Analysis on Promoting the Innovative Development of International Communication of Traditional Chinese Medicine through Artificial Intelligence Technology

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Abstract: In the context of the new era, high-tech represented by artificial intelligence(AI) is playing an increasingly important role in promoting the inheritance, innovation, and international communication of traditional Chinese medicine(TCM). In order to implement the policy of accelerating the reform and development of TCM, we need to fully utilize the efficiency output advantages of AI, explore the close relationship between AI and TCM, and thus shoulder the historical responsibility of redounding the prosperous development of TCM.

1. Introduction

In the modernization process of TCM, the promotion and application of high-tech is indispensable. The "Implementation Plan for the Major Project for the Revitalization and Development of TCM" issued by the State Council on February 28, 2023, has explicitly proposed to "focus on national strategic needs and major scientific issues of TCM, layout a number of key projects for TCM technology innovation and key technology equipment projects, strengthen the construction of the TCM technology innovation system, enhance the ability of inheritance and innovation, and accelerate the modernization of TCM."[1]. It can be seen from this that in the context of the new era, high-tech will play an increasingly important role in promoting the inheritance, innovation, and international communication of TCM.

In the current field of high-tech, AI has emerged as a disruptive force, especially driven by the common needs of mobile internet, big data, supercomputing, sensor networks, brain science, and economic and social development. With its advantages of "deep learning, cross-domain integration, human-machine collaboration, collective intelligence, and autonomous control"[2], AI is profoundly changing human society and becoming a strategic technology that leads future development. In view of this, this article will focus on the theme of "TCM + AI," take international communication of TCM as the entry point, comprehensively explore the significant role that AI technology can play in promoting international communication and exchange of TCM, and thereby better contribute to the construction of a global community of health for all.

2. Overview of AI

The concept of "Artificial Intelligence", abbreviated as AI. From a comprehensive perspective, the definition of AI in academia can be mainly divided into two categories: one is practice-oriented, which views AI as a branch of computer science that primarily focuses on "researching and developing new technology sciences, including theories, methods, techniques, and application systems, for simulating, extending, and expanding human intelligence"[3], In other words, it is the study of how to make machines intelligently process tasks that would typically be handled by humans. The other category is experiment-oriented, which believes that AI research mainly focuses on the mechanisms of intelligent behavior and is conducted through the construction and evaluation of artificial artifacts that attempt to adopt these mechanisms[4]. From a practical perspective, both academic and industrial circles currently lean towards the practice-oriented definition and mostly

judge and classify the AI system from this perspective. Based on the practice-oriented approach, we can define AI as a kind of "machine intelligence that simulates human thinking and behavior, demonstrating human-like abilities such as association, memory, learning, and reasoning, supported by algorithmic programs, bionics, cognitive science, and other technologies"[5].The development of AI can generally be divided into three main stages at the technical level: weak AI, strong AI, and super AI. Weak AI refers to the autonomy or limited autonomy that machines exhibit in form, achieved by applying technological means to make machines demonstrate varying degrees of intelligence and apply it to specific tasks. Although human society is still in a weak stage of AI, the scope of knowledge popularization and practical application of AI technology is becoming increasingly widespread. TCM, as a shining medical cultural treasure with Chinese characteristics, can also rely on high-tech such as AI for inheritance, innovation and international communication.

3. The Status Quo of the International Communication of TCM in the New Era

In the new era, the Party and government attach great importance to the inheritance, innovation and international communication of TCM. Through the efforts of relevant sectors, China's TCM cause has achieved some eminent achievements that have attracted worldwide attention.

3.1. Enhancement of International Recognition and Influence of TCM

According to statistics, TCM has now spread to 196 countries and regions. China has signed dedicated cooperation agreements on TCM with over 40 foreign governments, regional authorities, and international organizations. It has established 30 high-quality overseas centers for TCM, 75 international cooperation bases for TCM, and has been involved in the construction of 31 national bases for the export of TCM services. TCM has also been included in 16 free trade agreements.[6]In addition, China has established 15 Confucius Institutes and Confucius Classrooms for TCM worldwide. TCM, Tai Chi, and other courses are offered in over 240 Confucius Institutes in 78 countries. The registered students have reached 35,000, and the number of participants has reached 185,000.[7]During the COVID-19 pandemic, China has exchanged TCM diagnosis and treatment plans, clinical experiences, and other aspects with more than 80 countries and regions including Italy, Germany, and Japan. Chinese medicine practitioners have been sent to nearly 30 countries and regions to assist in local epidemic prevention and control. Lianhua Qingwen Capsules have also been approved for import and use in more than 10 countries.[8]

