

Amalgamation of Health Care Automation and Artificial Intelligence: A Narrative Assessment of its Feasibility in India

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ABSTRACT

This succinct study centers on the growing significance of robotics and artificial intelligence (AI) in the healthcare industry. It might be especially helpful for India, a country with a big and expanding population and little access to healthcare resources in its rural areas. AI uses quick and sophisticated algorithms to combine vast volumes of data. This enables the software to swiftly adjust the data characteristics' pattern. It could potentially clash with the majority of the health system's components, from detection to prevention and deterrent. Over the past few years, there has been a noticeable increase in the application of AI and robots in the healthcare industry.

In both metropolitan and rural hospitals around the nation, artificial intelligence may be used to do a variety of duties quite well. These tasks include helping with surgery, expediting hospital logistics, and performing routine checkups. AI has several benefits for the healthcare industry, including the ability to provide individualized patient care, secure working environments where healthcare providers are less likely to

contract infections, and efficiently managed operational chores. The healthcare industry, which is among the largest and most dynamic in the world, has a tendency to advance development through innovation and modernization. This profitable business is anticipating a major breakthrough in the future that will generate intelligent machines that think and act like people. The potential applications of AI and robots in healthcare include the following: remote patient monitoring, medication discovery, diagnosis of fatal illnesses, increased clinical trial activity, senior care, and epidemic outbreak prediction. However, given the cost, the shortage of experienced labor, and people's ingrained mindset, the practicality of deploying robotics in healthcare may be called into doubt. Replicating these technologies in smaller towns and rural regions to make these services available to a greater portion of the nation's population is the biggest difficulty. The purpose of this review is to identify the main obstacles and assess how viable and adaptable these new technologies are in the Indian context.

INTRODUCTION

In terms of health indices, India's healthcare system trails below many developing and a select few least developed nations, and it is far from offering universal healthcare coverage to the entire population. Furthermore, there are significant differences between the states in terms of attaining the intended health objectives and putting in place a reliable information system. The National Health Policy of India, which came into effect in 2017, has made it easier for different national healthcare stakeholders to communicate with one another through the digital corridor. The policy acknowledges the important role that technology plays in the provision of healthcare. In order to govern, advance, and implement digital health in the healthcare industry, it promotes the creation of the National Digital Health Authority (NDHA). Four major categories can be used to group AI

applications in healthcare: expressive, analytical, prognostic, and prescriptive. The only way to close the skills gap in the healthcare industry is to increase the application of artificial intelligence. AI makes it simple to diagnose common health problems, which lessens the burden for skilled medical personnel and lowers treatment costs in India. It is projected that artificial intelligence (AI) will contribute 957 billion USD to India's GDP by 2035 (Accenture, 2017). AI will also show to be a useful tool in lessening the nation's economic inequality.

According to a TCS global survey report from 2017, new jobs may be created as a result of impending AI-integrated healthcare projects, potentially offsetting the apparent decline of jobs caused by AI. There are certain shortcomings in the Indian healthcare system. The lack of physicians, nurses, medical technicians,

and healthcare facilities necessary to provide for the needs of the population is a deficiency. The constantly expanding requirements of the Indian healthcare system cannot be met by the current pool of trained physicians. In addition, the majority of these physicians work in metropolitan settings, and the shortage of medical professionals in rural areas contrasts sharply with that in urban areas. In India, only around one-fourth of the population lives in metropolitan regions, where 74% of graduating doctors are employed. Each doctor treats 19,000 patients due to resource maldistribution. In order to achieve the WHO-recommended minimum doctor-patient ratio of 1:1000, India will require 2.3 million additional doctors by 2030. Early concepts developed by a small number of healthcare entrepreneurs have the potential to both improve and lighten the load on India's healthcare

The following are AI's main areas of importance in healthcare:

1. Machine learning: the application and creation of whole systems capable of learning and adapting from patterns in data without the need for explicit instructions.
2. Natural language processing: An area of artificial intelligence devoted to the interpretation and management of written or spoken data produced by humans.
3. Robotic process automation: An automation technique that uses software to imitate human workers' back-office duties, such as data extraction, form filling, file movement, etc.

