

The Auxiliary Role of Large Language Models in Clinical Dialogues

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Abstract: In recent years, large language models (LLMs) have made significant progress in natural language processing (NLP). These models not only perform well in a variety of language tasks but also show great potential in the medical field. This paper aims to explore the application of LLMs in clinical dialogues, analyzing their role in improving the efficiency of doctor-patient communication, aiding in diagnosis and treatment, and providing emotional support. The paper also discusses the challenges and limitations of the model in terms of privacy protection, ethical issues, and practical applications. Through comprehensive analysis, we conclude that applying LLMs in clinical dialogues is promising. However, it requires careful consideration and caution by practitioners in practice.

Keywords: Large language models; Clinical dialogues; Natural language processing; Healthcare assistance; Ethical issues

Online publication: December 2, 2024

1. Introduction

Large language models (LLMs) are deep learning models that can understand and generate natural language text ^[1]. The core idea is to predict the next word in a sequence, often through techniques such as masking. Currently, trained by deep learning algorithms, large language models have acquired the ability to understand and generate natural language effectively. Large language models Artificial Intelligence (AI) technology provides new opportunities for medical development, which is applied in the fields of health management systems, auxiliary clinical decision-making, and clinical research ^[2].

In the medical field, clinical dialogues serve not only as a bridge for doctor-patient communication but also as a key to diagnosis and treatment. The introduction of large language models offers an innovative aid to this process. These models assist doctors not only in understanding patients' descriptions more quickly and accurately but also in extracting key information through natural language processing technology. This, in turn, aids diagnostic decisions and improves diagnostic accuracy. Additionally, they enhance patient experience

through natural language communication and provide personalized medical advice and health guidance. However, as the application of large language models in the medical field deepens, they bring forth inevitable challenges, such as data privacy protection, ethical concerns, and ensuring the accuracy and reliability of the models.

This paper aims to explore how to fully utilize the auxiliary role of large language models to enhance the quality of healthcare services based on protecting patients' privacy and ensuring ethical compliance. Moreover, the paper will discuss strategies for maintaining the accuracy and reliability of the model outputs through continuous algorithm optimization. It will also present the challenges and possible solution strategies, to offer valuable insights and guidance to the healthcare field.

2. Applications of large language models in clinical dialogues

2.1. Enhancing doctor-patient communication

Effective doctor-patient communication is essential for quality healthcare delivery. In clinical dialogues, large language models (LLMs) play a pivotal role in enhancing this communication by offering real-time translation services for non-English speakers, summarizing complex patient conditions in layman's terms, and conveying doctors' recommendations. For instance, LLMs can instantly translate a patient's complaints from one language to another, breaking down language barriers and facilitating better understanding. Furthermore, by summarizing patient histories and medical terms, LLMs ensure that both parties have a clear and concise understanding of the situation. The models also aid in explaining treatment options and aftercare instructions, which can be particularly beneficial for patients with limited health literacy. However, with these advancements come challenges such as ensuring the accuracy of translations and maintaining patient confidentiality. Addressing these concerns through continuous model training and strict data protection measures is crucial for the successful integration of LLMs in healthcare settings.

2.1.1. Real-time translation

Real-time translation is vital for patients facing language barriers in clinical doctor-patient dialogues. Large language models offer this service by integrating advanced speech recognition technology, instantly translating the patient's speech into a language the doctor can understand. They can translate not only the literal meaning but also grasp specialized terms and implicit meanings in medical dialogues. The models adjust to the patient's accent, speech speed, and dialect, ensuring translation accuracy and comprehensibility. Doctors can provide feedback on translation accuracy, allowing the model to learn and improve continuously. Throughout, the models safeguard patient medical information and privacy, consider cultural differences, and ensure the translated content's appropriateness across cultures. In emergencies, LLMs' real-time translation ensures patients receive prompt medical assistance.

2.1.2. Automatic summarization and recording

Large language models utilize their advanced natural language processing capabilities to capture key information from doctor-patient dialogues in real-time, automatically summarize patient conditions and doctors' diagnoses, and generate medical records summaries. This automated medical record system not only reduces the workload of doctors' medical records but also ensures the consistency and accuracy of medical records information. It provides a reliable reference for patients' subsequent medical consultations

and treatments, especially across different medical institutions, which is crucial for the long-term health management of patients. Additionally, studies have shown that discharge summaries written traditionally often miss details, and large language models are expected to change this situation ^[3]. Automated medical records generation assisted by LLMs also enhances and improves the timeliness of medical information, enabling real-time access to updated medical records for both doctors and patients, which is particularly important for the continuous treatment and health management of patients with chronic diseases. In conclusion, applying large language models to automatic summarization and recording in clinical dialogues not only optimizes the process of medical documents but also enhances the quality and accessibility of medical services, bringing substantial benefits to both doctors and patients.

