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AI Empowerment: A Brief Discussion on the Analysis and Construction of China's University Epidemic Prevention and Control System

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Abstract: This paper studies the use of artificial intelligence technology to build a scientific, comprehensive, and practical "technology-management-capability" trinity system for the prevention and control of major infectious diseases in colleges and universities, providing theoretical support and practical guidance for Chinese universities to effectively respond to future epidemics. The method applied in this paper is a literature review, analysing China's regulations and systems for supervising sudden infectious diseases or epidemic events in universities. Case analysis was conducted to analyze typical cases of AI technology used for epidemic prevention and control in six universities in China and other countries (Tongji University in China, Beijing University of Posts and Telecommunications in China, Shanghai University in China, University of California, Los Angeles in the United States, University of Cambridge in the United Kingdom, and University of Tokyo in Japan). The overall status, representative achievements, and key implementation processes of AI technology used in campus epidemic prevention and control in Chinese universities were summarised. Successful experiences and existing problems were summarised, and a "technology-management-capability" trinity prevention and control system framework was proposed. This study can provide a theoretical basis and practical reference for Chinese universities to respond to future epidemics, and will also help to maximize the health and safety of teachers and students, maintain normal teaching order and social stability in Chinese universities.

1. Research Background

With the acceleration of globalisation and population mobility, the risk of infectious diseases spreading on campus has increased significantly. Infectious diseases are a type of disease caused by various pathogens that can be transmitted between people, animals, or between people and animals. This includes many unknown or eliminated infectious disease sources that suddenly occur and cause social transmission, such as the sudden outbreak of new coronavirus pneumonia, atypical pneumonia, Middle East respiratory syndrome, and H1N1 influenza in recent years [1]. These infectious diseases have caused many deaths around the world and have made many people very concerned about disease prevention and control. As Chinese universities are places where students study, they have the

characteristics of a large number of people, high density, high mobility, a large number of susceptible populations and a complex structure. Due to the above factors, the risk of infectious diseases spreading in colleges and universities increases. It is difficult to prevent and control infectious diseases in colleges and universities, and the social risks are huge, which requires society to pay close attention to it [2]. Through previous research and investigation, it was found that many campus epidemics in China broke out and became public health events because the relevant departments failed to discover and manage them from the source as early as possible, and the isolation measures were not implemented in place [2]. For example, the Pan'an Lake Campus of the School of Science and Technology of Jiangsu Normal University has successively found 22 cases of tuberculosis among students on campus, but the specific number of suspected infections, the number of infections and the specific reasons are not clear at present. Chinese college students are important builders and service providers of society and an important force for the country's future, they are the backbone of the country and society[2].In addition, the implementation and supervision of prevention and control measures lack real-time precision, resulting in unsatisfactory prevention and control results. These deficiencies have led to huge challenges in China's campus infectious disease prevention and control work [2]. With the tremendous progress and development of science and technology, researchers have proposed to effectively combine artificial intelligence technology with campus infectious disease management and prevention [3]. However, this undoubtedly places high demands on the scientific research capabilities of various universities and the cooperation between different disciplines. Therefore, the focus of this study is to explore AI empowerment: A brief discussion on the analysis and construction of China's university epidemic prevention and control system in order to maintain the safety of university teachers and students.

2. Research Content and Methods

2.1 Research Content

The research content of this paper mainly covers the following three core aspects:

(1) Analysis of the application of AI technology in epidemic prevention and control in domestic and foreign universities

(2) Construction of epidemic prevention and control systems for major infectious diseases in domestic and foreign universities

2.2 Research Methods

Literature induction, Case analysis

3. Analysis of Typical Case Studies of AI Technology in Epidemic Prevention and Control at Universities

Based on the aforementioned research methodology, we selected typical cases of AI technology being used for epidemic prevention and control at six universities (three in China: Tongji University, Beijing University of Posts and Telecommunications, and Shanghai University; and three abroad: University of California, Los Angeles, University of Cambridge, and University of Tokyo). These cases are shown in Table 1.

