

A Study on the Establishment of Policing Governance by Utilizing Big Data based on Cloud

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Abstract

Background/Objectives: This study is to confirm the possibility of crime prevention and response by analyzing crime data that is stored as separate database for each institution. This method has the advantage of faster and more accurate information sharing. **Methods/Statistical Analysis:** To this end, we first look over the link between Cloud and Big Data then present an efficient procedure for utilizing the proposed method by analyzing case studies of each sector in accordance with the establishment of Policing Governance. In the field of crime prevention concerning a crime, related with Policing Governance establishment. **Findings:** First, we collect the data related to the crime and the damage that is possessed by various agencies such as the police, criminal justice agency and others in order to expand the collection channel. Crime related data refers to the information of criminal identification, crime locations, time, and date that is possessed by public agencies, private organizations, and non-profit organizations respectively. Second, collected data is stored and categorized within each crime category in a Cloud zone for proper analyzation. Finally, analyzed data is sent to each agency for real time visual observation in need. Based on the integrated information analysis, patrols and security can be reinforced on the anticipated crime scene and time. As a result, crime prevention possibility can be enhanced through flexible operation of the police force. **Application/Improvements:** This is to diversify the collection channel and it also acts as a complementary measure for the disadvantages of existing system since it stores the data in a Cloud zone that allows easier access and usability. In terms of information utilization aspect, it is expected to be useful for solving and reducing crime as all the related agencies.

Keywords: Big Data, Cloud, Crime Prevention, Data Mining Analysis, Policing Governance

1. Introduction

Of late, the cybercrimes and terrorisms have been on increase, globally. In Korea, especially in 2014, the total crime cases are 3,528 per 100,000 people. The traffic crime cases are 1,137. The white-collar crime cases are 592. The assault crime cases are 575. The theft crime cases are 528. Above all this, the white-collar crime continues to increase from 2010 to 2013¹.

As modern society has arrived to the information-oriented society and become more scientific, criminals are not only local people but also diverse ethnic people and international people like foreign workers, immigrants so appointment of more police officers is not a solution.

Today, the massive information has been creating in mobiles and internet. Moreover, each public department and private organizations can provide safer and faster services to people because of Big Data, which analyzes the massive information about crimes, based on Cloud. Also the massive information of each organization is analyzed through each process like collecting, saving and analyzing and the result comes up. This result can be useful to prevent crimes and catch criminals² and it makes the each organization and the government to cooperate in getting through potential crimes or crime investigation. It would set the stage for solving crimes and reduction of economic cost.

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In this study, many organizations and private companies can organically share with the massive information. Under this circumstance, people can collect and save and analyze the data. When the information is needed, the data can be shared with many organizations and private companies regardless of time and place. The scheme of construction about Governance, which prevent and correspondence on crimes using Big data based on Cloud, will be provided. For this, first of all, check out the relationships with Cloud and Big data and examine the case of application of Big data. After that, the Governance model, using Big data based on Cloud, would be suggested.

This model analyzes the cases of the happened serious crimes, terrorisms and cybercrimes. The government and private companies share and publically distribute the analyzed information. That is why, the practical system will be useful to the law enforcements, which deal with the happened crimes and prevent crimes in the future.

2. Background and Related Work

2.1 Discussion about Cloud and Big Data

Cloud is the model, which makes possible to IT resources like shared server storage, application and services at the time when it's needed in Client device. In the cloud computing, it enables users to store their data remote storage location³. It is divided into Public cloud, private cloud and hybrid cloud depended on how to arrange the services⁴. The services or systems, which have to be important to data security and have a control about computing resources, use private cloud and when it is not, people use public cloud. Comparing public cloud with private cloud, it is same (Table 1.) as⁵.

Table 1. Comparison of public cloud and private cloud

Property	Public Cloud	Private Cloud	Hybrid Cloud
Elasticity	O	Δ	Δ
measurable Service	O	O	O
On-demand service	O	Δ	Δ
Network Access	O	Δ	Δ

Big data is a chunk of data, which is over the mark of usual software when it comes to save and deal with the data at certain times. The purpose of Big data is for ana-

lyzing the information and saving the data and reading flow of the unpredictable information⁶. The techniques of analyzing Big data are Text Mining, Opinion Mining, Social Network Analytics, which finds Herb user in network, and Cluster Analytics, which finds the similar groups⁶.

