

After COVID-19 Using AI to Improve the Disaster Resilience

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A B S T R A C T

At the end of 2019, the COVID-19 epidemic swept across all the world. The advancement of information technology has enabled the world to have more means to fight the epidemic. Artificial intelligence is doing its best to support the global anti-epidemic work. AI helps risk early warning, monitoring, and analysis in the early stage of the epidemic. Subsequently, during the emergency response to the crisis, AI performed outstandingly in assisting the diagnosis and treatment of new coronary pneumonia and assisting social governance. Nowadays, more and more countries choose "With Corona", which also plays a great role in recovery management. However, in this epidemic prevention and control, AI mainly focuses on the collection and processing of public and medical information, as well as natural language processing and other applications. Due to the suddenness of the epidemic, the technology itself is still incomplete and there is still great improvement space. Therefore, this paper summarizes the application of AI in COVID-19 crisis management by reviewing literature analysis, and on this basis, puts forward the following suggestions for the problems existing in the existing technology. The artificial intelligence data platform should be continuously developed and improved to improve security; and an intelligent disaster risk monitoring, early warning and prevention platform based on artificial intelligence technology should be constructed; and artificial intelligence technology should be flexibly used to transmit information and other suggestions to ensure the safety and effectiveness of information, respect The real feelings of the public, and suggestions for increasing people's trust. To face sudden outbreaks in the future, artificial intelligence technology can be used to quickly improve crisis resilience.

Key words: disaster resilience; AI; COVID-19; crisis management

1. Introduction

Along with the development and progress of human society, natural disasters, accidents, and public health events frequently occur, which seriously threaten the safety of the people's lives and property and the orderly development of the social economy (PELLING M, 2003; HENDERSON L J, 2004; MCCARTHY M P et al., 2020). It is important to carry out urban disaster risk management work scientifically and effectively, and to improve the resistance, responsiveness, adaptation, and resilience of urban system to uncertainty factors (Lu & Zhai, 2021: 22).

The proliferation of artificial intelligence (AI) provides a new approach to disaster risk management and strong technical support. With the rapid development and advancement of artificial intelligence technologies such as image recognition, natural language processing, machine learning, expert system and robot, artificial intelligence has become a kind

of disaster risk management technology (National Research Council, 2006).

Science development and technological innovation are indispensable for mankind to overcome the great calamity and epidemic (Xi, 2020). As a representative technology of next-generation information technology (IT), AI has strengths in computer vision, voice recognition, natural language processing, content generation, and data analysis, and can provide technical protection for emergency public health event management (Zhu et al., 2020). Artificial intelligence is used in various parts of the crisis management cycle in the global COVID-19 control. The world is working hard to find the application of artificial intelligence in all aspects of epidemic resistance, to explore innovation and to make epidemic control organization and execution more efficient.

The COVID-19 outbreak is a typical global outbreak of public health safety, which is widespread, spread fast and difficult to control. Under the

WHO's call, the world has taken active measures to prevent and control epidemics, especially in the face of the need for prevention of epidemics. Artificial Intelligence "goes to work" warfare "epidemic". It has made great contributions in monitoring and analyzing outbreaks, ensuring medical treatment, providing administrative services, and helping to resume work and return to production. Not only did it effectively contain the spread of the disease, but it also made an important contribution to the world's public health cause (Sun, 2020: 26). Sun et al. (2020) find that the majority of AI applications focus on the disaster response phase. Nowadays, more and more countries are opting to open their doors to co-existence with COVID-19. Restoration of governance after the outbreak will also require a change, taking advantage of the advantages of artificial intelligence to improve recovery efficiency, ensure national security, and enhance national happiness. Promote a fundamental shift in social governance and enhance resilience after disasters.

This study focuses on the application of artificial intelligence technology in crisis management in the era of with COVID-19. This paper first explains the concept of artificial intelligence and related technologies and combs the current situation of interaction research between artificial intelligence and crisis management. Based on these, several cases of AI's application in the management period of COVID-19 are analyzed. Finally, based on international research and practical experience, the paper puts forward the prospect of applying artificial intelligence technology to crisis management, which can provide some reference for future improvement of disaster resilience to unexpected crisis.

2. AI and Crisis Management

Artificial intelligence (AI), an integrated high-tech discipline born in the 1950s, combines machine intelligence with the concepts and technologies of intelligent machines. The application process covers information science, psychology, thought science, biological science, cognitive science, and system science. With the development and progress of recent years, artificial intelligence has made great achievements in many areas of society (Wang, 2015: 264).

