

Application of Big Data Technology in the Fight Against New Coronary Pneumonia Epidemic in China

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Abstract. In the fight against New Coronary Pneumonia Epidemic, Chinese Ministry of Health put forward the inevitable requirements of precise policy implementation and scientific epidemic prevention. Accordingly, the big data technology has been applied in the analysis of epidemic dynamic, information inquiry, disease prevention and treatment, and prediction of epidemic trend. And, great success has been achieved in the fight, where the big data technology has played a vital role. This article outlines the main applications of big data technology in the prevention and control of New Coronary Pneumonia Epidemic, and proposes suggestions based on the problems in the application of big data during the epidemic prevention and control period. In the later stage, the integration of big data technology in various fields should be accelerated, information should be further shared and the utility value of data should be maximized.

Keywords. Big data, New Coronary Pneumonia, big data technology, information query

1. Introduction

On December 2019, the outbreak of New Coronary Pneumonia spread quickly from Wuhan to the whole China. Chinese people, united as one, applied various kinds of emerging technologies to the prevention, treatment, detection and analysis of the epidemic, resource allocation, and so on. President Xi stressed on Feb. 10th, 2020 in Beijing that scientific epidemic prevention is one of the most important requirements in enhancing overall epidemic prevention, and the application of hi-tech methods is imperative in conquering the epidemic timely and comprehensively. During the prevention and control of this epidemic, big data technology, with the advantages of large volume, high efficiency, strong compatibility and various sources, has contributed greatly in analysis of epidemic trend, tracing the beginning of outbreak and information enquiry.

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2. Application of Big Data Technology during Epidemic

2.1. Tracing the Transmission Path with Big Data Technology

The wide application of big data technology can help with tracing the source of epidemic. To a large extent, the epidemic was controlled from the source and the infection source of virus was precisely traced [1]. The New Coronary Pneumonia Epidemic was outbreak around Chinese New Year, when population mobility and density reached a peak. Consequently, it become the top priority to monitor the movement of diagnosed and suspected patients. In modern society, mobile phones can act as the IDs of people. As mobile phone users are real name registered in China, and the purchase history of mobile phones is recorded, the users' information can be identified. What's more, with the help of digital map and Global Navigation Satellite Systems (GNSS), the position of mobile phone user can be precisely located. Thus, relevant departments in China carried out an overall big data analysis system to inspect closely in all cities and villages, making sure no person or family was missed. With regard to the diagnosed and suspected patients, their track and range of movements were precisely monitored using big data technology. So, the specific people and areas in epidemic prevention and control were determined and alerted, making the diagnose, isolation and treatment as soon as possible. While tracing the infection source, by analyzing recent movements of the patient, the hidden infection sources were traced. Internet companies and data platforms collect and integrate the data from National Health Commission of People's Republic of China, Ministry of Communications and Ministry of Industry and Information Technology, and set up official platform and APP for enquiry, making it easier to find out close contacts [2]. Travelers can use such platform and APPs to check if they were in the same vehicle with the diagnosed patients. The health code is a representative example of using big data technology. It can show the user's moving track in a month, guaranteeing the epidemic prevention verifiable and controllable and making traveling more convenient during the epidemic outbreak.

2.2. Intellectualization in Diagnose and Treatment of New Coronary Pneumonia

With rapid increase of patients during the epidemic outbreak, radiologists can hardly deal with such large number of CT images with eyes. The traditional methods exposed the weakness of manpower, time and source consuming [3]. The computer assisted detection and diagnose system, which adopted big data technology, can analysis the focus of infection precisely and swiftly. It can clearly present the infection of lung and determine whether the lung shows frosted glass character or not within a few minutes, largely reducing the burden of radiologists [4]. The project team of Artificial Intelligence Committee of Chinese Anti-Cancer Association and National Supercomputing Center in Tianjin have worked for 20 days, collecting adequate images of patients and setting data labels according to the characters of infections. They finally developed the "AI Assisted CT Image Analysis System", which can enhance the efficiency of screening and diagnose. As regard to the drug development, with the help of AI big data platform of drug development, numbers of test agencies have analyzed micromolecule information in new coronavirus and tested among thousands of clinical experimental drugs. Finally, they have achieved the vital

experimental information and accelerated the progress of new drug development to the full extent.

