Advantages of AI for healthcare in developing countries

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Abstract

Artificial intelligence (AI) refers to the capacity of computers or computer-controlled machines to undertake tasks typically necessitating human intelligence, encompassing processes such as reasoning, comprehension, generalisation, and learning from previous experiences. Over the past few decades, AI has experienced a significant surge and has witnessed a societal transformation, particularly with the advent of OpenAI's public models. Subsequently, its applications have extended to various domains, including the medical field. Artificial Intelligence has been a game-changer in various fields, and healthcare is no exception. AI can learn how to predict the outcome based on the input data meaning these algorithms can analyse medical images to detect signs of diseases such as cancer or heart disease. For developing countries, the focus often lies more on improving diagnostic capabilities rather than fine-tuning accuracy, given that lack of access to accurate diagnosis is a pressing issue. AI could help bridge this gap by providing faster and more reliable diagnostic support, especially in regions where there is a shortage of healthcare professionals or specialised medical facilities. This prompts the question: "Can AI find utility in healthcare within developing countries struggling with a great demand for doctors, and if so, how dependable and impactful could it potentially be?" We must also consider ethical, privacy, and regulatory aspects while advancing these technologies to ensure responsible and equitable deployment.

Keywords: Artificial Intelligence, Healthcare, Developing countries, Technology

1. Introduction

AI's ability to mimic human intelligence is a testament to its potential. This impersonation is achieved through the use of artificial neural networks, which are designed to replicate the way neurons function in the human brain. These networks consist of interconnected layers of nodes, or "artificial neurons," each of which can process information and pass it on to the next layer. Training these artificial neural networks involves a variety of methods, including supervised learning, unsupervised learning, and reinforcement learning. In supervised learning, the algorithm is trained on a labelled dataset, where the correct answers are already known. This allows the AI to learn how to predict the outcome based on the input data. Unsupervised learning, on the other hand, involves training the AI on an unlabelled dataset, allowing it to identify patterns and relationships in the data on its own. Reinforcement learning involves training the AI through trial and error, rewarding it for correct decisions and penalising it for incorrect ones. Over time, through continuous training and learning, these algorithms can become adept at identifying a wide range of diseases and conditions. They can analyse vast amounts of data quickly and accurately, making them invaluable tools in medical diagnosis. For instance, AI algorithms can analyse medical images to detect signs of diseases such as cancer or heart disease.

2. Motivation

In the summer of 2023, we had a trip to Uganda where we raised money to open a medical camp in the city of Jinja, this medical camp had around a 1000 people visit to get checked up as most people there had not seen a doctor in years, maybe their lifetimes. There we saw the biggest problem: not enough doctors as there were only 4 doctors for all the patients, as a result the camp was operating very slowly. There we also saw that what the doctors were doing was only medical diagnosis, so we thought why this could not be sped up or increased by AI, as not only the 4 doctors were not enough but a good chunk of the budget went to them, so when we got back, we started researching about how AI could help us improve this this process.

3. Problem

To be able to understand the healthcare challenges in developing countries, we have looked at the health statistics that distinguish them from their developed counterparts. The prevalence of infectious and parasitic diseases is alarmingly higher, with a mortality rate of 41.5% compared to just 1.2% in developed nations (World Health Organization, 2020). These numbers underscore a lack of healthcare infrastructure, clean water, sanitation, and basic health services-factors that are fundamental to improving healthcare in these regions.

In comparison, developed countries primarily contend with non-communicable diseases such as heart attacks and strokes, with a leading cause of death at 46.7% (World Health Organization, 2020). However, in developing countries, these conditions account for only

10.7% of deaths (World Health Organization, 2020). This contrast highlights a different reality: the lower incidence of non-communicable diseases is not a sign of better health but a reflection of shorter life expectancy due to preventable infectious diseases.

Compounding these issues is the shortage of medical professionals in developing regions. The data reveals a severe imbalance in the availability of doctors, with a significantly lower ratio of medical practitioners per capita than in developed countries. This shortage leads to overwhelmed healthcare facilities, prolonged patient wait times, and a reliance on under qualified health workers.

