

The Application and Legal Issues of Artificial Intelligence in the Global Prevention and Control of the COVID-19 Epidemic

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ABSTRACT

Artificial intelligence technology has played an important role in the global prevention and control of the COVID-19 pneumonia pandemic (Covid-19), but there are also some legal problems. In this paper, firstly, the contribution of artificial intelligence technology in COVID-19 prevention and control is analyzed and summarized, which involves many fields where artificial intelligence plays a key role: from virus protein molecular research, medical diagnosis and treatment, infectious disease propagation prediction and early warning, social public opinion analysis and rumor recognition, and further discusses the subdivision direction and development potential of artificial intelligence in various fields. Secondly, the legal and ethical problems in the application of artificial intelligence in epidemic prevention and control are summarized into three aspects: personal privacy and data protection, intellectual property rights, and network security risks, and the causes and conditions of these problems are analyzed in detail, and the possible temporary solutions are discussed. Finally, it calls for strengthening international cooperation and building a global collaborative research and development system for artificial intelligence epidemic prevention and control; It is expected that China will speed up the formulation of laws and regulations related to artificial intelligence and give full play to the guarantee role of laws and regulations as soon as possible; Thinking and looking forward to the global governance pattern in the post-epidemic era.

Keywords: *Artificial Intelligence, COVID-19, Application, Legal issues.*

1. INTRODUCTION

The epidemic of COVID-19 (COVID-19) sweeping the world has closely affected the hearts and minds of every country, every ethnic group, and every individual. The community with a shared future for mankind has been truly reflected in the COVID-19 epidemic.

Nowadays, with the rapid development of science and technology, the vigorous development of artificial intelligence, big data analysis, and cloud computing has brought technological innovation to social life, especially the rapid rise and maturity of artificial intelligence, which strongly promotes the scientific and technological productive forces in human society. In the new wave of scientific and technological revolution, the artificial intelligence industry has become the core driving force of the transformation and upgrading of the whole industry, with a super driving effect.

At present, researchers all over the world are looking for various ways to prevent, control, and alleviate the epidemic, focusing on tracking the spread of the virus, promoting virus detection, developing vaccines, finding new treatments and drugs, and mitigating the social and economic impact of the epidemic. In epidemic prevention and control, many applications of artificial intelligence have played a great role, but there are also some problems to be solved.

Especially in terms of legal regulations and ethical restrictions on artificial intelligence applications, there are many outstanding problems to be solved urgently. As a large number of artificial intelligence technologies currently do not have a comprehensive and multi-level application boundary constraint, artificial intelligence technology has become a double-edged sword. In the prevention and control of the epidemic, it not only plays a powerful role in creating convenience for mankind, but also brings us a series of legal and ethical issues,

such as privacy security risks, network security risks and intellectual property disputes.

2. TYPICAL APPLICATION OF ARTIFICIAL INTELLIGENCE IN EPIDEMIC PREVENTION AND CONTROL

There are four main aspects of artificial intelligence in epidemic prevention and control, which are summarized and analyzed as follows:

2.1. The Application of Artificial Intelligence in the Study of Viral Protein Molecules

Artificial intelligence plays an important role in protein structure prediction. For example, in the COVID-19 epidemic, the AI model is used to identify and predict the internal structure of viral proteins [1]. The 3D structure of proteins is determined by their gene sequence, which affects the function and function of proteins [2]. It will be time-consuming and costly to determine the protein structure by traditional experimental methods (such as X-ray crystal diffraction). At present, the AI model can be used to predict the protein structure. Artificial intelligence can also be used to improve virus DNA testing [3]. AI can be used to quickly design detection methods covering a variety of genomes to predict sensitivity and specificity.

Artificial intelligence can be used for drug utilization and the discovery of new drugs. The AI diagram neural network model is used to generate and screen COVID-19 drugs based on existing drug molecules and predict potentially effective drug candidates [4]. Use AI's deep learning and reinforcement learning methods combined with the measurement of drug similarity, novelty, and diversity to explore the generation of new drugs.