2.3. Analysis of Epidemic Trend with Big Data Technology

The core value of big data technology is to predict the epidemic trend [5]. By predicting the trend of viral transmission, a series of public concerned questions could be solved, such as when the epidemic will have a favorable turn, how long it will last for and where the risk of infection is higher. By observing and analyzing all data of diagnosed patients, experts concluded that the common new coronavirus incubation period is within 14 days and the transmission is influenced by multi-dimensional factors, such as climate, humidity, geology, transportation, social activities, sanitary condition, and so on. On this basis, the panel of medical experts took the advantage of big data technology, machine learning and time series analysis method, and referred to the model of 2003 SARS epidemic development. They further studied the transmission route, transmission speed, dangerous period, fatality rate, and incidence trend of new coronavirus. Then, they optimized the model of New Coronary Pneumonia Epidemic development, providing crucial reference for the public to enhance protection against epidemic and promote the health information [6]. According to the public report, Institute of Computing Technology, Chinese Academy of Science and AI team of Tsinghua University have developed a big data analysis and prediction system, which can collect open epidemic information on internet, and intellectually study and analyze by using the model. It has predicted the transmission trend and fastigium of New Coronary Pneumonia Epidemic in China. Based on the big data simulation model, Huayi Software of Dongfang Electronics Corporation has successfully predicted the peak number of diagnosis and the time of fastigium by excavating the hidden pattern of epidemic from the abundant data. Comparing the prediction data and real data, the prediction perfectly matches the real situation. To sum up, by analyzing the development of epidemic with big data technology, the scientific epidemic prevention can be achieved [7].

2.4. Information Disclosure in Big Data Environment

Big data technology has offered great convenience for the public to obtain and disclosure required information during epidemic. The epidemic map is the most direct method of big data disclosure, and is the data visualization applied in all different platforms. Dingxiangyuan is the largest forum for Chinese doctors. Its most influential product, the epidemic map, has been visited for over 400 million times during the New Coronary Pneumonia Epidemic, showing its great advantage of being professional, efficient and precise. Dingxiangyuan has also cooperated with national platforms, such as People's Daily, and Health China, to develop functions like customized daily report, online diagnose, and rumor refutation. Thus, epidemic information such as the number of confirmed cases, suspected cases, and death in corresponding areas home and abroad, can be presented to the public in a direct, comprehensive and authoritative way. The real-time epidemic data systems launched by Dingxiangyuan and Alipay have devoted to practical anti-epidemic, helping the public to relieve from fear of epidemic and maintaining the social stability. In addition to the epidemic map, the distribution map of fever clinics in China been highlighted in several social media platforms. The

positions of designated hospitals and fever clinics of each region have been released by internet map platforms. Users can switch to different map APPs for hospital information freely. It helps public to get medical care in time and get real-time geographic information of epidemic. Considering the increasing discussion on epidemic, Tsinghua University and RealAI company worked together to develop the “AI Topic Analysis Platform for New Coronary Pneumonia Epidemic”. By data analysis and AI modeling, the platform can randomly capture, collect and identify the hot topics and the guiding trend of news, solve the trouble of misleading information, and present the real-time official information to the public. With these advantages, the platform had strategic importance in the fight against epidemic.

2.5. Scientific Decision-Making Supported by Big Data Analysis

In the era of data, true data is the basis of scientific decision-making [8]. By deploying big data platform, government integrated the epidemic related information of public, communities, enterprises and individuals. The epidemic situation, population mobility, and resource allocation in each administrative level and each region, was controlled comprehensively and timely. With the help of prediction model, the risk was predicted, thus assisting government to make corresponding command, guaranteeing adequate resources, and helping with the recovery of enterprises and schools.