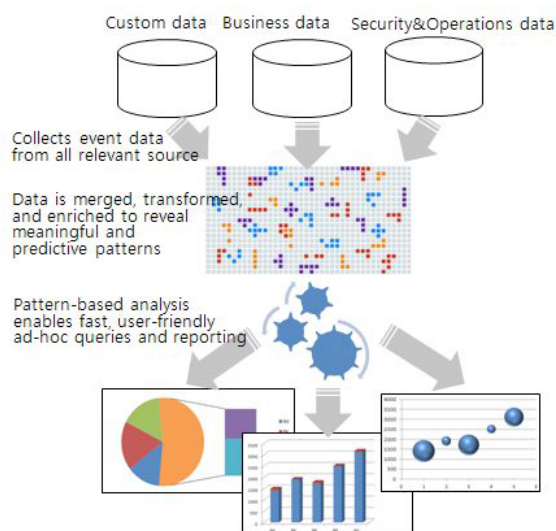


Figure 1. Big-data analytics methodology.

Moreover, when you look at the way to handle Big data, which uses Cloud, it is same (Figure 1.) as². To analyze Big data, it would be needed to the sever, which is able to use in distributed parallel processing in real time so this is Cloud service. The expandability and flexibility of Cloud service are effective to analyze Big data, which creates amorphous information in real time. Therefore, while people are dealing with the information about crimes, which is created by internet, mobiles and so on, the utilization of how to use Big data, which uses Cloud computing, would be easy to handle mass storages. In this study, people find similarities between public data, which is opened to law enforcement like prosecutors, police officers, correction centers, and private data, which is owned by private organizations and companies, by using Big Data, based on Cloud and Big data analyzes crime patterns. After this process is over, the data will be analyzed again and it will stop the crimes in the future. Furthermore, recent many studies show degree of risk, measuring a crime rate through crime pattern's analysis, used in Big data⁷.

Especially, when use of smart phones and tablet PCs has become daily routine, numerous smart-equipment mostly operates in a way of Cloud styled hosting. As a

result, the use of Cloud service becomes grown. The system captures and collects massive data including the information about crime, irrelevant data, which is collected by companies and civil groups. More importantly, the serious crimes will be solved by making the data of hidden crimes, like sex crimes, to Big data.

2.2 Governance Cases of using Big Data

Governance is about creating self-organized network of public parts, civil parts and non-profit parts, which is about self-controlled network or decision of policy between doers, to solve public problems. In other words, it creates a chain of network cooperating public service, civil service and non-profit service to prevent crimes effectively⁸ so this cooperative network is called as Governance. As a result, Governance will be needed for cooperating the government and private companies, using Big data based on Cloud to collect, analyze and share for crime prevention. In the United States, the authority uses Big data to solve crimes and prevent crimes. For example, the FBI's caught the terrorists of Boston marathon only for 2 days because they collect and analyze the 10TB video data. They use Big data to solve the big crime like this. And they also use Big data to catch gangsters and to control the prison inmates⁹. In South Korea, Big data has a much greater effect through geographical profiling system.

However, current crime prevention system, which uses Big data, only have public statistics data so it is hard to have correct data about hidden crimes because the Korean Big data only analyzes official statistics data of law enforcement¹⁰.

Therefore, the system, which can predict and response to the crimes of the government and private companies, has to be constructed. People can collect the data through contacting of various facilities in Cloud save storage and analyze Big data through co-relationship of the crime prevention and the crime correspondence.

3. The Composition of System and Application Method

This chapter will explain structure of Governance system, based on Big Data, which is constructed in each part. Moreover, it mentions how to function each part in the system and the overall system. It will predict the crimes in the future.

3.1 Construction of System

In this study, as looking at the construction of the system, first of all, various crime cases and the information about occurrence of damage will be sent to the public organization like police officers and private companies. Next, the data, which is collected from each department, saves in Cloud zone all at once and the saved data will be analyzed depending on offender classification. Lastly, the analyzed data, which is by each department in real time, will be allowed to observe and send to each organization. Figure 2 suggests the model of Governance system, uses Big data, based on Cloud.

3.2 Modular Function Processes of the Proposed System

The process of Governance, using Big Data, based on Cloud, collects the data and the collected data saves in Cloud. It will extract from the saved data through Big Data and people analyzed the data and send it to each organization.

When you look at process about saving, analyzing and sending the data of the proposed model, it is as in the following.

First of all, the system collects the data of law enforcement like police officers and the data of private companies or non-profit organizations. This data means all data, which belongs to the government and non-profit organization, like profiles of criminals, place and time of crimes.

Secondly, the data, which is related to crime cases and damages from each department, saves in Cloud zone and people can see the required data, saved in one storage, when crimes and accidents happen. Especially, it allows the system to save massive information and the data, becomes to Big data, finds similarities between other information and classify crimes through Text mining.