As an enabling technology to improve the effectiveness of incident management, the study of the effectiveness of artificial intelligence in four categories of contingencies: natural disaster, accident disaster, public health event, and social security event (Zhu et al., 2020:35).

AI technology is widely used in medical, industrial, commercial, telecommunications, and urban management. With the sudden outbreak of COVID-19 in China at the end of 2019, artificial intelligence

technology has played an important role in improving efficiency (Dong et al., 2022: 137).

With the rapid development of urbanization, the density of spatial factors increases, and the complexity of the risk faced by cities increases. Strengthening disaster risk management and improving disaster prevention and disaster relief capabilities can effectively reduce disaster losses and promote urban safety and sustainable development. The development of artificial intelligence has brought new opportunities and technical support to the field of disaster risk management (Lu et al., 2021:22).

With the rapid development and advancement of artificial intelligence technologies such as image recognition, natural language processing, machine learning, expert system and robot, artificial intelligence has become a kind of disaster risk management technology. And, in the context of big data, cloud computing, and the Internet of Things, AI-based data mining and risk assessment technologies respond quickly and efficiently, highlighting the advantages of AI's ability to handle uncertainty and complexity (ALEXANDER DE, 2014: 717).

The number of research on disaster risk based on artificial intelligence technology has been on the rise, and the number of research has increased rapidly since 2016. Mainly concentrated in water resources, geological sciences, environmental sciences, engineering, and computer sciences. In recent years, research has focused on the application of technologies such as machine learning, image recognition, and data set (Lu et al., 2021:24).

With the development of information and communication technologies, mobile Internet, the Internet of Things, 5G and AI have been widely used. It has become the main means of communication and communication among organizations and has changed the mode and state of communication among departments with the advantages of speed, interaction, timely and dynamic. Government Informationization has also developed online, big data, mobility, and intelligence, and technology-enabled organizations and people have become new trends in urban governance and urban emergency management (Li, 2021:123).

By combing the application of AI technology, the focus of AI technology is different at different stages of disaster, and the field of disaster risk management. First, disaster prevention and warning. Based on machine learning and image recognition techniques, disaster data can be collected and cleared based on data mining, computer vision and computer graphics, and used for disaster monitoring and warning and risk assessment (ABHIGNA P, 2017; JIA X et al, 2017; WU C L et al, 2006). Real-time data can be obtained for disaster monitoring early warning and risk assessment based on data mining, computer vision and computer graphics

techniques (CHOWDHURY F H et al., 2017; KIA M B et al., 2012; NAGATANI K et al, 2013). Next, disaster preparedness and response. Based on the analysis of disaster information in natural language processing, it is possible to process and analyze the big data of time and space quickly (IVIĆ M, 2019). Real-time disaster damage monitoring based on neural networks and random forest models can help prioritize disaster relief (VETRIVEL A, 2018; DOSHI J et al., 2020). Finally, disaster recovery. These include deep learning-based loss assessment, robot-based disaster relief, visualization, and computer vision-based disaster recovery simulations, etc (SYIFA M et al., 2019; PETROPOULOS G P et al., 2010).

3. Application of AI in Crisis Management about COVID-19

In late 2019, China, the Ministry of Science and ICT issued a "Pneumonia Initiative to Take full advantage of the power of artificial intelligence to fight the novel coronavirus infection disease" and called for accelerating the use of AI products. Related enterprises and institutions have responded quickly to the development of numerous intelligent products that have played an important role in improving the efficiency of management and control, reducing the risk of human infection, and improving the efficiency of medical treatment (Zhu et al., 2020).

With the development of machine learning technology and the accumulation of more and more available data, artificial intelligence can now assist epidemiological predictions more accurately and quickly. It includes the speed of transmission, the movement of susceptible people, the way of transmission, and the impact (Wang & Ao, 2020: 44). AI has fully played the role of improving efficiency and ensuring security in the process of managing the COVID-19 crisis and has made great contributions to the prevention and control of the epidemic.

(1) Early Warning and Monitoring Analysis of COVID-19 Crisis

AI can monitor the epidemic and allocate medical resources in a reasonable manner, guide the people to prevent diseases, reduce the cost of national disease forecasting and control. It will be an important early warning tool for crisis control. With the development of AI technology and the accumulation of more and more available quantities of data, artificial intelligence has been able to aid epidemiological predictions accurately and quickly, including spread rate, susceptible population movement, spread mode and impact (Chen, 2020: 53).

Because crisis events are highly uncertain, AI can use big data analysis models and practical techniques to detect possible signs of crisis and

conduct risk assessment. For example, the Health-Map system, developed by Boston Children's Hospital during the COVID-19 outbreak, predicted the global COVID-19 pandemic earlier.

