS to consolidate all its disparately held data sources in order to facilitate analyzing their multiplicity. Thisaction willtend to correlate and vector activities in an effort to provide a general overviewof these data sets [4].Using the existing data,coupled with the appropriate software, the organization can seize an opportunity for acquiring the potential capability to accurately tell where crimes are likely to occur and thereby target these locations for specific attention.

The use of"big data" can becomea critical success factor forthe organization in its relentless efforts to managing spiraling crime rates [5]. Its application can also steer the organization toward outperforming the competition– the criminal elements. Exploring this new technology will provide fertile ground for the decision makers to ensure that the organization becomes a pioneer among its peer organizations within the regionin use of big data.

This latest trend in data storage and analytics provides a platform for launching its predictive/proactive policing trust in order to improve the effectiveness of the organization's crime management strategies.

2. WHAT IS BIG DATA?

Big Datais a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications. Big Data is also defined as data sets where the three V's – *volume, velocity* and *variety* – present specific challenges in managing these data sets [6].

3. CURRENT SITUATION

There exists within TTPS a large repository of approximately two decades of crime data stored in the organization's criminal database alternatively called the Records Management System (RMS) which consists of structured fields as well a free-form unstructured text data.

In searching this large data repository for important crime controltips, police officers and crime analysts create and runcustomized queries where the expected results are pre-determined based on the query parameters.

In addition to thiscentral repository of crime data, several other data driven departments exist with very large data storage requirements. These departments include a cyber-crime unit, closed circuit television (CCTV) control center [7]and criminal gang and intelligence unit (CG&IU) [8]. The cyber-crime unit investigates all technology related crimes including white-collar crimes. The CCTV control center captures and stores video footage from security cameras strategically located to monitor streets, highways and police compounds. The CG&IU maintains profiles on gang membership. These three departments contain disparate data sources.

Analyzing online social networks such as Facebook, Twitter, My-Space, Linkedln, Printerest, Google Plus+, Ning, Meetup, Multiply, Tagged, My-Life [9] etc. is a core function of the cyber-crime unitultimately requiring big data analytics. This overwhelming amount of data will not go away and as such the organization is required to be able to handle it.Because of storage limitations, video footage captured from the CCTV security camerasare subjected to a storage life cycle before being overwritten.Video archiving, especially for long term reference, is required and could be facilitated with big data analytics.

There is no currentsystem for automatic notification of suspicious persons and/or activities. Anomalies such as thecriminals or suspects from abroad commuting to a single location or when there is a noticeable large amount of criminality at specific localitiesshould be flagged for dedicated attention.

It is evident that theTTPS urgently needs to seek solutions that can facilitate faster and more accurate data searches and automatic screeningof suspected individuals and criminal activities. The solution must also facilitate improved investigations into existing criminal activities and proactively prevent new crimes from happening. Can "big data" provide the solution?

4. CHALLENGES

The situation as it exists, exacerbates the need for policy makers to recognize thatin reality the TTPS' data storage capacity may eventually become exhausted due to the exponential growth of data over time. The amount being amassed is becoming so large that eventually it will be difficult to find some of the most valuable pieces of information that would be intuitive for crime fighting. In this regard, the TTPS' leadership must address key questions such as

- How will the organization's data be dealt with when the volume becomes so large and varied?
- Does the organization store all of its data?
- Is all of the data analyzed?
- Is there currently a way of finding out which data points are most critical to the TTPS?
- How can the data be used in the best way possible to benefit the organization?

TTPS has traditionally used only subsets of its crime data for analytical purposes since the organization has been constrained to simplistic analysesbecausethe sheer volumes of data sometimes overwhelm the available processing platform.

It is important to mention that not all of the intuition to be gained about crime and criminal activity are better answered by bigger data.