Table 1 Comparison of AI applications in epidemic prevention and control in domestic and foreign universities

University name	Overview of the overall situation	Key links in the implementation process	Representative results
China: Tongji University	Develop intelligent monitoring systems that integrate multimodal recognition technologies (face recognition, body temperature detection, behavior analysis, etc.)[4]	1. Multi-source data fusion processing 2. Deep learning model iteration 3. System integration and deployment	1. Build a National Center for Epidemic Control Geographic Information System (NCP-GIS) 2. Implement spatial visualization of epidemic situation analysis 3. Achieve 92% accuracy in tracing individual movements[4]
China:Beijing University of Posts and Telecommunications	Build a smart epidemic prevention platform, integrating 5G and IoT technologies[5]	1.Multi-dimensional data collection 2. Trajectory modeling and analysis 3. Intelligent warning push	1. Developed a "Five-Color Map" epidemic assessment system 2. Deployed intelligent security robots 3. Increased personnel information management efficiency by 60%[5,11]
China:Shanghai University	Build a health management platform and optimize the material allocation mechanism[6]	1. Medical knowledge graph construction 2. Material demand forecasting 3. Service process digitization	1. The platform has completed three iterations of upgrades. 2. Response time for nucleic acid testing appointments has been reduced to 30 seconds. 3. Accuracy of material allocation has increased by 45%[6]
University of California, Los Angeles	Developing an epidemic risk assessment system[7]	1. Multi-source data integration 2. Risk model training 3. Visualization	1. Developed the UCLA-SUEIR prediction model 2. 88% accuracy in identifying potential cases 3. Over 90% student and faculty satisfaction[7].
University of Cambridge, UK	Build a smart medical service platform[8]	1. Telemedicine system development 2. User profile development 3. Smart push optimization	1. Medical demand forecasting accuracy reached 82% 2. Remote consultation utilization reached 72% 3. Information reading rate increased by 43%[8]
University of Tokyo, Japan	Deploy intelligent disinfection and information interaction system[15]	1. Robotic path planning 2. Natural language processing 3. Disinfection efficacy evaluation	1. Disinfection coverage reached 87% 2. Disinfection efficiency increased by 55% 3. System user satisfaction (85%) [9].

4. Research Status Summary

Main Achievements: Currently, six universities have achieved significant results in utilising AI

technology for epidemic prevention and control. In terms of epidemic monitoring and forecasting, they have developed a variety of effective models, such as the Tongji University NCP-GIS system (with a 92% accuracy rate for trajectory tracing). These systems can provide relatively accurate forecasts of epidemic trends. In the field of intelligent interactive information systems for epidemic prevention and control, AI technology has been used to strengthen the exchange and supervision of personnel information management and monitoring. For example, the Beijing University of Posts and Telecommunications' "Five-Colour Map" system has increased management efficiency by 60%. The University of Tokyo in Japan has achieved a breakthrough in intelligent campus security robot technology.

Comparison: A comparative study revealed distinct characteristics in the application of technology across universities. In terms of research focus, domestic universities tend to build comprehensive prevention and control platforms, such as the multi-scenario integrated system developed by Tongji University, while international universities focus more on specialised technological breakthroughs, such as the medical resource optimisation algorithm developed by the University of Cambridge. This difference reflects the specific technological requirements of different epidemic prevention and control systems. In terms of application scope, domestic research primarily serves campus management, such as Beijing University of Posts and Telecommunications' three-tiered management system of school, college, and class, while international research more often influences public health decision-making, such as UCLA's risk assessment model, which has been incorporated into local government epidemic prevention systems. Regarding challenges, domestic universities primarily face infrastructure (such as Shanghai University's integration with municipal data platforms) and user adaptability (such as training in the use of intelligent systems). International universities, on the other hand, are more constrained by data quality (such as the multi-source data integration of the University of Tokyo) and model complexity (such as the multivariate processing of multiple variables at the University of Cambridge).