METHODOLOGY

The current investigation was carried out in April through June of 2022. The primary resources used to search the literature were databases like Pubmed and Google Scholar. Web of Science and Scopus databases were not included. The majority of the research articles that were considered in order to compile the data came from 2013 to 2022. The use of robotics and artificial intelligence in healthcare research

Healthcare robotics' operational mechanisms

Deep learning and machine learning are two examples of AI applications used in robotics in healthcare. Large volumes of data are combined using quick and clever algorithms in artificial intelligence (AI). This enables the software to swiftly adjust the data characteristics' pattern. AI implementation is mostly program-oriented, with the created program comprising the fundamentals of the system's operation. All of the data is sent into online systems like the "cloud," which can store enormous amounts of data and information for usage on the internet. Future developments in the healthcare industry could be greatly facilitated by the application of AI.

AI's primary goal is to acquire and analyze data from sensors and programs in order to solve problems. Another objective is to acquire new skills and react to unusual circumstances by thinking outside the box and keeping in mind the workable

systems in the future. The corona virus disease 2019 (COVID-19) pandemic recently presented a significant challenge to the healthcare industry, resulting in a significant demand for robots, AI-based solutions, and pharmacy. During the COVID-19 epidemic, numerous reputable hospitals worldwide have shifted to robotic and artificial intelligence (AI) processes for tasks including patient and staff screening at the entry point and disinfection. During the most recent epidemic, strategies like video conferences with doctors, remote teaching, telemedicine, and remotely monitored procedures were implemented. The main benefit of the pandemic experience has been increased adaptability for robots utilization in the healthcare industry.

AI also helps the healthcare system with administrative applications, patient engagement and adherence, and applications for diagnosis and treatment. AI saves a significant amount of time while also making the jobs of nurses, doctors, and other healthcare professionals easier. Therefore, the smart course of action for India to pursue its goal of universal health coverage is the use of digital technologies for the prevention, diagnosis, and treatment of various illnesses.

papers was carefully examined, with a focus on how feasible it would be in the Indian context. India, robotics, artificial intelligence, and healthcare were among the pertinent search terms used. It was challenging to look out the necessary information because there isn't much information on robots' utilization in the Indian healthcare industry, which calls for more research.

solution to apply in comparable circumstances. In order for it to learn, think, and recommend the best options to consumers, it works to create expert arrangements. In order for machines to function exactly like people, they strive to imbue them with intelligence.

Artificial intelligence might potentially clash with most aspects of the health system, from detection to prevention and forecasting. Healthcare professionals must receive uniform training to adopt new technologies such as robotic process automation, machine learning, natural language processing, etc., even though the rate of adherence to these technologies is much lower than when they first appeared. The functioning of robotics in healthcare is ultimately the result of the interaction of deep learning, machine learning, and artificial intelligence, as shown in

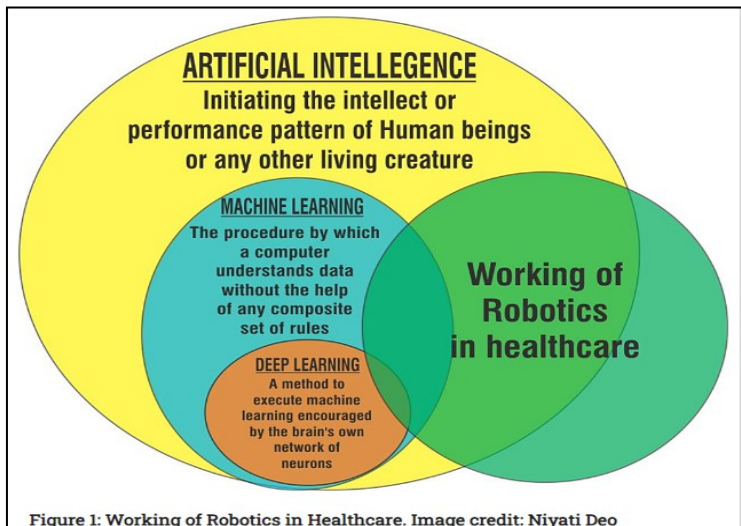


Figure 1.