3.2. Further Acceleration of the Construction Process of International Legalization and Standardization of TCM

With the continuous improvement of the influence of TCM overseas, the international legalization and standardization of TCM have also made notable progress. In terms of the international legalization of TCM, according to statistics from the World Health Organization, acupuncture and other TCM diagnostic and treatment methods have been recognized by 113 member countries. 29 member countries have formulated relevant laws and regulations for the standardized use of TCM, and 20 member countries have included acupuncture and other TCM diagnostic and treatment methods in their national healthcare systems.[9] On March 31, 2022, the World Health Organization (WHO) released the "Expert Assessment Report on TCM Treatment for COVID-19" which explicitly affirmed the effectiveness and safety of TCM in treating COVID-19. The report encouraged WHO member countries to consider the possibility of using TCM in their healthcare systems and regulatory frameworks, providing strong support for further promoting the international legalization of TCM. Regarding the international standardization of TCM, as of now, China has been actively promoting the establishment of the International Organization for Standardization (ISO) Technical Committee for TCM (ISO/TC249). This committee has successively developed and published 89 international standards for TCM[10], including traditional Chinese medicine materials, products, instruments, etc.

4. Proposals on Furtherance of the International Communication of TCM Utilizing AI

Nowadays, many industries have utilized AI technology for structural transformation and upgrading, and have achieved considerable benefits. The development of TCM in the new era can also take this opportunity to achieve some substantial outputs:

4.1. Utilizing AI technology to Excavate and Protect Ancient Chinese Medicine Books

TCM classics are the foundation and carrier of preserving, recording, exchanging, and disseminating knowledge of TCM in our country. They are the experience summary of the Chinese nation's understanding and treatment of diseases and the essence of the treasure trove of TCM[11]. Utilizing AI technology to enhance the organization, exploration, and protection of TCM classics aligns with the requirements of utilizing technological innovation to promote the international communication of TCM in the new era. General Secretary has explicitly stated the need to strengthen the protection, rescue, and organization of ancient Chinese medical books, traditional knowledge, and diagnostic and treatment techniques, promote scientific and technological innovation in TCM, and enhance international exchanges and cooperation in TCM.[12]

The role of AI technology in the compilation and preservation of TCM classics is mainly reflected in the construction of digitalized TCM classics. Specifically, through the use of technologies such as optical character recognition (OCR), AI sentence reading, and entity recognition, TCM classics can be digitized and transformed. This involves building an all-in-one digital intelligent platform for TCM classics, gradually achieving intelligent conversion of the text, and utilizing the wisdom of TCM classics. The intelligent conversion of TCM classics refers to the transformation of paper-based texts into digital texts, and then using AI technology to organize and classify the content of these classics. This results in interactive, touchable, and visual digital works that are convenient for people to consult and use. The wisdom utilization of TCM classics mainly refers to the application of AI technology to a massive amount of TCM literature. This enables the automatic generation of knowledge graphs for ancient texts and the intelligent organization of the content of these classics. This allows the classics to be retrieved, associated, and deeply explored in textual form, and supports the use of knowledge graphs on the front end of the Internet.

4.2. Utilizing AI Technology to Promote the Construction of International Standards for TCM Terminology

International standardization of TCM is an effective mean for the successful global communication of TCM. Promoting the construction of international standards for TCM can provide norms for the industries, provide a lever for government management departments, and facilitate the formation of a common language in international cooperation and exchanges in TCM, promoting mutual understanding[13]. Therefore, in the current era of rapid development of the internationalization of TCM, we must vigorously promote the construction of international standards for TCM. Among them, the construction of international standards for TCM terminology is of paramount importance and holds a foundational and strategic position in the modernization and internationalization of TCM development.

The widespread application of new information technologies such as AI, big data, and cloud computing in the fields of medicine and language services has brought new opportunities for the construction of international standards for TCM terminology. Specifically, the construction of international standards for TCM terminology includes two aspects: standardization of terminology and standardization of translation of terminology. AI technology has great potential in both areas. In terms of the standardization of TCM terminology, we can use AI's biologically inspired recognition system, big data mining technology, and database architecture to digitize, organize, and visualize different TCM disease names, syndromes, herbal names, and formula names. We can build various standardized and unified TCM terminology databases with organic correlations, and embed them in internet promotion and usage to strengthen the standardization of TCM terminology. In terms of the standardization of the translation of TCM terminology, we can organically integrate AI technology with corpus construction. By building an intelligent parallel corpus of TCM, a multilingual corpus,

and a comparable corpus, we can jointly create a multi-modal and standardized TCM terminology translation platform based on the internet, which can automatically process multi-language information, retrieve and manage professional corpus resources, conduct machine translation, post-editing, word table statistics, result output, and other AI technologies and operational management elements. This platform can be used by TCM practitioners and students both domestically and internationally, gradually realizing the international standardization of TCM terminology.

