A REVIEW ANALYSIS ON THE POTENTIAL FOR ARTIFICIAL INTELLIGENCE IN HEALTHCARE

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Abstract— *The main aim of this paper was to review how artificial intelligence plays a critical role in healthcare. Artificial intelligence (AI) will be used more and more in healthcare due to the growing intricacy and volume of data. Payers, suppliers of treatment, and organizations in the health sciences are already using a variety of AI methods [1]. Adverse events connected to substandard treatment are one of the top ten causes of mortality and disability in the world, and between a third and half of these occurrences seem to be avoidable. Investments in minimizing harm may save money and enhance patient outcomes. Using AI as a tool to enhance safety both within and outside the hospital has enormous promise since it can provide solutions to forecast risks, gather a range of data, including new and already-available data, as well as contribute to quality improvement efforts [1]. For example, artificial intelligence may assist in decision-making by identifying patients who are at high risk of hospital injury and guiding preventative and early intervention initiatives. Outpatient, community, and home settings may all benefit from AI's use [2]. These new technologies, when used in conjunction with digital techniques, may enhance communication between patients and healthcare practitioners, therefore reducing the occurrence of avoidable illnesses. Existing data will be useful, but new data will be accessible thanks to sensor technology, which should lead to better predictions. Patient involvement and adherence, as well as administrative operations, are some of the most common uses for these technologies [2].*

Keywords: *Electrical automation control, automation, artificial intelligence, technological system*

I. INTRODUCTION

There is a growing use of artificial intelligence (AI) and associated technologies in the private sector as well as the general public sector, as well as in healthcare. With these new technologies, patient care and administrative operations inside healthcare organizations have the potential to be transformed [2]. Several studies have already shown that AI can diagnose sickness as well as or better than humans, according to the researchers. Even now, algorithms can detect malignant tumors with more accuracy than radiologists, and they are directing researchers in the design of clinical trial cohorts [3].

As a rule, the term "artificial intelligence" refers to computing technologies that mimic human intellect in ways that are not possible with human beings alone. Some gadgets may play a function that is usually interpreted and decided by humans [3, 4]. These methods are multidisciplinary and may be used in a variety of industries, including medicine and health. AI has been used in medicine since the 1950s when doctors used computer-aided algorithms to try to enhance their diagnosis [5, 6]. Recent breakthroughs in medical AI have sparked increased interest and funding because of current computers significantly increased computational capacity and the large quantity of digital data accessible for gathering and use [6]. The use of artificial intelligence in medicine is changing with time. A wide range of medical professions may benefit from the use of artificial intelligence (AI) applications in medicine, including clinical, diagnostic, rehabilitation, surgical, and prognostic techniques. Clinical decision-making and illness diagnosis are important areas in medicine where AI is having an influence. To identify illness and guide clinical choices, AI systems can absorb, analyze, and report massive amounts of data from several modalities [6,7]. Using artificial intelligence (AI) tools, we can mine massive amounts of medical big data to unearth previously undiscovered information [7,8]. Health services administration and patient care therapies may be improved with the use of these technologies [8]. There are many reasons why we don't expect AI to completely replace humans in the medical field for many years to come. In this paper, I will explore AI's potential to automate care as well as some of the roadblocks that stand in the way of its quick adoption in healthcare [3].

II. PROBLEM STATEMENT

The main problem that this paper will address is to review the roles of artificial intelligence in healthcare. The health sector's development is now lagging behind schedule. Faced with major issues including an aging population, increasing demand for services, rising prices, and healthcare worker shortages, the sector is rapidly turning to artificial intelligence (AI) [8]. And it's not hard to see why. Artificial intelligence (AI) applications for healthcare have advanced at an astronomical rate in the last several years, according to Gartner. The number of scientific publications released each year is increasing at an exponential rate. Many start-ups, big medical technology businesses, and so-called "Big Tech" firms are developing AI-enabled products and services. In the public health sector, AI has a lot of potentials. Despite its sluggish deployment, AI is becoming more popular because of the potential savings it offers in the delivery of health care [8]. The use of artificial intelligence (AI) to reimagine the healthcare industry has been widely accepted in many areas. The digital segment focuses on AI's core areas, such as health management systems, electronic health records, and the active monitoring of medical choices made by clinicians by AI-assisted systems [9]. The use of artificial intelligence (AI) technologies to help physicians make patient diagnoses has lately gotten some interest from

researchers. With improved technology and more thorough data, this AI will be able to identify a wide range of ailments in the near future [9].