2.2. The Application of Artificial Intelligence in Medical Diagnosis and Treatment

Artificial intelligence is causing a change in the mode of health care, and its application in the current outbreak of COVID-19 has considerable prediction and diagnostic value [5]. Artificial intelligence in COVID-19 medical diagnosis can use clinical data to establish AI model to improve the accuracy of diagnosis [6]. The main clinical application model of AI focuses on the recognition of medical imaging. Medical findings show that COVID-19 has special radiological features and image patterns, which can be observed in CT scans[7]. But even for radiation medical experts to recognize these patterns is quite time-consuming, using AI to quickly identify computed tomography (CT) slices so that the disease can be diagnosed efficiently and accurately [3].

Artificial intelligence can be used for non-invasive measurement of disease tracking. Using AI, people with abnormal body temperature can be quickly and accurately identified in high-density flow of people, and those with abnormal temperature can be located and tracked for further detection. Medical findings show that COVID-19 has a different breathing pattern from the flu and the common cold, such as shortness of breath (rapid breathing) [8]. The prediction of this shortness of breath symptoms by AI can be used as the primary diagnostic feature and provide help for large-scale monitoring of potential patients.

The use of AI remote consultation can understand the patient's condition, analyze the disease situation, and give suggestions, which can effectively reduce the risk of close contact with infection among health care workers. In the process of critical diagnosis and treatment, medical service robots further reduce the infection probability of health care workers and effectively prevent the spread of the epidemic caused by human-to-human contact. The robot is equipped with cameras, microphones, stethoscopes, and other equipment; doctors are responsible for operating the robot outside the isolation window. The robot can not only be used to treat patients, but also undertake some other non-contact work.

Artificial intelligence can be used to predict the prognosis of patients and the survival rate of critically ill patients [9] [10]. The establishment of an AI model based on clinical data can help doctors identify high-risk patients as early as possible, which is expected to predict the prognosis of patients and reduce the mortality of critically ill patients.

2.3. The Application of Artificial Intelligence in the Prediction and Early Warning of the Spread of Infectious Diseases

The correlation, scale, and new data of the epidemic of infectious diseases drive a variety of modeling methods, such as artificial intelligence machine learning, and artificial intelligence will become an important means of prediction and early warning for epidemic control. A large number of Chinese and foreign scholars and companies use artificial intelligence and other models to predict the spread and development of the epidemic. According to foreign reports [11], Toronto artificial intelligence startup Bluedot (<https://blue-dot.global/>) issued a warning of pneumonia outbreak in Wuhan to customers as early as December 31, 2019, much earlier than the notification of the World Health Organization and the US Centers for Disease Control and Prevention ((CDC)). Bluedot is a company that uses data to assess public health risks and engages in automatic infectious disease surveillance. The company's AI-driven health monitoring platform analyzes billions of data points and

uses big data analysis to track and predict the spread of the world's most dangerous infectious diseases. Kamran Khan, an infectious disease doctor and founder of BlueDot, said: "the company's early warning system uses AI (Natural language processing and Machine Learning) to track more than 100000 outbreaks of infectious diseases by analyzing approximately 100000 articles in 65 languages every day. These data help inform customers of potential outbreaks and the spread of infectious diseases. "

The results of AI prediction system can usually be used as a reference for epidemic prevention and control, and it is of great significance for epidemic prevention and control. AI's prediction of the epidemic situation of infectious diseases can be divided into two categories.

2.3.1. Micro-data Analysis

One is the micro-data analysis, which simply uses the time series case data accumulated from the daily epidemic data of various places (including suspected, infection, recovery, death, etc.) to build an AI model to predict the possible case data of a certain period of time in a certain area in the future. For example, Al-qaness et al. [12] proposed a prediction model based on artificial intelligence to estimate the number of confirmed cases in the next ten days, which is an improved adaptive neuro-fuzzy inference system (ANFIS). Hu et al. [13] proposed a real-time COVID-19 prediction method based on artificial intelligence, which uses an improved cascaded automatic encoder to model and estimate the scope, severity, and duration of the epidemic in China. The results show that the epidemic trajectory prediction method based on artificial intelligence has high accuracy.

