English

Using Large Language Models (LLM) as virtual health assistants in Ecuador.

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Abstract

Introduction: Artificial intelligence (AI) is revolutionizing multiple sectors, including healthcare, by introducing innovative solutions that can be compared to the impact of the steam engine. AI can significantly enhance people's lives, protect the planet, and foster prosperity. One notable example is automatic speech recognition, which facilitates communication between humans and computers.
Objectives: This study aims to explore the importance and challenges of adopting large language models (LLMs) as virtual health assistants in Ecuador, and how these models can contribute to improving the quality of healthcare services, particularly within the context of Ecuador's 2023 Digital Health Agenda. **Methods:** A review and analysis of official documents, health policy reports, and recent initiatives in Ecuador was conducted. Emphasis was placed on the role of AI technologies, especially LLMs such as GPT-3, GPT-4, and Med-PaLM 2, in supporting healthcare systems in Latin America. **Results:** LLMs are transforming healthcare by reducing clinicians' administrative burden and improving decision-making accuracy. They increase access to personalized information and enhance patient engagement. AI can automate up to 36% of tasks in the health and social care sector, helping address the shortage of professionals in OECD countries. In Ecuador, although the 2023 Digital Health Agenda promotes AI through pilot programs, the lack of clear regulatory frameworks, supportive public policies, infrastructure, and digital culture hinders broader implementation. **Conclusion:** Despite the global advances in AI for health, Ecuador still faces structural and regulatory challenges that limit the application of LLMs. However, with targeted investment and policy development, these technologies have the potential to significantly improve healthcare quality and access across the country....

Key-words: Artificial Intelligence, Large Language Models, Healthcare AI, ChatGPT health

Resumen

Uso los modelos de lenguaje grandes (LLM) como asistentes virtuales de salud en el Ecuador.

Introducción: Artificial Intelligence (AI) has emerged as a transformative force in healthcare, offering solutions that enhance communication, decision-making, and operational efficiency. Among the most promising innovations are Large Language Models (LLMs), such as ChatGPT, which have demonstrated potential in supporting clinical workflows and improving patient outcomes. **Objetivos:** This study aims to analyze the feasibility, benefits, and challenges of implementing LLMs as virtual health assistants in Ecuador, within the framework of the country's 2023 Digital Health Agenda. **Métodos:** A qualitative review of official government documents, international health policies, and academic literature was conducted. Focus was placed on the integration of AI technologies into healthcare systems, particularly in Latin America, and the specific case of Ecuador's digital transformation efforts. **Resultados:** LLMs can automate a significant portion of healthcare tasks, potentially alleviating workforce shortages and increasing access to quality information. In Ecuador, the national agenda supports AI-based pilot projects; however, implementation faces barriers such as lack of regulation, limited digital infrastructure, and resistance to cultural change in healthcare environments. **Conclusión:** While LLMs offer significant opportunities to strengthen Ecuador's healthcare system, success depends on coordinated strategies, public-private investment, and updated regulatory frameworks. Their use as virtual assistants can bridge critical gaps in access and efficiency, especially in underserved populations.

Palabras clave: Inteligencia Artificial, Modelos de Lenguaje Largos, IA Sanitaria, ChatGPT salud

Resumo

Uso de Grandes Modelos de Linguagem (LLM) como assistentes virtuais de saúde no Equador

Introdução: A inteligência artificial (IA) está revolucionando diversos setores, incluindo a saúde, ao introduzir soluções inovadoras comparáveis ao impacto da máquina a vapor. A IA pode melhorar significativamente a vida das pessoas, proteger o planeta e promover a prosperidade. Um exemplo notável é o reconhecimento automático de voz, que facilita a comunicação entre humanos e computadores. **Objetivos:** Este estudo tem como objetivo explorar a importância e os desafios da adoção de grandes modelos de linguagem (LLMs) como assistentes virtuais de saúde no Equador, e como esses modelos podem contribuir para a melhoria da qualidade dos serviços de saúde, especialmente no contexto da Agenda de Saúde Digital de 2023 do país. **Métodos:** Foi realizada uma análise de documentos oficiais, relatórios de políticas de saúde e iniciativas recentes no Equador. A ênfase recaiu sobre o papel das tecnologias de IA, especialmente os LLMs como GPT-3, GPT-4 e Med-PaLM 2, no apoio aos sistemas de saúde na América Latina. **Resultados:** Os LLMs estão transformando a saúde ao reduzir a carga administrativa dos profissionais e melhorar a precisão das decisões clínicas. Eles aumentam o acesso à informação personalizada e promovem maior engajamento dos pacientes. A IA pode automatizar até 36% das tarefas no setor de saúde e assistência social, ajudando a enfrentar a escassez de profissionais nos países da OCDE. No Equador, embora a Agenda de Saúde Digital de 2023 promova a IA por meio de projetos-piloto, a ausência de marcos regulatórios claros, políticas públicas de apoio, infraestrutura e cultura digital limita sua implementação mais ampla. **Conclusão:** Apesar dos avanços globais da IA na saúde, o Equador ainda enfrenta desafios estruturais e regulatórios que limitam a aplicação dos LLMs. No entanto, com investimentos direcionados e desenvolvimento de políticas, essas tecnologias têm o potencial de melhorar significativamente a qualidade e o acesso à saúde em todo o país.

