Chapter 13
Application of Big Data in Digital Epidemiology

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ABSTRACT

Epidemiology is the study of dynamics of health and disease in human population. It aims to identify the occurrence, pattern, and etiology of human diseases so that the causes of these diseases can be understood, which in turn will help in preventing their spread. In traditional epidemiology, the data is collected by various public health agencies through various means. Many times, the actual figures vary a lot from the one reported. Sometimes this difference is due to human errors, but most of the time, it is due to intentional underreporting. Big data techniques can be used to analyze this huge amount of data so as to extract useful information from it. The electronic health data is so large and complex that it cannot be processed using traditional software and hardware. It is also not possible to manage this data using traditional data management tools. This data is huge in terms of volume as well as diversity and the speed at which it is being generated. The ability to combine and analyze these different sources of data has huge impact on epidemic tracking.

INTRODCUTION

The power of technology in this era is so huge that anyone can track your whereabouts just by using your cellphone location. They can even predict where you can be at some later point of time by using various analytics. This information may be used by a security agency for nabbing the criminals. But not only this! There is a Swedish project by the name of Flowminder which tracks the movement of population during any natural disaster and can use it for the sake of relief and rescue.

This is just one of the examples of a project in the field of digital epidemiology. Epidemiology is a field which deals with the study and analysis of various patterns, their reasons and how they affect the health and disease in any geographical area or a defined population. Traditionally the data has been

collected from various sources by different agencies and it is analyzed using tools to get some insight into the reasons for the spread of diseases. The new field of digital epidemiology relies on collecting the data using digital techniques such as getting data from various social networking sites and then using computational methods to measure health and the spread of disease. Governments of various countries are supporting projects which use big data for digital epidemiology. Air quality data is being captured by environmental scientists from the polluted areas and then it is compared with the health status of the people living in those areas. This can give an insight into the correlation between the environmental hazards and the diseases present there. Information on sexual and social networks are gathered by Epidemiologists which helps them predict the signs of spread of diseases so that early warning signs can be issued.

Big data analytics helps in predictive modeling in healthcare sector which provide faster, better and more targeted results in digital epidemiology which helps to develop better vaccines faster. It also helps in analysis of disease patters which helps track disease outbreaks which results in faster disaster management.

The study of distribution and changes of health and disease in human population is Epidemiology. It identifies the incidence, distribution and etiology of human diseases in order to understand their causes in a better manner which in turn will help in preventing them from spreading (Green, Freedman & Gordis, 2000). Traditionally, the data was collected by various public health agencies which used to go to the hospitals, doctors and the effected people to get first-hand information. Latest work in this area is to get the data from online sources. People search for different types of information on the internet. The pattern of search in any particular area can give us some insight on their health issues. This has become possible due to increase in use of electronic devices and modern communication techniques (Eysenbach, 2009). Due to the huge size of this data various big data analytics tools are used to process it and get useful information.

The electronic health data set is so large that it cannot be managed by traditional software and hardware. The traditional data base management system also fails to manage such huge amount of data (Zenger, 2012). It is not only huge in volume but is also very diverse and extremely fast changing. These are the main reasons why we need big data techniques to handle them.

BIG DATA IN HEALTH CARE

Epidemic tracking has gone through a huge change as it can combine and analyze various sources of data. Big data initiative in the health care sector is being supported by governments of many countries. Some of the instances are: The government of Denmark is providing anonymously health as well as hospitalization data for carrying out research in the field of Big Data (Szlezak et al., 2014). They have a program which helps in better care of patients with diabetes and heart diseases by employing data analytics on the medical data available (IBM, 2013).

Swedish government is also trying to help research in Big Data analytics. Huge amount of data from lab results, healthcare centers and from ambulances carrying critically ill people or accident cases can be merged for the analytics purposes. A lot of research is going on for developing tools and techniques which can support decision making. One important area of research is the analysis of structured and unstructured data to study the effect of various drugs (Network, T.S.B.D.A., 2013).

A project on review of Big Data privacy was undertaken by the US government in January 2014. The recommendations of this work can be found in Podesta et al. (2014) and PCAST (2014). There is a World Health Organization project by the name of "Be He@lthy Be mobile" which uses the mobile

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