Currently, surgery is the medical specialty using robotics to grow the fastest. In the realm of surgery, it seeks to advance human capabilities and get over human constraints. The All-India Institute of Medical Sciences in New Delhi, India, installed the country's first urologic robot, da Vinci S, in 2006. This launch was followed by a remarkable national growth of robotic surgery. As of July 2019, India boasted 66 centers and over 500 proficient robotic surgeons who have effectively executed over 12,800 procedures with the aid of robots. This unanticipated growth in robotic surgery indicates that robotic surgery in India has a highly promising future. One of the greatest innovations in surgery is the advent of the da Vinci Surgical System. Surgeons perform better during surgery when they have access to comprehensive information on the inside health of their patients thanks to high-definition computer vision. Because robotics offers benefits including mechanical accuracy, permanence, and the capacity to operate in hazardous environments, engineers and medical researchers have been attempting for many years to devise new applications for robots in surgery. Robotic surgery has been a major contributor to the improvement of the Indian healthcare system in recent years. Hundreds of robotic surgeons are reportedly stationed at several Indian hospitals. One of the greatest innovations in surgery is the advent of the da Vinci Surgical System. Surgeons perform

ASSISTANCE FOR MEDICAL PROFESSIONALS

Robotics can improve patient care not only in operating rooms but also in clinics and outdoor patient departments. During the COVID-19 pandemic, for instance, robots were deployed to screen questionable patients at the entry to medical facilities. Robots and automation are also utilized in research labs, where

better during surgery when they have access to comprehensive information on the inside health of their patients thanks to high-definition computer vision. Because robotics offers benefits including mechanical accuracy, permanence, and the capacity to operate in hazardous environments, engineers and medical researchers have been attempting for many years to devise new applications for robots in surgery. Robotic surgery has been a major contributor to the improvement of the Indian healthcare system in recent years. Hundreds of robotic surgeons are reportedly stationed at several Indian hospitals. The use of robotics in surgical training is becoming more and more important. For instance, students can experience real training scenarios and events through virtual reality simulators. In the virtual environment, practicing the operations is made simple. Approximately one million surgical procedures involving several departments within the healthcare industry employ surgical robots on a large scale. Throughout the procedure, AI assists the surgeon in receiving accurate alerts and making the right suggestions. Providing the optimal surgical application for the patient is greatly aided by profound learning data. Experts who are frequently concentrated in large cities and unavailable to patients living in small towns and rural areas can also be facilitated by robotics.

they do a variety of laborious and repetitive activities to free up scientists' time for more thoughtful work and speedier scientific advancements. Therapeutic robots can guarantee rehabilitation following traumatic brain injuries, strokes, paralysis, etc.

Organizational Logistics

Medical robots are more practical to utilize for a variety of tasks since they effectively streamline workflows and lower risk. Robots, for instance, can arrange and clean patient rooms on their own, reducing the chance of social interaction in wards for contagious diseases. Therefore, human support robots (HSR)

are used for cleaning [20]. Hospital patients receive their medications more efficiently thanks to robots equipped with software that recognizes medications. This kind of help allows hospital staff to spend more time directly caring for patients.

ADVANTAGES OF USING ROBOTICS IN HEALTHCARE

- **Specialized Medical Attention**

The advancement of AI in conjunction with physically assisted technology has led to the creation of socially helpful robots, or SARs. Because SARs may communicate with patients in a way that elicits an emotional response, they are emotionally intelligent robots that contribute to exclusive patient care. Interaction, communication, camaraderie, and emotional attachment are among the several forms of reaction [12]. A safe environment for patients and medical staff, optimal patient care, and flawless operations in medical settings are all ensured by the thoughtful application of robots in the healthcare system. When autonomous robots are used in healthcare, there is very little possibility of human error or carelessness. The creation and ongoing advancement of SARs has completely transformed the health and social care industry.

