

Harnessing the Potential of Artificial Intelligence and Machine Learning Technologies in Building the Future of Healthcare Services

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Abstract

The immense potential of Artificial Intelligence (AI) and Machine Learning (ML) can enhance and revolutionize current and future healthcare. It can have widespread applications ranging from medical technology in diagnosis and treatment, manufacturing of medicines, improving healthcare administration and economics, upgrading medical education, skill and training, as well as in medical data management and analysis. It is imperative for doctors, healthcare practitioners as well as all healthcare workers and allied healthcare personnel to orient and familiarize themselves with AI and adapt to its incorporation and application in healthcare.

Keywords: Artificial Intelligence, Machine Learning, Computerized Numeric Control, Centralized Monitoring System, Geofencing, Big data

Introduction

The potential of Artificial Intelligence (AI) as far as applicability in the field of healthcare is concerned is tremendous. Administrative and operating systems, entrenched in Artificial Intelligence, would in time be capable of not just handling routine and procedural tasks, but also of handling complex and high-pressure situations optimally.^[1]

It is noteworthy that while some constituents of modern medicine have been around for such a considerable amount of time, the potential of Machine Learning (ML) and Artificial Intelligence (AI) remains mostly undiscovered and underutilised.^[2] The health care services of tomorrow will do well to integrate AI and ML into their infrastructure as these technologies will serve a multifaceted role.

In recorded history, several infectious diseases like: the plague, influenza, malaria, yellow fever, and AIDS have snatched many lives and incapacitated several hundreds of thousands. While the pace of innovation, in the field of medicine is commendable, it is most impressive in times of necessity and great duress.

For instance, the World Wars brought to the fore the efficacy of blood transfusions and the administration of antibiotics that increased manifold during aforesaid wars.^[3]

AI and ML in Healthcare

Diagnosis and Treatment

AI and ML can help enhance technological advancements in diagnosis and treatment, as well as improve manufacturing processes of drugs and vaccines.

Recently, during the COVID global crisis the innovative vaccine based on re-engineering mRNA was developed in a matter of a few months, which is unprecedented, and AI also provided cutting-edge applications in disease, medicine, treatment, and target recognition.^[4] However, it is also pertinent to note that most technology and techniques utilised in healthcare tend to stand the test of time and remain effective and safe even over the course of several decades. Anaesthesia has been around since the 1840s and continues to remain indispensable.

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Even most modern diagnostic, surgical and back-end machines have been around for several decades. The CNC, 'Computerised Numerical Control', machine has been in rotation for over half a century but its usage in medicine has been recently studied, as in using this novel method for tablet production by applying subtractive manufacturing as an alternative to formative (powder compression) and additive (3D printing) manufacturing for the on-demand production of solid dosage forms. This approach was used to produce patient-specific hydrocortisone tablets with specially made polyethylene glycol and hydroxypropyl cellulose thermal cast drug polymers.^[5]

AI will also assist in providing better treatment and post treatment monitoring to patients. While M.L. would enhance physical machines such as: MRI machines, CT scanners, Doppler and Ultrasonography, A.I., on the other hand, would assist with the decision-making process by evaluating the output from said machines and then provide diagnoses, prognoses and possibly suggest lines of further treatments.^[6]

Healthcare Administration and Economics

AI and ML can also help in healthcare management, organization and economics. An AI based Centralised Monitoring System would help in substantial reduction in cost, improve time management and increase efficiency in the administration of hospitals.^[7] Consequently, Artificial Intelligence would categorically and spectacularly transform the way hospitals operate. The centralised control system would manage general staff, administrators, doctors and medical staff and it would do so, much more expediently as compared to any human being. It would also perform autonomous tasks removing scope for error.

Administrative and daily operations would also benefit from the control system. The system will make available OT, ICU, ICCU, OPD chambers for optimal use by surgeons and physicians according to the actual real-time live location of aforesaid personnel. Appointments would also be taken care of by the intelligence module of the system, which would synchronise and optimise calendars to minimise time-delay and clashes. The agendas for important as well as routine meetings could be handled by the centralised monitoring system and many more integrated sub-systems.

Another interesting use of AI, which is relevant for not just healthcare, but other sectors as well, is Geofencing^[8] The cell phones of employees and staff could be used as pinging points and be geofenced in different zones pertaining to the individual's area

and his or her scope of work. This would completely render the practice of maintaining attendance registers obsolete and redundant since as soon as an organisation member were to enter their specified zone, an automatic entry into the system would be made. The system would not just track individuals, but also keep a tab on geospatial locations of ambulances and other hospital vehicles to best monitor and utilise them optimally. This reporting system would help those, who are in charge of management, to make informed decisions about their employees. Human Resources could also benefit since such a system might be useful as an index to determine the contribution of the individual to the organisation and thus help in deciding promotions, pay raises, bonuses and affirmative action for efficient employees.^[9]

Medical Skill Enhancement

In addition to having benefits in the administration of hospitals and other healthcare units, A.I. could help in substantive aspects as well such as medical education, training and skill enhancement.^[10] Decisions taken during meetings could be refined as per best global practices by the system autonomously. Dissemination of information would be quick, precise and objective, without an inkling of bias.

A system which would function with Artificial Intelligence at its core, would also make management and acquisition of resources seamless and infallible. It would continuously monitor the status of the inventory of medicines, consumables, equipment, fuel and other resources that the healthcare system hinges upon. It could also be programmed to rely on a predictive model that would analyse past statistical trends that would help reduce unnecessary surplus in the inventory, thus saving space and unlock surplus fund.

Medical education is a lifetime learning process stretching from undergraduate to postgraduate, specialty training, and beyond. It also applies to various healthcare professionals, including doctors, nurses, and other allied healthcare professionals. Therefore, it is essential to acknowledge the immense role of artificial intelligence in futuristic applications like Virtual Inquiry System, Medical Distance Learning and Management, teaching videos and non-analytical humanistic aspects of medicine.^[10]

Data Management and Analytics

The integration of 'big data' with information on suppliers and distributors, AI could also present options which would minimise the cost of acquisition.^[11]

Even quality control checks could be undertaken by the system, minimising the workload on the employees, who would not be burdened by the rigours of completing routine procedural checks. Overall costs of running the hospital could be reduced substantially, if the potential of such a set-up is translated from the metaphysical into something tangible.

Additionally, Artificial intelligence is immune to some of the barriers that are faced routinely by humans generally. AI incorporates natural language in its essence and therefore it would do away with the need to type prescriptions and discharge summaries as the system would adapt and auto-fill a substantial portion of such documents.^[12] This model of functioning would also help in translating languages and bridge the gap between doctors and patients, who are used to and speak different languages. For instance, any person speaking a regional language like Hindi, Urdu, Marathi, Assamese will not need an interpreter since AI would translate in real-time and also transcript the contents in the particular language that the hospital uses. Distance would also be no impediment to an AI enabled system as diagnoses, treatments and follow up care could be seamlessly managed remotely.

Conclusion

AI and ML will change the landscape of healthcare and greatly enhance its globalization and benefits. It's application ranges from medical technology in diagnosis and treatment, manufacturing of medicines, Computerized Numeric Control, improving healthcare administration and economics with Centralized Monitoring Systems and Geofencing, upgrading medical education, skill and training, as well as in big medical data management and analysis. Doctors, and all persons working in the healthcare industry should increase their awareness and knowledge on AI, and understand the benefits and patient care enhancement that AI can equip them with. Timely adaptation to its incorporation and application by health care personnel can help seamless synchronization of the futuristic healthcare revolution with AI and ML

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