However, this existing dilemma provides a couple of choices for the organization in moving forward:

1. **Front-end Analytics –**This involves a process of screening data prior to entry into the RMS. It is a necessary pre-requisite to meaningful progress that the quality and nature of the available data be improved [10]. Applying analytics on the front-end provides data pre-processing which determines the relevance of the input data based on context. This methodology creates a priority system that determines which data will be included in analytical processes and those which can be placed in low-cost storage for future processing if needed.

2. **High Performance Analytics –** This approach involves applying high performance analytics to scrutinize the massive ever-growing data [10] using modern day technologies such as in-memory analytics, grid computing and in-database processing.

In-memory analytics is a technique for querying data when it resides in a computer's random access memory (RAM) as opposed to querying data that is stored on physical disks. The result is accelerated query response timesthat facilitate faster decision makingby business intelligence (BI) [11].

In addition to providing incredibly fast query response times, in-memory analytics can reduce or eliminate the need for data indexing and storing pre-aggregated data in OLAP cubes or aggregate tables. This reduces information technology (IT) costs and allows faster implementation of BI and analytic applications.

Grid computing (or the use of a *computational grid*) is applying the resources of many computers in the network to a single problem simultaneously - usually to a scientific or technical problem that requires a great number of computer processing cycles or access to large amounts of data [12].

In-database processing, alternatively referred to as in-database analytics, is the integration of data analytics into data warehousing functionality because it provides significant performance improvements over traditional methods. Whereas traditional approaches to data analysis require data being moved out of the database into a separate analytics environment for processing, and then back to the database.Doing the analysis in the database, where the data resides, eliminates the costs, time and security issues associated with the old approach. Therefore, "big data" is one of the primary reason why it has become imperative to collect, process and analyze data efficiently and effectively [12].

"Unstructured data does not belong in relational structures. Putting it there is trying to put a square-peg into a round hole and will ultimately be expensive in the form of misappropriated and hard to find files"[13].

There is little evidence of strategic planning for information systems as many programmes and projects are carried out on an ad-hoc basis. As such, strategic planning for information systems remains a novel activity. Information systems development is driven by many things, none of which include supporting organizational objectives. As it relates to the culture of the use of modern data systems and technology the enthusiasm is not pervasive throughout the entire organization.

Although the organization utilizes technology such as geographical information systems (GIS), relational database management systems (RDBMS), local and wide area networks (LAN and WAN) for network connectivity similarto that of its counterparts in the developed world,a gap still exists in the high level of efficiency and effectiveness that developed countries have been able to achieve using these systems as opposed to seemingly low levels that have been achieved locally.

5. COLLABORATIVE EFFORTS

In addition to its localized crime management strategies, the TTPS recently (beginning of 2013)entered a strategic alliance with the criminology department of the University of Cambridge (UK) to supplement its crime control efforts.This alliance focuses on an evidence based policing (EBP) approach [14] using a Triple "T" (targeting, tracking and testing) experiment as its research design/methodology. *Targeting* focusses on places, offenders, victims, gangs and specific offences. *Tracking* involves spatial and temporal dimensions of crime and*testing*involves comparing intervention methods used and similar problems experienced, then asking the questions which one works better, which method is cheaper and which one gets the best results at the cheapest cost.An important feature of this experiment involves crime mapping for hotspot policing [7].It is being conducted within specifically selected police jurisdictions where hotspots have been identified, geo-fenced and attention being focused on those areas as a proactive crime deterrence strategy.

6. SOCIAL, ETHICAL &LEGAL ISSUES

In developed countries such as the United States, United Kingdom and Canadathe right to privacy is held sacred by most citizens. Despite increased acts of terrorism, citizens of these countries remain unwilling to relinquish this integral right in favor of their respective police agencies. The increased use and growing sophistication of data analytics currently used by law enforcement agencies has influenced both the enactment of legislation and the creation of policies in order to appease publics concerns for potential abuse.