2.2. Aiding in diagnosis and treatment

Large language models can help doctors to better explain diagnoses and treatment plans in clinical dialogues, thereby improving patients' understanding and acceptance of medical decisions ^[4]. They assist doctors in quickly accessing the latest medical knowledge and clinical guidelines to better understand the patient's condition. Moreover, large language models also provide auxiliary diagnostic advice by analyzing diverse medical data.

2.2.1. Improving doctor-patient communication and drug safety monitoring

Large language models serve as a communication bridge between doctors and patients, explaining diseases, treatment plans, and prognoses in understandable language, thereby enhancing patient compliance and satisfaction ^[5,6]. In drug therapy, they also monitor and provide early warnings of potential drug interactions and adverse reactions in real-time, ensuring patients' drug safety.

2.2.2. Comprehensive diagnosis and personalized treatment recommendations

Large language models deeply analyze patients' medical data including medical history, symptoms, physical signs, and laboratory test results to provide comprehensive diagnostic suggestions. By combining data processing with machine learning algorithms, they generate possible diagnoses and treatment plans as a reference for doctors and offer decision support. Identifying complex medical patterns assists doctors in quickly and accurately diagnosing diseases. Furthermore, these models generate personalized treatment plans based on individual patient differences like age, gender, and medical history, improving treatment outcomes and optimizing medical resource allocation.

2.2.3. Clinical decision support and knowledge update mechanism

The large language model provides physicians with real-time clinical decision support, including evidence-based support from up-to-date medical research and interdisciplinary collaborative advice. These models help doctors make decisions that conform to current medical standards by continuously learning and integrating the latest medical knowledge. Additionally, they can adapt to the changing medical environment and provide support to areas with insufficient medical resources through telemedicine services, thereby promoting the accessibility and equality of healthcare services.

The auxiliary role of large language models in clinical dialogues can help improve the quality and efficiency of medical services. In practice, caution should be exercised when utilizing large language models in

clinical dialogues. The diagnostic suggestions and treatment plans generated by LLMs are for reference only. Doctors should combine clinical experience with professional judgement for comprehensive consideration, to maintain human-machine collaboration to provide better medical services to patients. Moreover, protecting patient privacy and ensuring data security are crucial issues that require high attention when using large language models.

2.3. Providing emotional support

In clinical dialogues, emotional support is crucial for patients' recovery. Large language models can utilize natural language processing to identify patients' emotional states and offer tailored emotional support ^[7]. For example, for patients with anxiety or depression, the model can generate comforting and encouraging messages to alleviate stress and anxiety, thus improving their psychological well-being.

2.3.1. Personalized emotional support

Personalized emotional support from large language models is a significant advancement in clinical care. By analyzing the nuances of a patient's language, including their tone and emotional cues, these models can craft responses that are specifically tailored to the individual's current emotional state. This customization ensures that the comfort and encouragement provided are in tune with the patient's needs, enhancing the emotional resonance of the interaction. Such an approach not only demonstrates empathy and understanding but also strengthens the therapeutic alliance. It allows for a more nuanced and effective form of support, as the model can adapt its communication style to better suit the patient's preferences and psychological requirements, ultimately contributing to a more positive clinical outcome.

2.3.2. Continuous support and availability

Large language models offer an unparalleled advantage in continuous emotional support, a service that transcends the constraints of human healthcare providers' schedules. These models are accessible 24/7, providing an unwavering presence of reassurance and empathy to patients. The round-the-clock availability is particularly beneficial for individuals who may require support outside of regular business hours or during times of acute emotional distress. By being there for patients at any moment, these models offer a reliable source of comfort and understanding, which can be crucial in managing emotional health. This constant availability not only aids in immediate emotional relief but also plays a significant role in long-term mental well-being, as it empowers patients to seek help proactively and without delay.

2.3.3. Cultural sensitivity and diversity

Large language models are programmed for cultural sensitivity and diversity in their emotional support responses. They are designed to understand and respect different cultural norms, beliefs, and expressions of emotions, ensuring that the support provided is appropriate and respectful for diverse patient populations ^[8]. This approach enhances the effectiveness of emotional support, fostering trust and rapport between patients and the healthcare system.

