Artificial intelligence in healthcare

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Preamble

Artificial Intelligence (AI) has emerged as a transformative force in various fields, and its potential in medicine is particularly remarkable. The application of AI in healthcare holds immense promise, as it has the ability to revolutionise medical practice and the delivery of healthcare services. Over the past decade, AI has made significant strides in numerous medical specialties, presenting opportunities to enhance patient care, diagnostics, personalised treatment plans, and administrative processes within healthcare organisations. However, despite the tremendous opportunities presented by AI in medicine, there are also significant challenges to overcome.

Intelligence vs Artificial Intelligence

Exploring the concepts of intelligence and artificial intelligence (AI) is crucial for gaining a comprehensive understanding of their implications.

Intelligence is a fundamental aspect of human capability. It encompasses various abilities, including calculation, reasoning, perception of relationships, learning from experience, memory retrieval, problem-solving, comprehension of complex ideas, fluent use of natural language, classification, generalisation, and adaptability to new situations. These cognitive abilities collectively define intelligence.(1)

On the other hand, artificial intelligence (AI) refers to the simulation of intelligent behaviour and critical abstract thinking comparable to that of a human being using computers and technology.

History and background of AI

Coined by John McCarthy in 1956, AI represents the science and engineering behind creating intelligent machines capable of autonomously making decisions and performing actions on behalf of humans.(2) AI is not a singular technology but rather a collection of software and hardware components that support various areas such as machine learning, computer vision, natural language processing, and robotics.(3) In the book "Artificial Intelligence: A Modern Approach," Russel and Norvig classify AI into seven components: reasoning and problem-solving, knowledge representation, planning and social intelligence, perception, machine learning, robotics (motion and manipulation), and natural language processing, each of which can be further subdivided into subsets.(4)

The history of AI traces back to figures like Alan Turing, one of the pioneers of modern computers, who developed the Turing test in 1950. This test evaluates a computer's ability to exhibit human-level performance in cognitive tasks. The interest in AI surged during the 1980s and 1990s, and in recent years, there has been a growing focus on developing new healthcare models leveraging AI technology.(2)

Understanding the nuances of intelligence and AI is essential as these concepts shape our perception of human cognition and lay the foundation for the development of intelligent machines. By delving deeper into the history and classifications of AI, we can appreciate the progress made in this field and anticipate the potential impact of AI on various industries, including healthcare.
**Healthcare AI**

The integration of AI into the healthcare industry, known as healthcare AI, consists of a range of technologies such as machine learning, natural language processing, and deep learning. These cutting-edge tools have been employed to address various challenges and improve different aspects of healthcare.

**Diagnostics and management**

By leveraging AI, healthcare providers can derive meaningful insights, make accurate diagnoses, and develop tailored treatment strategies for individual patients. An AI system which was developed in China with the capability to diagnose paediatric diseases using available clinical data has shown similar proficiency to clinicians. Diagnosis of cardiac arrhythmias and epilepsy in real time were also made possible using wearable AI. AI excels at analysing vast amounts of data, allowing medical professionals to identify disease markers and trends quickly and accurately. It also allows early disease detection by evaluation of radiological images and predicts patient outcomes. In North London, AI algorithms are used to prioritise emergencies for one million patients, surpassing the capabilities of a single physician.

**Administrative tasks**

Furthermore, AI has the potential to streamline administrative processes within the medical field. Tasks like medical coding, billing, and patient scheduling can be automated, reducing the burden on healthcare professionals and enabling them to focus more on patient care. AI performs tasks such as digitising medical records and providing reminders for follow-up appointments or immunisations. For example the new generation of chatbots can help with medical documentation. There are new programmes such as "Ambient Clinical Intelligence" that can analyse the conversation between a doctor and a patient and develop an electronic health record. Another programme called "Babylon" in the United States arranges patients' appointments and routine tests. This increased efficiency in operations can lead to cost reductions and improved resource allocation within medical organisations.

**Research, scientific writing and publishing**

The advent of AI has empowered scientific publications by leaps and bounds. Those which once seemed to be laborious tasks are now made efficient, accurate and easy by AI powered tools. An AI tool is available to enhance efficiency in almost all aspects of scientific writing and publishing. From starting a literature search (eg: using Google Scholar), gathering relevant articles and organising (eg: Mendeley, Zotero), summarising and extracting information (eg: Scholarcy), analysing (eg: Tableau), citing and creating bibliography (eg: Zotero), running the grammar and language check (eg: Trinka) to the final plagiarism check (eg: Turnitin) are now made efficient by AI tools.