But, while artificial intelligence cannot substitute for human decision-making in pandemic risk early warning, it can be used for further analysis by experts based on the results of risk studies. Blue Dot, a Canadian artificial intelligence company, was caught early in the COVID-19 outbreak and issued an early warning of possible infectious diseases (December 31, 2019) through analysis reports using natural language processing technology. It is about a week ahead of official announcements by the World Health Organization and the Centers for Disease Control and Prevention. Based on analysis of global airline ticket data, Blue Dot also predicts that the virus will spread to Bangkok, Seoul, Taipei, and Tokyo within days of its first appearance.

Intelligent technology is used to continuously dig up relevant data and carry out targeted emergency warning and epidemic prevention intervention to lock down the outbreak time, spread area and disease type early. In the early stages of crisis management, it played an important role in curbing the spread of the disease.

(2) Response to COVID-19 Crisis

1) Supplementary diagnosis and treatment of COVID-19

AI can be used to aid medical judgment and improve the efficiency of virus diagnosis. COVID-19 is highly contagious and widespread, and many suspected cases require rapid diagnosis and digestion, and Image-assisted analysis is the earliest and most widely applied artificial intelligence technology in medical field, "AI+CT" can effectively assist doctors in making decisions. Through training on 51 confirmed patients and more than 45,000 anonymous CT scans, the diagnosis accuracy of deep learning models can be 95% and the diagnosis time can be reduced by 65% (Chen et al., 2020).

The online consultation platform supported by artificial intelligence has realized the mobilization of doctors' resources across regions and hospitals, greatly alleviating the shortage of medical resources and the risk of cross-infection of offline services, also help people living in remote areas, far from health-care resources, access health care. It plays a role in reducing the burden on hospitals, integrating medical resources, helping the vulnerable, and reducing the concentration of people (Zhou, 2020: 39). During the COVID-19, the machine translation platform developed by China's Alibaba Cloud Technology to help the Anti-epidemic Center optimizes the engine in the medical field for this

epidemic, helping medical staff around the world to communicate in multiple languages for free, and providing machine translation capabilities for the international doctor exchange center. The global sharing of scientific research results and advanced experience has played an important role.

2) To assist in social governance

AI supported such as big data analysis and face recognition can be used to detect and control infectious agents more quickly. Intelligent robots can be used for contactless delivery, cleaning, and disinfection, monitoring the implementation of quarantine policies, reducing human-to-human contact, and blocking virus transmission routes (Zhou et al., 2020:39). In addition, China and South Korea have introduced a "health code" system that uses big data analysis to identify and protect healthy people while facilitating their lives during the pandemic.

During the COVID-19, AI can help to notify outbreaks more quickly, comprehensively, and intuitively, making it easier for the public and the international community to keep track of their developments in time. The World Health Organization (WHO) also publishes a chatbot in WhatsApp that provides users with up-to-date information or channels on outbreaks, protective measures, travel advice, news coverage, rumors, donations, and more, as needed.

As the information spread, rumors became another "virus". If it is not clarified in time and effectively, it will cause serious harm to citizens' mood and social governance, and artificial intelligence can play an important role in identifying rumors and clarifying the internet ecology (Long et al., 2020: 19). Facebook and Instagram have made it mandatory to filter out false information and ban advertisements for products that create tension over COVID-19, suggesting limited supply and 100% effectiveness.

Analyzing big data by artificial intelligence technology, grasping public opinion, and disseminating scientific and reliable information as soon. Based on the latest situation of the epidemic, the government should evaluate the public sentiment, assist the government in formulating policies, and stabilize social anxiety after a sudden disaster.

(3) COVID-19 Recovery Management

Before the COVID-19 outbreak, Selwyn et al (2020) argued that technology was changing traditional classroom teaching, showing trends from "platforms in class" to "classrooms on platforms". During the epidemic, many countries adopted social isolation measures to prevent the spread of the virus. Against this background, "work at home" and "online classes" have become the main forms of work learning during the epidemic. AI is embedded

in online education, telecommuting, and teleconferencing in all fields. Software platforms developed and provided by technology companies are becoming central and mainstream in everyday educational activities (Jeremy et al., 2022: 6).

Whether it is monitoring economic recovery, supporting data-driven recovery decisions, or developing tools to return to work and study, artificial intelligence can provide a guarantee for the full recovery of economic and social life. In the face of difficulties in recruiting workers, the epidemic has forced manufacturers to carry out artificial intelligence transformation in some applicable areas, breaking down the long-standing problems of labor shortages and old-fashioned thinking (Zhou et al., 2020: 40).