In conclusion, the use of large language models for emotional support in clinical conversations offers a range of benefits, including personalized support, continuous availability, and cultural sensitivity. By leveraging technology to provide tailored emotional support, healthcare providers can better address the

emotional needs of patients, contributing to improved overall well-being and patient outcomes.

3. Challenges and limitations

Despite the immense potential of LLMs in clinical dialogues, several challenges need to be addressed in their practical application. These include ensuring data privacy, mitigating algorithmic bias, and improving the interpretability of the models' decisions. To overcome these challenges, ongoing research is essential to develop robust mechanisms for data protection, to create more transparent and fair algorithms, and to enhance the models' explainability. Additionally, fostering collaboration between technologists, clinicians, and ethicists will be crucial in navigating the complex landscape of healthcare technology integration.

3.1. Ethical considerations

The application of large language models (LLMs) in clinical dialogues not only brings convenience but also raises a series of ethical issues. The first is the privacy of patients. The patient's medical records include private data such as their health status and genetic information. Large language models must ensure their security and confidentiality, and also strengthen the management of data encryption, anonymity, and access control. In another aspect, informed consent is one of the basic principles in medical ethics. When applying large language models in the medical field, it is necessary to ensure that patients fully understand their use methods, potential risks, and the purpose and scope of their own data use. This requires medical institutions to provide clear, transparent information to patients and obtain explicit patient consent before applying these technologies. Ensuring confidentiality and protection of patient data is essential to maintaining trust and adherence to ethical guidelines ^[9].

3.2. Accuracy and reliability

Another limitation of large language models in clinical dialogues is the need for accuracy and reliability of the generated responses. LLMs, despite their prowess in linguistic capabilities, must have their medical knowledge and accuracy rigorously verified. The generation of inaccurate or misleading information by these models could have severe results, including patient harm. It is imperative for medical professionals to carefully screen and validate the outputs of LLMs. This validation process ensures that the information provided is not only reliable but also scientifically substantiated. Such stringent checks are vital to establish trust in the model's responses, guaranteeing their utility in healthcare environments. Ensuring that LLMs are used responsibly requires ongoing oversight and the integration of expert medical input to correct and refine the models' outputs, thereby enhancing their accuracy and reliability in clinical dialogues.

3.3. Cultural sensitivity and context understanding

Cultural sensitivity and context understanding are vital for large language models to provide effective emotional support in clinical dialogues. These models must navigate the complexities of diverse cultural backgrounds, beliefs, and emotional expressions, which can greatly affect the quality of support offered ^[10,11]. The importance of training these models on a wide range of datasets that reflect different cultures cannot be overstated. It is crucial for models to not only understand but also adapt to the cultural contexts they engage with, ensuring that their responses are respectful, appropriate, and empathetic. This adaptability enhances the models' ability to connect with users on a deeper level and provide emotionally intelligent support that

is sensitive to cultural nuances. In doing so, the models can foster trust and rapport, which are essential for successful therapeutic interactions.

3.4. Privacy protection

Medical data is highly sensitive, making the protection of patient privacy a critical issue when utilizing large language models. To safeguard this data, robust measures such as data encryption, anonymization, access controls, and adherence to data minimization principles must be implemented to prevent data breaches and misuse. By addressing these challenges and limitations proactively, healthcare providers can not only enhance patient care and support through the auxiliary role of LLMs in clinical dialogues but also ensure ethical considerations and cultural sensitivity are upheld^[12–14]. This proactive approach will foster an environment of trust and pave the way for the responsible integration of advanced technologies in healthcare, ultimately leading to improved patient outcomes and experiences.

4. Conclusion

Large language models show a wide application prospect in the field of health and may become the core of artificial intelligence in medical institutions. However, to fully leverage the potential of large language models, a series of key challenges must be overcome, and effective integration with traditional systems achieved. This process requires in-depth research and technological innovation to ensure the depth and breadth of the application of large language models in the medical field^[15]. Future research should concentrate on enhancing specific aspects of model performance, such as improving the accuracy, interpretability, and adaptability of large language models. In parallel, there is a pressing need to develop relevant legal regulations and comprehensive ethical guidelines that govern the use of LLMs in the healthcare sector. These guidelines should address issues like data privacy, informed consent, and algorithmic transparency. Moreover, fostering interdisciplinary collaboration among AI specialists, legal experts, ethicists, and healthcare professionals will be vital in navigating the complex ethical and regulatory landscape. By combining technical advancements with robust governance, we can ensure the safe and effective integration of LLMs into clinical practice, maximizing their potential to improve patient care.

Disclosure statement

The authors declare no conflict of interest.

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