Third, the crime data, which saves in Cloud zone, will be analyzed and classified into 5 serious crimes, cybercrimes and terrorisms. In the cases of murder, robbery, rape, theft and assault (5 serious crimes), the data, which related to criminals' profiles, characteristics and destinations, will be analyzed through geographical profiling and analysis of behavior patterns. It makes people to predict behavior patterns or area of act of 5 serious criminals. Also, the system classifies cybercrimes or terrorisms and selects main leads. The case data of these cybercrimes and terrorisms finds co-relationships between each data

through hierarchical cluster method. By using data, people prevent terrorisms and stop unnecessary investigation and it increases investigation efficiency.

Fourth, the analyzed data will be shown as graphs or diagrams to see easily. This data will be sent to various organizations, which are related to the cases, through mobiles and internet. Especially, public institutions, which are based on the analyzed data, can reduce the possibilities of crime in the future like enforcing patrols and it can run the elective system about the shortage of police officers. Moreover, based on the data, analyzed by private groups and non-profit organization, it is possible to have the safety system by enforcing civil-patrols and cooperating with police officers in a crime-ridden district. The budget and resources will be used in the district, where needs to rebuild and be safe, to create safe society (Figure 2).

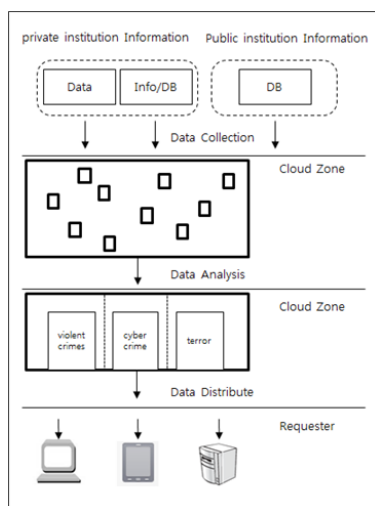


Figure 2. Proposal model of system of policing governance by utilizing big data based on cloud.

Therefore, this study shows that the system makes the massive information save in one cloud zone and it makes us easy to access the data so it will be much easier and faster to solve the crimes.

4. Evaluations of Suggested Model

In this chapter, the existing model and the suggested model will be compared. This study makes a fair estimation between the existing model and the suggested model, including pros and cons.

Table 2. Evaluation of the difference between two models.

Category	Existing system	Proposed system
Data acquisition course	Simple	Diverse
Data saving	NoSQL	Cloud
Data analysis	statistics, geographic profiling, data mining, pattern analysis, hierarchical cluster analysis	
Data utilization	Public organization	Public organization, civil groups, non-profit organization

The existing model and the suggested model, both of them can construct safe society system, which prevent and predict the crimes in future. However, there are differences about constructing the system as follows.

First of all, the existing model only uses public data, which is conducted from law enforcement like police, but the suggested model conducts various data from the government, civil groups, private companies and non-profit organization so it makes people easier to secure hidden-crimes statistics and analyzed more accurate crimes. Second, when the data has to be saved, the existing model uses NoSQL, but the suggested model uses Cloud, which allows people to access and save the data regardless of time and place, if the suggested model is connected with wire-wireless network. Moreover, the suggested model classifies the data to 3 different crimes, which are suitable to each crime analysis, to look through the data. This data analysis uses statistics, geographic profiling, data mining, pattern analysis, hierarchical cluster analysis and so on. At last, the existing model mostly uses the data from law enforcement as a part of utilizing the resources but the suggested model uses the information from not only the government but also private groups so it makes us to respond faster and cooperate each other easily

5. Conclusion

These days, our society has arrived to the information-oriented society and it makes people to access the massive information. In the information-oriented society, anybody can search and use the information. Life becomes a lot easier. However, in fact, it has been used in serious

crimes, cyber-crimes, terrorisms and so on. Especially, when the number of smart phones in use rapidly goes up, various cyber-crimes has been committed. The authority collects the massive data but the data is not organized systematically so the authority often misses hidden meaning of data¹¹. That is why, to solve these kinds of problems, each department has to share the information and cooperate with each other and there has to be a policy about minimizing crime damages.

This study shows that it makes the massive data of cases, which collected in various organizations, analyzing and checking to construct Governance system, using Big Data, based on Cloud. Moreover, this data is analyzed and the analyzed data is used in crime prevention and, when crime happens, is a purpose of cooperating with other organization and minimizing the damages. The construction of the system conducts the data from various organizations and saves in Cloud. It analyzes the information and sends the information to each department immediately. It makes the government and the others to cooperate and solve crimes, when the system connects with wire-wireless network. The system will help minimizing damages and catching the perpetrators. However, the Governance system, which is based on Cloud, can be became an issue of human rights violation by accessing all the information from the different groups so there must be a bond of sympathy, which develops between people and the government must legislate the law about this.

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