4.1 Analysis of Problems in the Promotion of AI Technology

(1) Data Security Risks [10].
(2) High cost of technology application [11].
(3) Insufficient technical literacy of personnel[12].
(4) Technical adaptability issues[12].

5. Constructing a system for universities to respond to major infectious diseases

Based on the above research and analysis, each university can try to establish a "technology-management-capability" three-in-one prevention and control system to respond to campus epidemics.

5.1 Technical Support System

In view of the differences in technical foundations among different universities, it is recommended to adopt a layered construction strategy. For universities with insufficient technical reserves, the following paths can be taken:

(1) Technology introduction and cooperation: By joining the "Healthy Road" open source platform alliance led by Shanghai University, a basic prevention and control system can be quickly deployed. The platform has achieved technology sharing among multiple universities.

(2) Data value mining: Universities with a computer science foundation can organise interdisciplinary teams to use machine learning algorithms to analyse the health data of teachers and

students collected by the platform, generate visual epidemic trend maps, and provide data support for decision-making.

(3) System integration innovation: Universities with strong technical strength can refer to the use of federated learning technology by Beijing University of Posts and Telecommunications to integrate 8 types of campus data and develop an intelligent platform containing 12 analysis tools. It is recommended to integrate Tongji University's multimodal recognition technology, deploy intelligent monitoring nodes in key areas, and build a three-dimensional prevention and control network.

5.2 Establishment of management and operation mechanism

The effective operation of the intelligent system requires the establishment of a supporting management mechanism:

(1) Organizational structure optimization: Establish an epidemic prevention and control command center headed by the school leaders, with a technical expert group responsible for data ethics review [12] to ensure compliance with the requirements of the "Technical Plan for the Prevention and Control of the New Coronavirus Pneumonia Epidemic in Colleges and Universities" [12].

(2) Emergency response system: Learn from the "Five-colour Chart" mechanism of Beihang University to establish a dynamic management system with four-level response plans and clarify the resource allocation standards corresponding to each level [13].

(3) Guarantee system construction: Refer to the experience of the University of Tokyo, reserve intelligent emergency equipment and establish strategic cooperation with AI companies; learn from the Cambridge University model, formulate system failure handling plans, and ensure seamless human replacement in emergency situations.

5.3 Capacity Building System

(1) Technological Innovation: Support qualified universities to establish joint laboratories with enterprises, focusing on the research and development of low-cost epidemic prevention technologies. Based on the Shanghai University shared platform, promote the transformation of technological achievements.

(2) Talent Training: Develop modular training courses, incorporate AI application capabilities into the faculty and staff assessment system, and regularly organise cross-departmental emergency drills.

(3) Resource Integration: Promote school-enterprise cooperation, establish a technology sharing alliance, and lower the application threshold for small and medium-sized universities[14].

6. Conclusion and Outlook

AI technology provides a revolutionary tool for epidemic prevention and control in universities, but it requires comprehensive support from various sources, including funding, technology, and policies. Currently, the application of AI to campus epidemic prevention is concentrated in top universities in the West and China, which almost all have their own epidemic prevention and control systems. However, many Chinese universities have not yet adopted AI for campus epidemic prevention and control due to funding, talent, technology, or a lack of theoretical knowledge. The "technology-management-capability" trinity epidemic prevention and control system, constructed based on the data analysis in this article, draws on practical experience from Tongji University's intelligent monitoring and Beijing University of Posts and Telecommunications' data management, as well as advanced concepts from Cambridge University's dynamic early warning and the University of Tokyo's intelligent services. It is highly scientific and practical. It can not only promote the deep integration of AI systems and campus smart development for universities lacking funding and

technology, but also enable information exchange and technology learning among universities, establishing a long-term mechanism for multi-platform learning. By combining technological empowerment with institutional innovation, Chinese universities will undoubtedly build more resilient epidemic prevention and control capabilities. Future research may focus on cost-control solutions for intelligent technology, balancing data security and privacy protection, and improving cross-platform system compatibility.

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