Ensuring a positive and positive attitude of the public is also an important aspect of the recovery stage. By analyzing and searching big data, we can grasp the public sentiment, understand the most concern of the people, and release the most scientific and reliable information. Transparency and effective communication of information are essential to prevention, and big data searches strongly support information exchanges during the pandemic. The media can apply natural language processing techniques to real-time comparisons of suspected rumors and explanations, as well as to assess social conditions based on current symptoms, mortality, and treatment (Wang et al., 2020: 21).

4. Using AI to Improve Disaster Resilience

AI as a tool is not a complete substitute for humans. The purpose of human-machine cooperation is to work together in different ways, to take advantage of each other's strengths, to accomplish the task better. The COVID-19 pandemic has caused serious damage to countries around the world and neglecting rapid detection of large-scale viruses in the early stages of the outbreak and not taking preventive measures to block the spread of the virus are important factors (Song et al., 2022).

This requires that those involved value learning of theoretical knowledge and build experience by actively participating in the practice of dealing with unexpected public-health events. In addition, the government should develop a sense of crisis, maintain sensitivity and alertness to the crisis, detect and solve problems in a timely manner, and effectively reduce the occurrence of crises. How to respond effectively to a crisis that has already occurred and how to deal with it in a timely and effective manner is the focus of the crisis management process. Therefore, based on the application of artificial intelligence and the problems revealed in the crisis

management process after the outbreak, the following suggestions are made to enhance resilience after the disaster.

- 1) Continuous development and improvement of AI data platform to enhance security.

The application of AI in the field of electronic technology has a long history. With the rapid development of the Internet, the security of Internet technology has become a concern (Chen et al., 2012: 54). Establishing strong legal, technical, and regulatory mechanisms has always been the focus of AI development.

In the era of big data, many countries are using modern information technology to prevent and control public health events because of the continuous crisis of infectious diseases and viruses, so that the movement of the population and the spread of the disease can be identified in a timely manner.

Therefore, we should strengthen the protection of personal information, raise the awareness of big data risk management, clarify the responsibility of cyber security and control, create a safe and reliable cyberspace, and establish the ethical code of AI. In addition, we should increase the flow of information and establish effective supervision mechanism so that commercial intelligence platform cannot acquire and use citizen information at will, prevent personal information leakage, and implement cyber information security warning and first aid (Sun, 2020: 28). So, we should accelerate the establishment and development of a unified data platform covering public safety, health, population, and economy and society, and lay the foundation for information in response to emergencies such as major outbreaks.

- 2) Based on AI technology established an intelligent disaster risk monitoring, warning, and prevention platform.

In the early stages of the epidemic, the alertness and precautions were inadequate, and the optimum period of prevention and control was missed. In the early days of Covid-19, individual warning messages were not reflected properly, and problems such as a serious shortage of emergency supplies by category were frequent in various countries. Showing a lack of awareness of the importance of public health emergency planning, leading to confusion in early emergency decision-making and management, and inadequate response, the specialization and scientific capability of emergency management need to be strengthened (Luo, 2020:51). The effects of disaster risk are uncertain, so it is increasingly important to perfect scientific predictions and scenario simulations and use them as reference for planning decisions (Lu et al., 2022:30).

We should make full use of the existing disaster monitoring resources, improve the ability of urban disaster forecasting and early warning and real-time evaluation, collect relevant data on urban disaster

and set up a comprehensive database of urban disaster. The data repository includes various data such as disaster data, socioeconomic data, and urban multi-source data. Based on this, data mining, data processing, and data management using artificial intelligence technology can be established. Based on database construction, risk assessment and warning module of artificial intelligence technology are added to make disaster plan in advance. By establishing a timely and effective prevention platform and developing a corresponding recovery plan, we can reduce the risk of disaster and improve our resilience in the future.

- 3) The government should use AI technology to deliver information to ensure the safety and effectiveness of the information, respect citizens' true feelings, and increase public trust.

The risk prevention mechanism of urban disaster is comprehensively strong and complicated, requiring a strong subject to become the core dominant. The government is the core of the risk prevention mechanism for urban disasters, and at the same time, the government has abundant resources and mainstream media. In urban disasters, inadequate government awareness of the severity of disasters, inadequate response, and poor resilience can trigger urban vulnerability, resulting in inadequate response to crises, delayed optimal intervention, etc. (Wang, 2021:57). Therefore, the government should take the lead in establishing a disaster recovery system by utilizing AI technology to cooperate with citizens, society, and public services.