Palabras-chave: Inteligência Artificial; Grandes Modelos de Linguagem; Inteligência Artificial na Saúde; ChatGPT na área da saúde

INTRODUCTION

Artificial intelligence (AI) is transforming various sectors of humanity, including healthcare. Its potential to significantly enhance lives and promote prosperity[1] is evident in innovations like automatic speech recognition, which facilitates communication between humans and computers.

Large language models (LLMs) are capable of analyzing vast amounts of data and providing accurate answers. In healthcare, these models support diagnoses, recommend treatments, and optimize the management of medical record.[2] They work as learning machines that absorb extensive text and decipher their rules. To do this, they use specialized algorithms that act as instructors, teaching them the different structures and patterns in natural language.

LLMs process large amounts of data and are among the largest models due to the extensive number of parameters determining their ability to generate text accurately[3]. While their potential is significant, the limited training on specific medical data restricts their use in clinical practice. Furthermore, in Latin America, these technologies face challenges associated with digital infrastructure, research investment, and regulatory development.

LLMs are transforming the healthcare industry by reducing administrative burdens and improving medical decision-making. Their greatest impact lies in empowering patients through personalized information and effective communication, improving health outcomes.[4] LLMs help understand and generate human-like text, facilitating complex medical tasks and improving patient care. Their potential includes extracting key information from electronic medical records and medical literature to support informed decision-making.[5]

In addition to optimizing decision-making, AI can automate numerous tasks within healthcare, enabling professionals to spend more time on direct care. This approach could help reduce the projected staff shortage and elevate the quality of clinical work.[6] In 2023, JAMA mentioned that while general-purpose LLMs are capable of performing medical-related tasks, they have not been trained on medical records or specific preparation for the tasks of these professionals. This limitation hinders their direct use in the healthcare sector.[7]

LLMs in Latin America and the Caribbean have the potential to revolutionize health service delivery, despite the economic, social, and technological differences that may impede their adoption. While countries such as Brazil, Mexico, and Uruguay are leaders in the sector, others face barriers to health investment, research funding, and perceptions of their implementation. Understanding this situation involves analyzing not only health investment but also research funding and challenges related to perceptions and barriers within the health system.[8]

According to a study conducted by the IDB, most LAC12 countries have laid solid governmental foundations by developing their AI systems in line with state initiatives aimed at improving connectivity, expanding infrastructure, implementing national digitalization strategies, promoting the use of open data, and developing national AI agendas[9]. However, there are no known other publications on Large Language Models (LLM) in the region, indicating a potential area of opportunity for future research and development in this field.

Ecuador's 2023 Digital Health Agenda seeks to drive the digital transformation of healthcare providers by promoting an innovative digital ecosystem and specific solutions for health challenges[10]. These solutions, including AI pilots, will allow progress within the framework of global commitments and be a regional benchmark for technological innovation in health.

A significant challenge facing the Ecuadorian Health System in adopting AI is the absence of clear regulatory frameworks and public policies that promote the ethical and responsible use of this technological innovation. This encompasses data protection and privacy, as well as the prevention of algorithmic bias and discrimination. Also, it contributes to its Digital Agenda such as cultural change, technological infrastructure, and investment in research and development.

In line with the above, the following research question emerged:

What are the importance and challenges of adopting large language models (LLMs) as virtual health assistants in Ecuador? How can these models improve the quality of healthcare in the context of the 2023 Digital Health Agenda?