**Drug development and innovation**

Applications of AI in clinical development, manufacturing, patient surveillance, and post-market surveillance are already being utilised by healthcare providers, insurers, and life sciences companies to streamline processes and improve care. The field of surgery has achieved commendable reductions in postoperative complications by robotic surgeries which are minimally invasive and higher in precision than conventional procedures.

All in all, healthcare AI holds immense potential to revolutionise healthcare practices and improve patient outcomes. It enhances diagnostics, personalised treatment plans, and administrative processes, leading to cost reductions and improved resource allocation. With its wide-ranging applications, AI is transforming the healthcare industry and providing optimal care to millions worldwide.

**Limitations and challenges**

While AI technology in healthcare brings excitement and optimism, it is vital to address its limitations and concerns.

**Data quality and quantity** pose a significant challenge, as AI systems rely on robust and representative data for optimal performance. For example Machine Learning technology which is used in image recognition, speech recognition, etc. enables learning automatically from raw data to generate models that make accurate predictions.

**Ethical implications** surrounding AI in healthcare are multidimensional. These include data privacy and responsible use of patient information, potential biases in AI algorithms, accountability and transparency.

**Security risks**, such as data breaches and
AI in academic research and publication is a double-edged sword. Despite its numerous positive applications that enhance efficiency and accuracy, various motives such as financial gains, career advancements, and recognition in the competitive academic world could drive those conversant with new AI technologies to misuse them in producing fabricated research, encouraging fraud and contaminating the body of scientific research. The repercussions of such misuse maybe so grave as to impact new health policies and therapeutic interventions.

Failure to address algorithmic biases can exacerbate health disparities and inequitable outcomes. In addition to these, mistakes could be made by AI tools giving rise to the issue of accountability since it is difficult to establish accountability in such a situation.

Transparency in AI models is crucial for user trust and understanding but is equally challenging to manifest due to the complicated nature of the technology which the service provider might find difficult to explain and the recipient find difficult to understand.

Certain human traits like critical thinking, communication, and empathy cannot be fully replicated by machines, raising concerns about patient-provider relationships and care quality. It is important to recognise that AI cannot entirely replace human healthcare professionals, as their expertise and judgement remain essential.

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By addressing these challenges, we can harness the potential of AI in healthcare while ensuring patient privacy, trust, ethical use, and equitable outcomes.

**Future of AI**

The future of AI in healthcare holds immense potential for revolutionising the industry and benefitting individuals worldwide. With advancements in AI, we can expect sophisticated applications that improve patient care, diagnostics, and healthcare processes. However, it is important to address challenges such as data privacy, ethics, and responsible AI use. By carefully implementing AI, we can transform healthcare and improve countless lives. While concerns exist about developing soft skills in AI systems, future advancements may enable the extraction of the best characteristics from both humans and machines, resulting in empathetic AI. Striking a balance between effective AI use and preserving the unique capabilities of the human brain is crucial.

Although there is apprehension about AI displacing human medical jobs, proactive management and oversight can harness the maximum benefits from AI systems. By embracing AI technology while preserving the human element in medicine, we can navigate this transformative era and leverage its full potential in healthcare.

It is important that all the medical professionals get well conversant with the application of AI since we are roaming in an unknown territory. It is high time that AI is incorporated into the curriculum of primary and secondary education in Sri Lanka as well as to the medical curriculum.

**Conclusion**

Advent of AI has revolutionised healthcare and holds great promise for further development. However, certain challenges must be overcome for successful implementation. These challenges include data quality, transparency, ethics, biases, impact on human skills, high costs, security risks, and research protocol concerns. By overcoming these challenges, we can maximise benefits from AI while prioritising patient safety, privacy, and equitable healthcare outcomes. It is crucial to foster education and training that prepares healthcare professionals to effectively utilise AI in medicine and to continue exploring and developing practical applications.
There should be a fine balance between the effective use of AI without losing the automation of the human brain. This will ensure that AI technology is harnessed responsibly and effectively to revolutionise healthcare practices and improve patient outcomes.

References