2.3.2. Macro-data Analysis

The other is through the analysis of multi-source and multi-dimensional environmental factors and epidemic factors, such as traffic data, public opinion data, social data, and so on, through group macro big data analysis, the use of artificial intelligence algorithm to find the relationship between multi-dimensional data and epidemic spread, to achieve the role of analysis and early warning of epidemic spread. For example, Prasse et al. [14] use a network model of urban interaction (such as traffic flow) in Hubei to describe the epidemic situation in Hubei, which is helpful to accurately predict the prevalence of the virus in each city. Mizumoto et al. [15] used machine learning models to analyze the incidence of asymptomatic cases in the infection data of the Diamond Princess. In addition, relevant departments and technology companies make use of massive data and information of different dimensions, such as map data, aviation data, mobile communication data, e-commerce consumption data, etc., to make

comprehensive modeling and analysis, and make reasonable decisions and judgments for the epidemic situation.

AI early warning system can quickly locate the areas with a high incidence of the epidemic, enable the government and epidemic prevention personnel to conduct rapid epidemic screening and disease diagnosis in cities, and play an essential role in urban epidemic prevention and control.

2.4. The Application of Artificial Intelligence in the Analysis of Public Social Opinion and the Identification of Rumors

Social media and online platforms have become one of the main distribution channels around the spread of virus information. Although many countries and international organizations have used these platforms to communicate constructively with the public, there is also some online information that makes people overwhelmed, and the spread of misinformation or rumors is becoming more and more common. The World Health Organization (WHO) also works with social media and search companies to track the spread of specific rumors and to ensure that WHO information is at the top of the virus-related search[3].

Artificial intelligence has played a certain role in the control of epidemic public opinion. On the one hand, government functional departments grasp the dynamics of public opinion for the first time through intelligent search [16], analyze the focus of public concern, and accurately predict the trend of public opinion [17], so as to release the most scientific and reliable information. For example, artificial intelligence can be used to analyze the interaction and participation of social media content related to COVID-19 [18], collect comments and posts related to the keyword "COVID-19", and do natural language processing (NLP) to analyze people's approval or questioning of official epidemic prevention measures and strategies. On the other hand, artificial intelligence models can help identify accurate and reliable news articles [19], such as important guiding principles in epidemic prevention and strengthen official advice. In addition, natural language processing ((NLP)) is used to identify suspected rumors and publish true information to refute rumors in real time so as to help appease people and stabilize social anxiety.

Transparent and effective dissemination of information is essential for epidemic prevention, and artificial intelligence supports the exchange of information during the epidemic. By using big data, various localities can analyze the flow of people involved in the outbreak, understand their distribution, predict macroscopically how many people may be infected, and help the government make decisions on the means of material delivery and control.

3. LEGAL AND ETHICAL ISSUES ON THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN EPIDEMIC PREVENTION AND CONTROL

The legal and ethical problems faced by the application of artificial intelligence in epidemic prevention and control need to be considered [20]. At present, the development of artificial intelligence lacks of forward-looking, operable, and instructive laws and regulations. The application of artificial intelligence to the ground and for the benefit of the people urgently needs the guidance and protection of laws and regulations. To ensure the safe, reliable, and controllable application of artificial intelligence in epidemic prevention and control is the responsibility and task of legal professionals and employees in the artificial intelligence industry. The follows is some analysis on the legal issues of artificial intelligence under the background of COVID-19 epidemic prevention and control.

3.1. Artificial Intelligence Data Collection in Terms of Personal Privacy and Data Protection

As governments may pay more attention to public health issues than data privacy issues in extraordinary times of a COVID-19 pandemic, such as the use of AI for epidemic surveillance and surveillance, people may worry about potential long-term adverse consequences for personal data privacy and related human rights issues. However, given the public health threats posed by pandemics, personal data can be collected and analysed in accordance with European GDPR [21] (Article 9) as long as there are clear and clear public health objectives. Even if it is possible for government agencies to collect more detailed and extensive personal data than is acceptable to many, timely collection and analysis of big data is essential to combat the pandemic. Therefore, on the one hand, government agencies need to be sincere and patient when communicating with the general public and stating their reasons; on the other hand, the key is that government agencies should be extra careful in dealing with this kind of big data.

In short, the epidemic big data often involves personal privacy, and it is necessary to do a good job in protecting personal privacy and releasing it in accordance with the law [22]. When using big data for analysis to support joint defense and joint control, do some "decryption and desensitization" processing according to the principle of invisibility of personal information. In the collection and use of personal information, the principles of legality, legitimacy, and necessity shall be followed, and personal information other than those needed for epidemic prevention and control shall not be collected and provided or used for purposes other than those needed. For example, the data

sources in health, transportation, public security, industrial information, and other departments are deployed to a unified data analysis running environment according to the requirements of privacy protection, and the full data of multiple data sources are modeled, analyzed, and mined by artificial intelligence.

