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Editorial

Artificial Intelligence for Healthcare Systems of Developing World: Opportunities and Risks

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Artificial Intelligence (AI) is now everywhere. It refers to systems that demonstrate intelligent behavior, such as the ability to analyze their environment to take action that is typically displayed by humans and animals. AI-embedded devices possess the ability to learn through example scenarios and past data presented to the system. The word AI was first introduced to the research community in 1956 at a conference at Dartmouth College in the United States [1]. With time, the AI industry expanded from data to information, then to knowledge, and ultimately to intelligence. Due to the depth and breadth of learning capacity associated with AI technologies, today it has become one of the hottest research areas, finding applications in but not limited to computer vision, marketing, industrial automation, big data, and the Internet of things (IOT).

AI has the potential to transform the entire landscape of healthcare, as it can be applied in diagnostics (especially for early detection), treatment planning, and evaluation of prognosis [2]. For example, in medical imaging, visual representations of parts of the human body such as organs, bones, and tissues, are created for clinical purposes for monitoring, diagnosing, and treating diseases and injuries. Analysing these medical images for diagnosis using machines has taken flight in the past decade owing to the advancement in electronic and AI technologies. This development possesses the potential to improve patient care while reducing the labor and cost of the healthcare system. In line with this positive prognosis, many high-income countries have already integrated AI into their healthcare systems [3]. One of the very first deep learning-based applications approved for clinical use was the retinopathy detection software (IDx-DR) by Digital Diagnostics (formerly known as IDx) released in April 2018 [4].

In 2017, United Nations (UN) convened the "AI for Good Global Summit" with the objective of identifying the potential of using AI in delivering critical public service in developing countries [5]. In the developing world, the rapid increase in population with restricted specialised labour and capital, imposes a huge pressure on its healthcare system. In such environments, the healthcare system demands innovative yet efficient technologies to complement the existing system by reducing the cost and human labour requirements. AI has shown potential for improved delivery of services in low-resource settings.

Applications of AI in Health Care

AI-embedded machines are expected to simulate intelligent behaviours. Although the popular culture expects artificial general intelligence from AI-enabled machines and applications, given the complex nature of this technology many researchers focus on artificial narrow intelligence. In artificial narrow intelligence, machines and algorithms are trained to perform a specific task. AI for healthcare is one

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application where artificial narrow intelligence is utilised to make problem-specific intelligent decisions. In literature there exist many applications, which discuss how to implement AI systems in healthcare with resource-poor settings. These applications at most incorporate existing infrastructures of developing countries such as data centres, and IT resources to introduce AI-driven healthcare applications, contrary to requesting for new capital investments.

A recurring research area in AI-driven healthcare is Expert Systems, where machines/algorithms are trained to solve a specific problem using the base knowledge of the problem and the reasoning approach. For example, Fuzzy logic system was presented for Cholera Disease Detection in [6].

Machine Learning (ML) is a subcategory of AI which incorporates supervised, unsupervised, or reinforcement learning methods to analyse data to identify patterns present. In the recent past, ML and Deep Learning (a sub-field of ML) algorithms are tested exclusively for healthcare applications. A few examples of scenarios are detecting tumours using Magnetic Resonance Imaging (MRI) [7], estimating the effectiveness of treatment plans [8], and data analysis of wearable sensors such as fitness trackers to aid patient care [9].

AI planning tools that study automated planning and scheduling techniques, could be adopted to improve the utilisation of human labour in healthcare, cost-effective management of emergency rooms (ERs) and operating theatres (ORs), plan day-to-day clinics, and maintain pharmaceutical drug delivery systems [10].

These AI systems can support healthcare staff such as physicians to diagnose and choose treatment plans from remote locations using the available data while considering the behaviour and experience of patients from the same remote geographical location. Healthcare officials can plan the preventive methods and treatment process by considering the projection of the availability of drugs, vaccination history, and possible outbreaks. Researchers in Philippines have developed an ML algorithm to predict dengue occurrences with increased accuracy using past field data [11]. In some instances, digital health platforms can be used at remote or low-resource locations to act in place of human experts, if one is not readily available. For instance, in Nigeria, mobile phone recordings of an infant's cry are used successfully to predict possible birth asphyxia [12].

Challenges and Risks

As mentioned earlier, AI in healthcare utilises an artificial narrow intelligence approach. Hence for successful implementation of AI techniques in healthcare, it is essential to clearly identify a specific problem with a specific solution. Further, up-to-date field data is an essential component when it comes to AI systems. Data collection, privacy preservation, data interpretation, and model updating at regular intervals play a key role in the successful deployment of these AI technologies. For instance, the effectiveness of AI-based scheduling applications depends highly on an updated accurate large quantity of data. If the data is outdated, the predicted outcome and the planned schedules, would not carry any meaningful information.

Another key challenge faced by AI technology at deployment is the maintenance of trust with the clients. Accuracy tracking mechanisms of these expert systems may assist to build the trust between clinicians and patients when it comes to the exactness of the system output. IT infrastructure of the developing nations and the IT literacy of the health sector employers also affect the deployment of these technologies. In some instances, new facilities need to be built, and officers need to be trained to manage and maintain the expert systems.

AI-based healthcare, unfortunately, comes with a risk as well. System error or algorithmic error can outperform the advantages. Hence it is essential to have regular, maintenance checks. Moreover, for

the safer side, it is better to have AI-based health care as a complementary system that works hand in hand with the human expert.

In conclusion, AI holds a remarkable potential to transform healthcare sectors in the developing world. The difficulties faced by developing countries due to a lack of specialised services, and resource limitations can be tackled using AI-enabled tools. Routine preventive service planning, scheduling, and execution can be effectively managed by coherently analysing past data and predicting patterns. Successful expert systems can be carefully designed using readily available electronic devices, such as mobile phones with access to cloud processing to strengthen disease detection and prevention in resource-poor settings. However, effective deployment of these services would require a good understanding of the social, economic, and political context of the local community. Further research into AI in resource-poor environments, would facilitate an archive of sustainable development in healthcare sectors in developing countries.

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