In Trinidad and Tobago, similar to the developed world, there are parallel concerns and citizens have expressed very little confidence in the TTPS' ability not to abuse them. Despite the fact that local police officers claim that such abuse is rare, the absence ofclear policy guidelines governing the use of such systems does little to reassure the public.

Adequate security exists to prevent unauthorized access to organizational data. However the Data Protection Act No 13 of 2011 [15] in its current incarnation is inadequate for providing data protection and privacy because it has not yet been proclaimed law. The Freedom of Information Act Chapter 22:02 [16], however, grants members of the public the rights to access documents and other information in the possession of public authorities.

7. CRITICAL CONSIDERATIONS

The author envisages some pertinent questions being posed by individuals challenging the idea being presented in this paper in order to clear ambiguities which may exist in their individual minds. Some of these potential questions may include but not limited to the following:

- Does the TTPS have the need?

- Does big data exist within the organization?

- Does the organization possess the resources to engage in big data projects?

- What may be the estimated costs of these projects?

Seemingly, the more questions asked will allow one to endlessly question the risks versus the rewards. However, rationalizing the risks can also bring to the forefront another potential disadvantage where it can lead decision makers to slip into a wait and see mind-set.

For some individuals, the organization's data may not be considered as "big data". However the reality is that large volumes of disparately held data [17] do not currently form part of the organization's enterprise-wide data. As such, the silo data remain sealed from the rest of the organization. Aggregating this silo data with the enterprise data may not be an easy task, but the potential benefits are enormous and the aggregation may qualify it as big.

8. POTENTIAL BENEFITS
Big data can provide the following benefits to the TTPS[18]:

- It allows for a narrower segmentation of criminals in order to facilitate a much more improved targeting of these individuals by way of customized interventions;

- The sophisticated analytics which is available can substantially improve decision making within the organization, minimize risk and unearth valuable information from the stored crime data which otherwise would not have been possible;

- It will unlock significant value to the organization by making information transparent;

- It will allow the organization to collect more accurate and detailed data which can be used to facilitate controlled experiments that can ultimately result in better decision making;

- Real-time monitoring and forecasting of events that impact the performance and operations of the organization;

- The provision of timely insights from the vast amounts of data which includes those already stored in the RMS, from disparately held data sources, the internet, social media and video capture.

9. CULTURE CHANGE REQUIRED

Any modern police agency should have GIS, LAN, WAN, Databases. Despite possessing these, the TTPS is not subsumed sufficiently by a technology oriented corporate culture. Given this major shortcoming, introducing big data technology into the organization requires an acceleratedchange of the corporate culture.Full acceptance of modern technology is required at all levels within the organization, more so at the executive level where greater buy-in may be required.The organization, as a whole, must effectively be prepared to be much more flexible in order to rapidly evolve its existing business model.

The corporate culture requires an infusion of greater dynamism and innovation supportive of the implementation and use of technology. It is hoped that this paradigm shift will pervade the entire organization thereby enabling it to deliver higher quality and effective services.

In pursuit of this goal, the organization must be prepared to make mistakes in the process of implementing big data as a predictive/proactive crime management toolbut in the process should not "throw the baby out with the bath water".

10. CONCLUSION

TTPS' leadership must be cognizant to the reality that achieving proactive policing involves much more than is now being done and extends way beyond the mere mapping of hotspots [19] and focusing attention on these areas.

Big data can be perceived as the missing piece of the puzzle required for solving difficult cases, identifying new threats and monitoring communication that can be vital in keeping at-risk communities safe.

The systems, tools and techniques to analyze and mine the type of data housed internally are available out there and by adopting a more methodical approach towards "big data"is a risk that may be required to be taken.

As such, a key issue is not the dilemma whether to do or not to do, but really how to start. This initiative could be a step in the right direction for the organization in its quest to effectively deal with the issue of crime. Reducing crime to acceptable levels has the potential to remove the international media's focus on Trinidad and Tobago and restore the confidence of the disillusioned public and the travel advisory proponents.

11. ACKNOWLEDGMENTS

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