- **Safe and Protected Working Environment**

Robots can readily fill the roles of nurses, ward boys, receptionists, and other healthcare personnel. The various kinds of robots, such as medical servers, nurse robots, receptionist robots, and so on, can carry out the aforementioned tasks quite effectively [15]. Automated mobile robots, or AMRs, are utilized in many healthcare settings to perform tasks like distributing medical supplies and linen, gathering patient data, and providing food and water to patients. This prevents medical personnel from coming into contact with pathogens and, consequently, stops the spread of infections. ..The most widely employed robots during the epidemic, according to Podpora et al., were hospitality robots

like Wegree and Pepper created by SoftBank Robotics in Japan, as they helped slow the rate at which the disease spread [15]. Excellent work was done in the areas of pandemic preparedness, screening, contact tracing, disinfection, and enforcing social distance and quarantine during the COVID-19 pandemic. The National Informatics Center and the Information Technology Ministry developed the Arogya Setu app, which has shown to be beneficial in managing the COVID-19 pandemic. Healthcare professionals' physical strain is reduced when social robots do labor-intensive tasks like moving patients or lifting large beds.

- **Streamlined Tasks for Operations**

Automated mobile robots (AMRs) ensure that more exact processes are followed, regularize routine jobs, and lessen the physical strain on healthcare personnel. These robots can handle the staffing shortage, maintain a record-keeping system, and send orders on schedule. They make certain that supplies of medications and other equipment are available as needed. Automated robots can quickly sterilize, clean, and prepare rooms for incoming patients, freeing up medical staff to attend to other critical patient-related tasks. Artificial intelligence can be used to diagnose various diseases in robots in an efficient manner. With the use of AI and deep learning, the radiologist robots—which possess computational imaging capabilities—make diagnoses. These automata are also used for doing diagnosis procedures like MRIs and X-rays and hence are of great advantage for healthcare workers, as it protects them from harmful radiations used in these procedure

FUTURE PERSPECTIVE

The healthcare industry is widely acknowledged as one of the largest and most dynamic sectors of the global economy. It seeks to accelerate progress by utilizing novel ideas and modernity. This industry used to rely solely on manual procedures, which took longer and were more likely to be made by mistake. The health sector is undergoing a change as a result

Senior citizens help

By 2050, it is expected that the number of senior persons will have doubled worldwide. Technology for socially supportive robots might develop to meet this increasing need. The main causes of loneliness for older adults living alone are home ownership, marital status, poor health, and a lack of social support. According to a study by Abdi et al., social robots play a critical role in senior citizen healthcare. It was clear that

of the most recent advancements in machine learning, which aim to build intelligent robots that behave and think like real people [8]. Even while robotics and artificial intelligence (AI) applications in the healthcare industry are still in their infancy, the future appears to be quite promising in terms of feasibility and acceptance [21]. The following are the healthcare domains where AI and robotics are most likely to adapt quickly:

research participants were just as nervous about having humans look after them as they were about robots, even though many of them were reluctant to acknowledge the importance of robots providing care. Numerous interviewees agreed that since humanoid robots are programmed with human traits, they are more trustworthy. Many participants agreed that since humanoid robots are programmed with human traits, they are more trustworthy than people. Given that the number of elderly

people in India is rising as a result of better health care and that there appears to be a shortage of qualified hospital staff to meet the growing need, it can be argued that the use of robots in elder care will mark a significant milestone. Hospitals are developing mental commit robots to treat their elderly patients. Through physical contact, these robots can have an impact on humans' psyche, physiology, and social interactions. It was noted that this input boosted the elderly people's mood. Numerous research projects are in progress to investigate the potential for enhancing social robots' communication skills with humans. The senior population's acceptance of the robot is significantly

AI for Medical Diagnosis

Approximately 80,000 deaths are attributed to incorrect medical diagnosis each year, according to reports. In the past, high caseloads with incomplete details have resulted in serious errors. AI can anticipate and diagnose illnesses more quickly since it is immune to these mistakes. AI is being used