3.2. Intellectual Property Rights of Artificial Intelligence Technological Achievements

For those inventions that have undergone rigorous research and development, the protection of intellectual property rights is extremely important. The grant of patents is based on the premise of establishing novelty and creativity, and on the basis of protecting the interests of patent holders, it further shows the development of the latest technology so as to help other researchers in the same technical field.

The ownership of intellectual property rights of creations with the high social value produced by the application of artificial intelligence in the epidemic needs to be clear [23], such as screening drugs and synthetic new drugs, chest CT virus identification and diagnosis model, transmission prediction and early warning model, etc., should be given legal protection according to the application order of patent and software copyright, in order to avoid disputes. For example, the therapeutic drug "Redcivir" is an antiviral drug that has long been developed by Geely and has obtained a number of patents. Wuhan virus Research Institute applied for patents aimed at the use of "Ruidexiwei" against novel coronavirus, not pharmaceutical patents. Only by clarifying these patent relationships can legal disputes be effectively avoided.

It is necessary to integrate intellectual property policies in promoting public health management. For example, experts recommend that drug patents be obtained through the use of important compulsory licensing instruments for health care related to COVID-19 [24] [25]. There are also some provisions on compulsory drug licensing in the patent system of many countries and regions, which have been really applied in practice. Some examples include the "Siplo" compulsory license case in the United States, the "Tamiflu" compulsory license case in Taiwan, and the "Duojiimi" compulsory license case in India.

In addition, the innovation of therapeutic drugs and vaccines that ultimately contain the epidemic also involves the issue of intellectual property (IPR) of emerging medical and technological innovations because only patented vaccines can be put on the global market, which is also one of the keys to solving the global epidemic.

3.3. Artificial Intelligence Technology in Terms of Network Security Risks

Since the outbreak of the epidemic, people's homes and office hours have increased significantly, which has directly led to a great increase in the utilization rate of the Internet. E-mail, text messages, and social media continue to be high-frequency ways of network attacks. These cyber attacks will also adopt high-tech means such as artificial intelligence and big data. Internet frauds during the epidemic include:

One is shopping fraud, including the false sale of epidemic prevention materials such as masks, false sales fraud using fishing shopping websites, online brushing fraud, and refund fraud, including train or air tickets refund fraud, tourism/hotel/fast food refund. The third is impersonation fraud, including impersonating charitable institutions to defraud charity donations, impersonating government departments to promote "special drugs", pretending to be relatives and falsely claiming that COVID-19 is infected with fraud, and so on.

In the special situation of the epidemic, the use of artificial intelligence, big data, and other technologies by lawbreakers also brings social security risks. Therefore, at the critical juncture of epidemic prevention and control, there are urgent requirements for the ethical norms of artificial intelligence and the legal regulation of its application, and the malicious abuse of artificial intelligence should be prohibited; at the same time, it also poses new challenges to network security. We should clarify the network security prevention and control responsibilities of the relevant subjects, clarify legal responsibilities, and create a safe and reliable network security space.

4. CONCLUSION

At present, the situation of global epidemic prevention and control is grim, and international cooperation is particularly important [26]. We should strengthen international exchanges and cooperation, strengthen the sharing of scientific research achievements and resources, and jointly build a global collaborative research and development system for artificial intelligence epidemic prevention and control technology [27]. We will earnestly implement the joint construction of a community with a shared future for mankind. At the same time, China should actively communicate and coordinate with other countries and international organizations, learn from them, speed up the formulation of relevant laws and regulations on artificial intelligence, and give full play to the safeguarding role of laws and regulations on artificial intelligence as soon as possible.

The COVID-19 pandemic has put tremendous pressure on public health policies and systems around

the world, triggered far-reaching political, economic, social, and technological problems, and brought uncertainty to global well-being and development prospects. With the emergence of these wide-ranging problems, each country must begin to innovate and think about improving its political and legal systems to deal with the implementation of governance in the aftermath of the COVID-19 epidemic.

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