The New Coronary Pneumonia Epidemic outburst around Chinese New Year Festival, when productivity was quite limited that medical and living supplies could not satisfy the anti-epidemic requirements. As the situation getting severe, the designated hospitals released the list of demands via social platforms and media. However, a series of problems exposed that the demands were released in scattered platforms; repeated donation happened; contributors had problem searching the information of hospitals in need of help; hospitals might receive uneven resources due to different level of popularity. To solve this problem, some enterprises and volunteers set up the resource allocation platform based on the data of open demands. Resource information such as geographic position, hospitals in need of it, name, category, number and contact were presented on the platform. In this method, the efficiency of resource allocation was increased, and the supply of short resources was guaranteed. Meanwhile, by organizing and analyzing the accumulated data of the platform, future resource planning and allocation could be optimized. As for the recovery of enterprises and schools, related government departments actively propelled the application of online working, information sharing, and video conference and distance education system. Along with the establishment of health care big data sharing mechanism, the blueprint of overall recovery of enterprises and schools was carried out. At the same time, the traffic flow information, the internet data of online office and the electricity consumption in each region were monitored for comprehensive analysis on the recovery of different industries, providing a reference for related departments to make policy efficiently and scientifically. On the other hand, local big data center took advantage of big data to develop enterprise recovery management system, in which workers' information can be registered and verified online and their traffic information was recorded timely. Thus, the prevention and control of epidemic after recovery could be conducted well organized and the data could be traced and controlled [9].

2.6. The Adoption of Cloud Computing and Internet of Things

Cloud computing, internet of things and AI technology are getting mature, and fusion applications of the advanced technologies have played key role in the fight against New Coronary Pneumonia Epidemic [10]. Based on internet of things technology, R&D institutions developed AI robot for temperature test, auto drug delivery, assisted treatment and sanitary in public area. Especially in the isolation area, robot can deliver food, daily supplies instead of human being, avoiding the infection to the largest extent. On road intersection and gateway of building, robot can check automatically take temperature and identify the mask, thus raising alarm in abnormal situation. Except for that, infrared thermal imaging devices can quickly test temperature in crowded, saving great manpower. What's more, internet of things technology brought intelligent delivery lockers, unmanned supermarkets to daily life, avoiding the hidden trouble of internal infection. With wide application of the mature 5G + cloud computing technology, tele-medicine system is gradually completed and the cure rate of new coronary pneumonia patients is getting higher. As the problem of long-distance is solved, and the critical patients are given special attention, health of the public is better guarded.

3. Comparison of Epidemic Control before and after the Application of Big Data Technology

The application of big data technology plays an important role in epidemic prevention and control. In the early stage of the epidemic, the problems of different types of data in different regions are not shared, the circulation speed is slow, and the integration is not complete, which bring great resistance to the comprehensive data analysis of epidemic change forms and effective prevention and control. Through the application of big data technology, combined with other modern scientific and technological means, the effective analysis and scientific decision-making of epidemic prevention and control data were realized, which laid a solid foundation for winning the epidemic prevention and control war.

4. Major Problems in Big Data Technology Application

During the fight against new coronary pneumonia epidemic, some problems and shortcomings of big data application were exposed. For example, data was not effectively used in crossing fields, and data sets did not follow the unified standard, leading to inefficient use of data sets. Besides, the existing data manage and apply system did not match the top level of national requirement. Hardware facilities were not so developed and were imbalanced in different regions. In some regions, facilities and professionals were insufficient for the development of big data technology. As for data protection, related laws and regulations were not integrated, only some terms and rules were launched in specific area. It is challenging to protect personal data of citizens, traffic data and economic data [11]. To collect adequate data is the basic of big data application, however, the repeated collection and invalid collection of privacy data

in different regions may lead to the increasing of working load, disorder in later data processing and problem in information communication. It is also a major challenge to collect enough data, apply mass data, balance the data protection and communication, and unify data format.

5. Conclusion

The core of big data technology application is the searching and sharing of mass data. When it comes to the prevention and control of epidemic, the requirement on data precision is more strict. Each suspected case should be followed and reported precisely and the prediction of epidemic should be made based on mass data. The work around epidemic is not over yet, and the exploration in big data technology application continues. It is highly suggested that big data technology be used in medical information platform to enhance data sharing and management. To better support future epidemic prevention and control, it is suggested that different types of data from different fields should be organized, summarized and categorized, data privacy protection should be enhanced, and data management system and related laws and regulations should be completed.

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