Medication Discovery The topic of drug discovery is one of the main areas where AI applications can be beneficial. A new drug must go through around 14 years and an average of 2.6 billion dollars' worth of procedures before it can be sold, although AI can accomplish

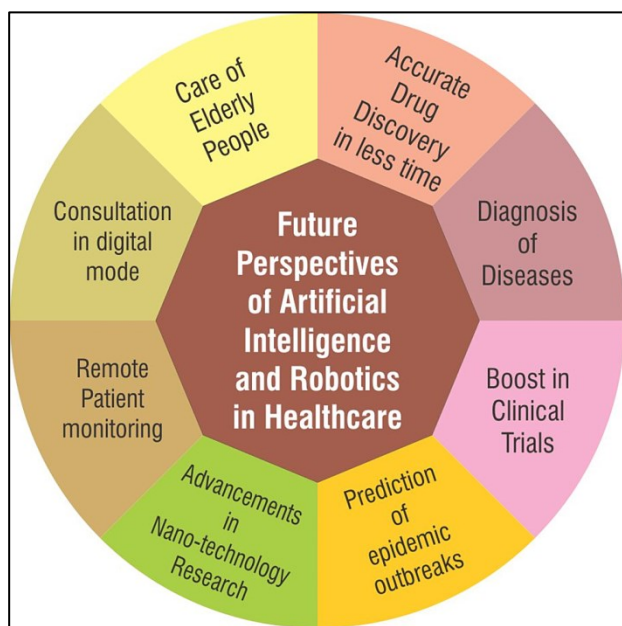
influenced by its physical appearance. Giving companion animal robots to elderly individuals with dementia has been shown to have positive effects. Research indicates that elderly individuals suffering from dementia can benefit from cognitive stimulation from companion animal robots that are suitable in terms of size, weight, and form. The National Institute of Advanced Industrial Science and Technology (AIST) in Japan developed the seal-like robot PARO, which has shown to be highly beneficial for enhancing elderly persons' cognitive capacities and sleep habits.

extensively in cancer detection, where prediction and early detection are crucial. AI-supported technologies are being used by numerous businesses to identify and diagnose various cancer types.

the same task faster. The Ebola virus outbreak that recently occurred in 2015 in West Africa and several European nations was contained with the use of artificial intelligence (AI), which aided in the rapid discovery of a suitable treatment and stopped the outbreak from spreading to other parts of the world.

CONCLUSION

Despite being in its early stages, the use of robots in healthcare has several prospects for medical personnel, particularly in urban settings. It is impossible to dispute AI's important contribution to fields including drug development, disease diagnostics, digital health consultations, robotic surgery, remote patient monitoring, and epidemic outbreak prediction. In India, the growing importance of robotics in the care of the elderly has been acknowledged and is gaining traction. It is currently impossible to consider the deployment and oversight of health services without the use of robotics and artificial intelligence. Numerous innovative methods are being developed for the application of robotics in the healthcare industry, which could ultimately result in lower costs. But a strict and ongoing monitoring system must be established in order to control the quality of robotic procedures. The application of AI and robotics in India's healthcare industry could represent a turning point in raising the standard of treatment currently provided. It has undoubtedly assisted in filling the vacuum left by the large number of unfilled positions for physicians, nurses, and paramedical personnel as well as the shortage of qualified



health professionals. Reaching the isolated areas of the nation with inadequate infrastructure and outdated technology is the major obstacle. Reaching the underprivileged community is hampered by the high cost of implementing AI and robotics in the healthcare industry. In addition, mistakes and mechanical breakdowns are possible. In addition, mistakes and technical breakdowns brought on by inadequate maintenance plans run the risk of having lethal repercussions. The Indian government ought to assist businesses in investing in artificial intelligence

(AI) and promote public-private partnerships (PPP) in the fields of AI and healthcare. To improve AI and robotics application in the healthcare industry, policy makers need to address ethical concerns. It is clear from weighing the available data and common sense that India should gradually increase its use of robotics, starting with well-known and equipped hospitals. It is only practical when used sparingly and in conjunction with a consistent reporting and monitoring framework.

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