METHODOLGY

This review presents a narrative literature analysis that examines the importance of large language models (LLMs) as virtual health assistants. The focus is on identifying and analyzing relevant studies addressing the impact, usage, and challenges associated with the implementation of LLMs in healthcare. To achieve this, various scientific databases, including Springer Link, Google Scholar, PubMed, and Scopus were consulted, utilizing combinations of keywords related to artificial intelligence in healthcare and large language models. The selection of literature was based on content relevance for the propose.

analysis, with an emphasis on studies that provide a comprehensive view of the use of LLMs in healthcare and their impact on the digital health ecosystem.

Some keyword combinations from the search included:

- "Inteligencia artificial en salud" AND "Modelos de lenguaje grandes"
- "LLM en atención médica" AND "ChatGPT"
- "Asistentes virtuales de salud" AND "Ecuador"
- "Transformación digital en salud" AND "Algoritmos de IA"
- "ChatBots en salud" AND "Modelos de lenguaje grandes"
- "Innovación tecnológica en salud" AND "Agenda Digital de Salud 2023"
- "Impacto de LLM en la atención médica" AND "Ecuador"
- "Aplicaciones de ChatGPT en salud" AND "Transformación digital"
- "Agenda Digital de Salud 2023" AND "Inteligencia artificial"
- "Desafíos en la adopción de LLM" AND "Salud en Ecuador"

RESULTS

The results demonstrate that LLMs have great potential to transform healthcare by improving its accuracy, efficiency, and personalization services. However, technical, ethical, and contextual challenges must be addressed to ensure successful and equitable implementation.

Importance of LLMs as Virtual Health Assistants:

LLMs, such as ChatGPT, have the potential to transform the healthcare industry by improving diagnostic accuracy, expediting decision-making processes, and decreasing the administrative burden on healthcare professionals. Research shows that these technologies can empower patients by facilitating access to personalized information and fostering better communication and shared decision-making [11].

These models can serve as vital virtual health assistants, providing medical information, addressing patient inquiries, and assisting in health management. This can improve accessibility and efficiency within healthcare, enabling professionals to focus on more complex and personalized tasks[12]. They can also perform tasks such as text generation and answering medical questions, showing near-human performance in medical Q&A benchmarks.[13]

Challenges in LLM Adoption

The use of LLMs in healthcare is experiencing sustained and increasing interest due to their potential benefits in areas such as diagnostics, predictive medicine, and personalized treatment, among others. However, several significant challenges must be addressed for their successful adoption.

It is essential to critically examine how these models will transform medicine and to actively engage in their development, validation, and use. This process involves the provision of relevant training data, clear specifications of the intended benefits, and thorough evaluations of these benefits through real-world testing[14]. LLM-powered applications are increasingly being used to perform medical tasks without the underlying model having been trained on medical records, highlighting the need for appropriate oversight in their development and application[15].

Therefore, it is essential to ensure the accuracy and reliability of the information generated by LLMs to avoid errors that could compromise patient safety. Protecting data privacy and security is crucial, as is the effective integration into clinical workflows without affecting existing dynamics. Also, gaining the trust of professionals and patients is crucial for the successful implementation of these technologies[12]. In this context, patient safety and accuracy are more important than human-like interactivity. Furthermore, the limitations related to bias and a lack of precise details in web-based training content are important [13].

According to Venerito et al., LLMs accelerate workflows. However, reliance on these models without an appropriate indication compromises medical accuracy[16]. For this reason, they consider it necessary to work on the methodical construction of indications and the evaluation of model results so that researchers can maximize relevance and utility.

At the ethical level, the risk of misinformation and the possibility that these models may be used to generate misleading or malicious content, such as phishing messages is another challenge when using LLMs. This raises concerns about the security and integrity of information in the healthcare setting [17].

On the other hand, LLMs in healthcare face several technical challenges. Ensuring the quality of training data is crucial to prevent inadequate

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responses, and the lack of automatic updates restricts their adaptability to new knowledge. Furthermore, the high computational costs involved can hinder their widespread implementation.[14]
When LLMs are used in specialties such as neurology, their major challenge is their ability to handle the complexity of narratives in neurology examinations. These examinations require a deep understanding of neuroanatomy, neuropathology, and neurophysiology, which can be difficult for language models struggling in situations requiring a nuanced understanding of context or specialized technical language. Furthermore, LLMs tend to generate confident answers even when they are incorrect, which can lead to misunderstandings in clinical practice[18].