In the event of a major urban disaster, it is necessary to reduce the adverse effects of the disaster by increasing its resilience (Wang, 2021: 57). From the public's point of view, there should be no panic, and the information issued by the government should be taken as the standard, and no rumors should be spread or spread (Wisner B et al., 2004). Strengthening one's own psychological quality will help improve resilience. According to the government's requirements, disaster prevention and mitigation requirements should be strictly enforced, people should be cared for, and digital, intelligent, and networked with the support of the government. Therefore, based on establishing a complete contingency plan, government departments at all levels should work in conjunction with each other to restore the economy after the disaster. At the same time, various sectors of society should be actively encouraged to participate so that measures to enhance resilience can be effectively implemented.

5. Conclusions

As a great scientific achievement, artificial intelligence has undoubtedly become one of the most important technologies of the 20th century, and it will

be one of the leading disciplines in future development. At present, some research results of artificial intelligence have been widely used in life and production. With the development of network technology and knowledge economy in the information age, artificial intelligence technology will receive more attention.

Artificial intelligence has played an indispensable role in controlling the outbreak, which will further fuel the development of artificial intelligence (Sun, 2020). At present, worldwide epidemic control has entered the normal stage of prevention and control, and at the same time, all kinds of control measures should be continuously optimized.

Use AI to improve the emergency management system for public health emergencies. During the epidemic prevention and control and recovery stage, 'smart city' construction and governance are accelerating the replacement of traditional urban governance, and the lack of information-based foundation required for epidemic prevention and control is reflected in this epidemic (Wang, 2020: 29). With the further deepening of informatization, traffic management, logistics supply chain, emergency disaster preparedness, information traceability, etc. will gradually be fully digitized, which will comprehensively improve the construction process of smart cities, realize modern governance. It provides the most important data foundation for AI disaster recovery prediction, technical governance, information management and control.

Use AI technology to strengthen data interconnection in various fields and realize resource integration. The meaning of data lies in value rather than numbers, and data will be more useful only when it is circulated (Sun, 2020: 28). In the era of big data, with the continuous improvement of the level of informatization in all walks of life, the continuous increase of cross-disciplinary talents, and the accumulation of relevant medical and epidemic experience, the construction of a comprehensive management system for government, urban and social data has been accelerated to give full play to the value of data, and provide the basis for epidemic analysis, Prevention, control and early warning provide reference, support response and recovery, and improve disaster resilience.

Countries should speed up the establishment of a strong and complete AI legal system to provide technical guarantees and regulatory mechanisms. At present, there is no clear legal basis for the protection of artificial intelligence in terms of privacy infringement, and it can only be adjudicated with reference to other relevant laws. Improving the legal system is the top priority to strengthen the privacy protection of artificial intelligence (Liu, 2022: 91). Artificial intelligence applications should fully respect the personal wishes of those being collected.

Data collection applications can only better promote the development and utilization of data by continuously improving data security assurance capabilities (Xiao et al., 2022: 18). Therefore, the application of artificial intelligence requires corresponding supervision by government departments to protect the legitimate rights and interests of individuals and organizations, maintain national security, and provide a stronger guarantee for the safe and healthy development of the artificial intelligence industry.

Integrate AI into life and establish a social operation system for major emergencies based on intelligent technology. By finding the emergency response experience of the epidemic, it is found that social development needs to closely follow the development of the artificial intelligence industry, realize the intelligent transformation of social development, and try to achieve unmanned operation when the epidemic occurs, reducing the risk of cross-infection of personnel during the epidemic. At the same time, improve the emergency management plan of the education system. Strengthen the management of online education, ensure the quality of teaching, and provide students with a reliable, reliable, and intelligent teaching environment. Combined with the key links of social operations such as transportation, hospitals, and schools, a social intelligent monitoring system should be established, to resume work as soon as possible in the face of sudden epidemics and improve the resilience of social crises.

The epidemic has not only given us pain, but also a warning and direction. At present, more and more countries around the world choose to open their doors to "with COVID". AI technology has provided us with a lot of help in epidemic prevention, and it is still emerging. Although the spread of the epidemic can only be postponed at present, the use of technological tools has improved the collaboration model, facilitated information communication, strengthened governance capabilities, and provided a clear path and experience for subsequent technological and industrial development. In this anti-epidemic battle without gunpowder smoke, the application of artificial intelligence technology has achieved results and has received widespread attention. In the future, artificial intelligence technology should be used to further complement the shortcomings of epidemic prevention and control, diagnosis and treatment, and further encourage and promote the application of artificial intelligence technology in crisis management.

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