These statistics paint a clear picture of the healthcare crisis in developing countries. Addressing this crisis goes beyond merely improving numbers; it's about fundamentally transforming the healthcare landscape to ensure accessibility, efficiency, and quality of care for all.
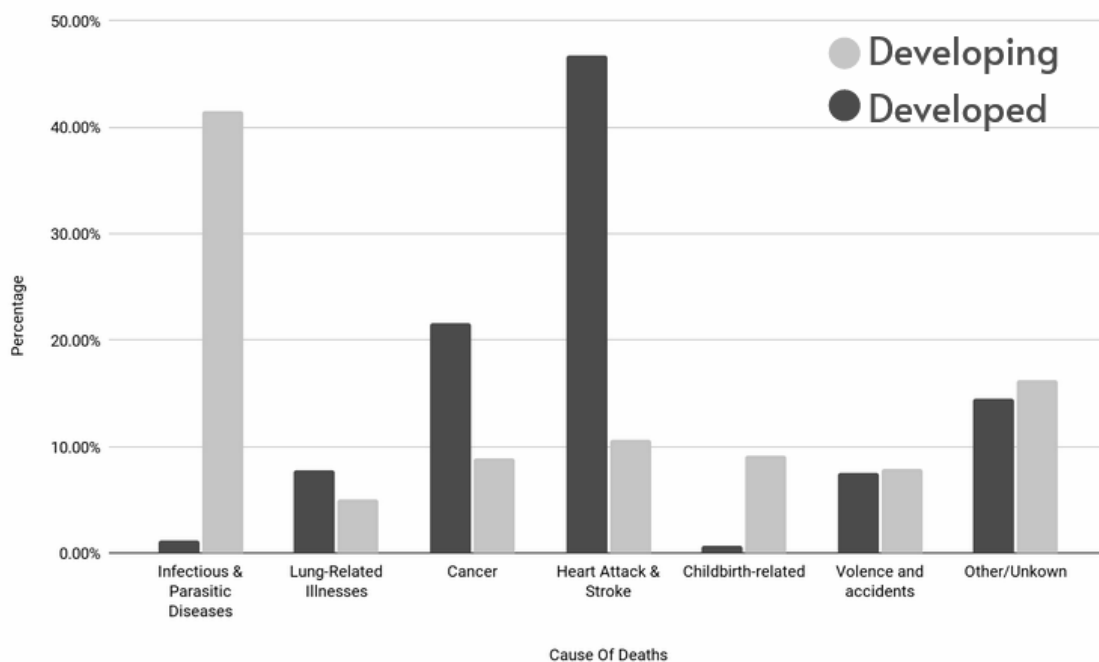
Fig 1. Cause of Death in Developed vs Developing Countries (chart by authors, data by World Health Organization)

4. Artificial Intelligence

Artificial intelligence or AI refers to the ability of computer systems to undertake tasks that would typically require human intelligence. AI at the most basic level is a program that is fed data and uses that data to predict outputs. Recently AI has skyrocketed through open AI's chatGPT models. While being very widespread among students, we wanted to take the idea of AI and weigh its implementation to solve crucial problems we observed during our trip.

How can AI be used in healthcare? AI is able to analyse large amounts of data from existing patients of diseases and using machine learning and neural networks it can make patterns to identify these diseases. Then patient data can be uploaded, and the AI can analyse the images according to the patterns it has made and diagnose the patient. This form of diagnosis is not just a proposal as it has already been in use, for example a research study done by Dabowsa and colleagues in 2017 used a neural network in identifying skin cancer and achieved high accuracy(Dabowsa, 2017), another research done by Sana Ansari and Imran Shafi in 2011 used a neural network to diagnose the liver disease hepatitis virus, this model achieved 97.59% accuracy (Sana Ansari, 2011) showing that if applied AI can even be more accurate than doctors.

Another benefit of introducing AI in developing countries is also opening jobs in the IT field. AI is able to create jobs in previously unexplored areas such as machine learning and data science. We can see examples of this throughout history, for example the invention of These jobs will not only be financially beneficial for people but also make the economy better and advance the country (Bessen, 2017).

4.1 Errors of AI

However Even though artificial intelligence seems very good so far there are many errors it can have especially in situations where there are two options such as medical diagnosis where the patient either has the disease or doesn't. There are three errors that can happen, the first one is type 1, it is when there is a disease, but the AI says to not apply treatment as it does not detect it, this can have very harmful effects as the patient will most likely stay sick and it might even get worse. The second error is type 2 error, this is when there isn't a disease but the AI says to do treatment as it detects the disease, this likely will only be harmful if the treatment makes people without the disease worse, which is rare, but this causes financial loss as there will be a treatment wasted on someone that does not have the disease. The last error is a mix of the two, where the AI doesn't identify the disease the person has but somehow identifies another disease which will be the most harmful as it not only leads to treatment loss but also progression of disease on the patient.

		Prediction from AI	
		Apply treatment	**Don't apply treatment**
Actual Situation	**Disease exists**	Correct conclusion	Type I error • Most likely harmful • Progression of disease
	Disease doesn't exist	Type 2 error • Can be harmful • Treatment loss	Correct conclusion

Fig 2. Errors of Artificial Intelligence (by authors)

4.2 AI's impact

Even though AI can have errors, for countries where millions of people don't have access to any doctor visits it can provide a big improvement, as AI can do what doctors can do and even faster, also it is cheaper as money is a problem for developing countries and the people in them, another positive factor of AI will be opening another industry in these countries that can provide jobs to people that need them and also boost the economy. One counterargument is that if the people can't get enough resources for doctors how can they get the treatments that might even be more expensive than the visit? This is a valid point however a lot of sicknesses can be solved without expensive medicine or even without medicine at all, for example something like antibiotics can cure a lot of diseases and is cheap, and even if it can't be cured knowing the disease can help contaminate it, for example smallpox, even though it might not get cured knowing someone has it and quarantining that person can save thousands of lives, as before smallpox has killed millions who were not aware of it.

5. Conclusion

In conclusion, the evolution of Artificial Intelligence and its subsequent integration into medical diagnostics offers an optimistic future, especially for developing nations grappling with limited medical resources. The challenges faced in areas like Uganda, with dire doctor shortages, underscore the transformative potential of AI in providing timely and accurate diagnosis. As AI continues to advance, its capability to diagnose conditions—some of which might have previously required specialist attention—can significantly enhance the reach of medical care. Moreover, the inclusion of AI doesn't just serve as a medical boon; it could pave the way for job creation in cutting-edge fields like data science and machine learning. While the march of AI in healthcare is promising, it's imperative that its introduction is accompanied

by careful ethical, privacy, and regulatory considerations to ensure it benefits all layers of society equitably.

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