Improving the Quality of Medical Care:

The use of LLMs, such as ChatGPT, has demonstrated impressive accuracy in clinical decision-making, and its particular strengths emerge as more health information becomes available[18,19]. Artificial intelligence in general has the potential to improve patient diagnosis and monitoring, which could lead to improvements in the quality of healthcare. This is because AI can help healthcare professionals make more informed and efficient decisions in their daily practice[18].

The optimization of clinical workflow and the responsible use of radiology services is a context with the greatest potential impact regarding the use of LLMs. Therefore, the integration of AI-based tools, such as ChatGPT, into existing clinical workflows could improve the efficiency and effectiveness of patient care[20].

According to Eggman et al., LLMs can improve the quality of healthcare by increasing efficiency in written communication and record keeping, potentially helping healthcare professionals to have more time to focus on other important tasks[17]. According to this study, LLMs could also improve patient care and reduce costs, in addition to facilitating multilingual communication, helping to overcome language barriers in patient interactions.

However, achieving effective integration of LLMs into healthcare requires investments in AI literacy and capacity building for both healthcare professionals and patients. This is essential to ensure the ethical and responsible use of AI and to maximize its potential benefits [11, 21].

DISCUSSION

Integration of the Ecuadorian Context

The results obtained reveal the potential of LLMs in healthcare, particularly for improving diagnostic accuracy, the efficiency of clinical processes, and the personalization of care [1,22]. However, for their implementation to be effective and equitable in the Ecuadorian context, it is necessary to address challenges related to the maturity of health information systems, data privacy, and inequalities in access to technology.

Implementation Challenges in Ecuador

In Ecuador, the integration of LLMs within the healthcare sector requires strengthening the maturity level of information systems, especially for the implementation of interoperable Electronic Health Records (EHRs), which facilitate the collection of quality and timely data and information. Currently, the absence of structured clinical databases that adhere to international standards represents a significant challenge. Access to high-quality and diverse data is essential for the effective training of these models, as insufficient or biased data can generate inaccurate responses and limit the models' ability to generalize in Ecuador.

Data privacy is another critical challenge in this country. Although Ecuador has established regulations for personal data protection, decision-makers in the healthcare and telecommunications sectors must refine these regulations for the implementation of LLMs in healthcare. The protection of clinical information must be ensured at every stage of the development and use of these models, minimizing the risks of improper exposure and ensuring compliance with ethical standards in their implementation.

Clinical and Educational Applications

LLM applications in healthcare can not only optimize medical care but also strengthen the education and training of healthcare professionals. AI-based chatbots can be used in patient triage, appointment management, and mental health support, in addition to facilitating medical research. Their ability to answer evidence-based clinical questions enhances the training of students and professionals, strengthening continuing medical education and clinical decision-making.
However, to maximize these benefits, it is critical to invest in AI literacy for both healthcare professionals and patients. Education on the use of these technologies will enable ethical and responsible use, reducing the risks associated with misinformation and overreliance on model-generated responses [11, 21].

Regulation and Inequalities in Latin America

In the context of the digital transformation in healthcare initiated by the governing body in

Ecuador, it is essential to establish clear regulations on data confidentiality and the prevention of bias in AI models. AI systems must be designed to be auditable and accountable, reducing the likelihood of clinical errors and ensuring their safe and effective use. Legal responsibility in this regard must fall on both the development teams and users, ensuring control mechanisms that prevent the misuse of these tools. At the regional level, the implementation of LLMs in Latin America and the Caribbean has the potential to deepen existing inequalities and gaps in healthcare due to differences in technological infrastructure and access to digital resources across countries. Inclusive strategies are required to ensure that countries with less development in digital health are not left behind in accessing the benefits of these technologies. Research findings highlight the necessity of creating specific policies and strategies that consider the specificities of each country to prevent digital exclusion and ensure that advances in AI contribute to reducing
gaps rather than deepening them.

CONCLUSIONS

Collaboration across multiple disciplines and sectors is crucial for technological transformation in Ecuador. It is essential that the public, private, and academic sectors work together to implement the country's digital transformation, ensuring the proper execution of each of the strategies outlined in the digital agenda, such as Artificial Intelligence in the healthcare sector.

In Ecuador, the lack of digital infrastructure represents a significant challenge to the democratization of the benefits of artificial intelligence (AI). It is necessary to improve internet connectivity and robust data centers that can handle the computational requirements of AI applications in this sector.

The central government must prioritize Artificial Intelligence to ensure funding for AI research and development, which is limited. Without adequate investment, it is difficult to drive innovation and the adoption of advanced technologies in the country.

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