Big Data Cognition for City Emergency Rescue

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Abstract. There are many kinds of data produced in the city daily life, which operates as an elementary component of the citizen life support system. The city unexpected incidents occurs in a seemingly unpredictable patterns. With the Big Data analysis the emergency rescue can be carried out efficiently. In this paper, the Big Data cognition for city emergency rescue is studied from four perspectives. From the data volume perspective, the spatial data analysis technology is divided into two parts, the indoor data and the outdoor data. From the data velocity perspective, the big data is collected from the eyes in the sky and objects on-the-ground networks, together with demographic data. From the data variety analysis perspective, the population distribution data, the socio-economic data and model estimates are included. From the data value mining perspective, the crime model estimates are studied. In the end, the application in the big public venues emergency rescue is introduced, which is located in Urumqi, Xinjiang, China.

Massive amounts of data are produced in the process of urban development, such as urban services data, environmental protection data, and public safety data and so on. With the constant development of information technology, the collection, analysis, integration of these vast amounts of information become a reality. City unexpected incidents often have great destructive power, which is difficult to predict and cope with. However, through the integration of diverse source information and collaboration between different departments in the city, we can make use of resources and response the emergency incidents timelier. Big data has changed people's cognitive pattern. It not only refers to large data quantification, diverse data and large data analysis and utilization, but also contains a thinking of big data which means considering the whole as target sample, focusing on the concept of relevance, and a cognitive pattern that try to process, analysis mass data, and thereby participate in the decision.
The comprehensive ability of high resolution remote sensing or aerial imagery, multi-level large-scale topographic maps, 3D spatial information and other sources of information need to be developed. The timeliness and authenticity of urban environment simulation are also hard to meet the need of intelligence decision. In this paper, the Big Data cognition for city emergency rescue is studied from four perspectives: data volume, data velocity, data variety analysis, and data value mining.\cite{3} Finally, this paper introduces a big public venues emergency rescue application cases in Urumqi, Xinjiang China.

1. The characteristics of big data

1.1 The Large Data Volume

The most important feature of big data is the massive data volume. The International Documentation Center (IDC) has issued a report named with the "digital universe" in 2020 which predicts that by 2020 the global digital universe will swell to 40000 exabytes, between each person is 5200 GB or more. Take the location data which includes the indoor and outdoor location as an example, the amount of data is far beyond the traditional survey methods that can be acquired. The accumulation of record involves progress and time. The amount of data is so big that we can’t fully analysis and utilization them.\cite{4}

1.2. The Velocity of Data

The application of big data usually request collect, analysis, react to the data rapidly and accurately. For example, the emergency rescue need the data which is collected from the eyes in the sky and objects on-the-ground networks, together with demographic data. An efficient multi-source heterogeneous data engines that can operate the massive amount of data is needed.

1.3 Data variety analysis

A challenge in the use of big data is that the data is more and more unstructured and complicated. The data needed in the emergency rescue contain real scene pictures / Street View, 3D models, the population distribution data, the socio-economic data and so on.\cite{5} Spatial position sensor, different application, gathering content vary widely, which leads that the data from the format to the data storage pattern are significantly different.

1.4 Data mining

Big Data is not just for information extraction but it’s bound to combine with data mining, especially mining implicit, non-obvious patterns, rules and knowledge. According to the different application, the big data cognition require that analysis the relevant data in detail. In this study, a lot of crime data is used to build a emergency model which could determine position with a high incidence of crime or emergency. With the emergency model, we could forecast key areas that emergencies might occur, guide people emergency exercises, and develop emergency plans.\cite{6}
2. Stage of big data application

Emergency management can be divided into three stages: monitoring and preparing phase, facing-it phase and recovery and rehabilitation phase according to the sequence of the emergency.

In the phase of monitoring and preparing, configure the software and hardware equipment and collect relevant information and data as detailed as possible. The big data take the whole as the sample. At the same time, pay attention to the personnel training.[7]

In the phase of facing-it, big data means that we could integration the advanced technical support and the wisdom of lots of people conveniently. The big data bring great for collaboration and also make the efficiency of the emergency disposal high.[8]

In the phase of recovery and rehabilitation, big data can gather many scattered forces on the Internet altogether and conclude the optimal solution. For example, with the application of big data, we can analyze where area is the most serious or design optimal rescue route in order to prevent the waste of resource.

3. Application

Due to the situation of indoor evacuation system is complicated and hard to assess authentic, there is no effective method to test whether the operational emergency plan pre-established policies or security is valid and feasible, and policymakers cannot get a way to gain experience in dealing with large-scale events or disasters. So it’s hard for them to make the right decisions in times of emergency.
This paper introduce an application of big data in which a large-scale events venue 3D simulation scenarios is created to simulate emergency including fire and blasts and the emergency response process after the event simulation in China - Asia-Europe Expo Urban Activity. The large venues in the city always gather large numbers of people and traffic in short term. Rapid evacuation should be implemented when emergency occurs. We build the virtual environment of interactive 3D model, integrated with video monitoring data, personnel deployment data, radio wave data, basic geographic data, social-economic data and so on. So, we can utilize the system to simulate a variety of emergency situations.

4、Conclusion and Future work

Big data technology can help to improve the auxiliary decision-making ability when facing the emergency. The government, enterprises and individuals should continue to support the research of big data technology. Encourage the application of emergency management of large data help to improve the cities’ service level. Stress the cultivation of talent team

However, the application of big data in emergency rescue still have a lot of room to improve. (1) The management of huge amounts of data efficiently still need improving. (2) The research of high performance priority algorithm to find out useful information from huge amounts data still need to be continued. (3) The use of virtual reality technology to realize the dynamic simulation of emergency monitoring ability needs to be improved in the future.

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