4.3. Utilizing AI Technology to Build Internationalized TCM Characteristic Industry

The characteristic industry of TCM refers to a collection of operating institutions that utilize TCM as a resource and combine it with the market economy, aiming to meet people's demand for TCM services and products. Since the 18th National Congress of the Communist Party of China, the country has introduced a series of policy measures around the development of the TCM industry. The TCM industry has become a part of the national strategy, and multiple cities across the country have taken the TCM industry as a local characteristic industry, advantageous industry, and pillar industry to focus on[14]. Exploring the development mode of the TCM industry under the new situation using AI technology and promoting the internationalization of the TCM industry is the internal driving force for achieving the sustained and stable development of the TCM industry, and is also an important way to inherit the TCM culture.

How to lay out the development strategy of internationalized TCM characteristic industry and continuously promote the development and innovation of TCM industry, the extremely important entry point is to use AI technology to integrate with the TCM industry, to build an intelligent and efficient international leading industry chain, which involves many elements: 1. Quality control and traceability of medicinal materials: AI can achieve the production, procurement, and management of medicinal materials through the Internet of Things and blockchain. The full process monitoring and traceability of processing and sales ensures the traceability of medicinal materials from planting to production, in order to better achieve quality control of the import and export of Chinese medicinal materials. 2. Drug development and optimization: AI can play an important role in the development process of TCM. Through technologies such as drug molecular design, virtual screening, and model generation, it can accelerate the development and optimization of TCM to meet the diverse market demands at home and abroad, improve research and development efficiency and product conversion rate. 3. Intelligent promotion and sales of TCM: Utilize AI technology to optimize the promotion and sales strategies of TCM products. Through big data analysis and prediction models, and combined with intelligent recommendation systems, recommend suitable TCM products and services based on the needs and preferences of domestic and foreign users. 4. TCM Cultural Tourism: AI can recommend suitable TCM cultural tourism routes and activities for domestic and foreign tourists based on operational data and market dynamics, optimizing the quality of tourism products and services. During the journey, people can also use the unique virtual reality and augmented reality technologies of AI to bring TCM cultural tourism scenes and experiences to tourists, allowing them to personally experience activities such as TCM treatment and herbal picking, enhancing the sense of participation and experience of domestic and foreign tourists.

4.4. Utilizing AI Technology to Build a Smart Platform for International Health Services of TCM

With the acceleration of global aging and the deterioration of the ecological environment,, non-communicable chronic diseases represented by cardiovascular diseases, metabolic diseases, and neurological diseases have become the biggest health problems facing humanity. The traditional medical model that focuses on "treating diseases" can no longer meet the urgent health needs of the current human society. This requires us to timely adjust the strategic priority of medical development from the pursuit of high-tech for curing diseases to the prevention of diseases and the promotion and maintenance of health[15]. From this perspective, in order to provide TCM healthcare and diagnostic services more scientifically and conveniently for both domestic and international people, we need to actively utilize new generation AI, big data, cloud computing, blockchain and

other information technologies to create an intelligent platform for international health services of TCM.

The international platform for intelligent TCM health services primarily utilizes the latest digital technologies such as natural language processing in TCM, knowledge graph construction in traditional Chinese and Western medicine, big data mining by renowned TCM practitioners, diagnostic and therapeutic effectiveness evaluation in TCM, and AI-based intelligent syndrome differentiation and treatment technologies. The aim is to create an open and shared intelligent international network platform for TCM health. On this platform, on one hand, AI technology and big data are deeply integrated. Based on individual physical conditions, personalized health prescriptions and adjustment plans can be provided through efficient human-computer dialogue and information processing analysis. This achieves precise individual medical care. The platform can also strengthen tracking and follow-up, collect health big data, and build disease prediction models and diagnostic knowledge graphs based on individual physical conditions and relevant risk factors. Ultimately, the goal is to regulate overall individual functions and prevent diseases. On the other hand, an intelligent auxiliary system for TCM syndrome differentiation and treatment can be built based on AI algorithms, with a highly intelligent backend supported by massive medical data. By simulating the thinking process of TCM syndrome differentiation and treatment, comprehensive analysis of patient data can be conducted to propose targeted treatment plans. This achieves the digital transformation of the traditional "observation, listening, questioning, and pulse taking" methods,which can effectively improve the efficiency and quality of consultation, and gain people's credence.

5. Conclusion

Based on the new era of international communication of TCM, we need to take advantage of the situation - fully recognize the important role of high-tech, and use AI, big data, cloud computing and other means to continuously promote the informatization, intelligence, and modernization of international communication of TCM, in order to better demonstrate the unique advantages of TCM in disease prevention, health care, rehabilitation, and other aspects. Although this path is full of thorns and challenges, as long as we maintain a clear mind and master advanced technology, we will definitely be able to shoulder the historical responsibility of the international communication and development of TCM, thereby promoting the construction of the "Healthy China" and "Human Health Community" systems, demonstrating the responsibility of a major country to the world, and telling the world the story of China well.

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