III. LITERATURE REVIEW

A. *Research in medical artificial intelligence (AI)*

In recent years, artificial intelligence (AI) approaches have sent shockwaves through the healthcare industry, igniting debate over whether AI doctors would someday replace human physicians. However, we think that artificial intelligence (AI) may help doctors make better clinical judgments or perhaps replace human assessment in some operational aspects of patient care for the coming years (eg, radiology) [10]. The recent effective uses of AI in healthcare have been made feasible by the rising accessibility of healthcare data and the quick development of big data analysis methodologies. Strong AI algorithms may uncover clinically significant information buried in huge amounts of data, which in turn can help doctors make better clinical decisions.

B. *Types of artificial intelligence (AI) used in healthcare*

The field of artificial intelligence encompasses several different technologies. In the healthcare industry, most of these technologies are directly applicable; nevertheless, the processes and operations they facilitate differ greatly. The following sections identify and detail several critical artificial intelligence (AI) technologies for healthcare [10].

i. *Machine learning: deep learning and neural networks*

Data-driven machine learning (DL) is a statistical approach for fitting and learning models using data. According to future prediction Deloitte poll of 1,100 US managers whose organizations already exploring AI, 63% of enterprises will be using machine learning in their operations. It's a general method with several implementations that's at the heart of many different approaches to artificial intelligence. Precision medicine is the most prominent use of classical machine learning in healthcare. This involves predicting which therapeutic interventions will be most effective for a given patient based on a variety of patient variables and the treatment environment. This is referred to as “supervised learning,” and it is required for almost all machine learning and precision medicine systems that use it [11]. Using a neural network, which has been around since the 1960s and has been well-established in healthcare research for many decades3, is a more advanced kind of machine learning that can be used to categorize patients and predict whether or not they would develop a certain illness. There are inputs and outputs, as well as weights associated with variables or "features" that link input with output, and this approach approaches issues from this perspective. Neuronal signal processing has been compared, although this is a poor analog to brain function [11].

Deep learning, or clustering algorithms with many layers of features or variables that predict outcomes, is the most sophisticated kind of machine learning. The quicker sequencing of today's graphics processing units and cloud architectures may reveal thousands of previously unseen characteristics in these models. Recognizing malignant tumors in radiography pictures is a typical use of deep learning in healthcare. In radionics or the discovery of therapeutically significant patterns in imaging data more than what the human eye can see, deep learning is increasingly being employed. Oncology-focused image analysis uses radionics and deep learning the most. Their combination seems to provide better diagnostic accuracy than prior generations of computer-aided detection (CAD) image analysis techniques. It is also a kind of natural language processing (NLP) that uses deep learning for voice recognition [11,12]. A deep learning model's features have little relevance to a human observer, in contrast to older kinds of statistical analysis. As a consequence, understanding the model's results will probably be difficult, if not impossible.

ii. *Processing of natural language*

Artificial intelligence researchers have been trying to decipher human language since the 1950s. NLP encompasses a wide range of applications, including voice recognition, text analysis, translation, and many more. Statistical NLP and semantic NLP are the two primary techniques. Because of statistical NLP's use of machine learning (in particular, deep learning neural networks), recent improvements in recognition accuracy have been possible. It necessitates learning from a big 'corpus,' or body of language. For the most part, NLP is used in healthcare for purposes such as creating, interpreting, and categorizing clinical documentation and published research. When used with unstructured clinical notes, NLP systems are capable of analyzing, preparing reports (for example, on radiological tests), transcribing, and conducting conversational artificial intelligence (AI) [13].

iii. *Rule-based expert systems*

In the 1980s, the main AI technology was collections of 'if-then rules, which were extensively employed commercially at the time and thereafter. Recently, they've been frequently used in healthcare for 'clinical decision support,' and they're still commonly used today. Today, many EHR vendors provide rules with their systems [12]. For expert systems, knowledge specialists and engineers are needed to create a set of rules for a certain knowledge domain in which they operate. They are simple to grasp and operate effectively till a certain point. Rules tend to break down when there are too many of them (often above several thousand) or when they start to contradict. Changing the rules might also be complex and time-consuming if the knowledge domain changes. They are gradually being phased out of healthcare in favor of data-driven and machine learning-based techniques [13].

iv. **Physical robots**

Over 200,000 industrial robots are deployed annually worldwide, therefore physical robots are widely known. In areas like factories and warehouses, they do predefined activities like lifting, relocating, welding, or assembling goods, while in hospitals, they transport supplies. As technology has progressed, robots have grown more human-like in their ability to collaborate and may be taught by guiding them through the desired activity. As more AI capabilities are integrated into their 'brains,' they are likewise growing more clever (really their operating systems). It is probable that, in the future, physical robots will benefit from the same advances in intelligence as having been made in other domains of artificial intelligence [14].

Since they were first licensed in the US in 2000, surgical robots have given doctors newfound' superpowers,' such as the capacity to see better, make more accurate incisions, patch up wounds, and so on. However, human surgeons continue to make important judgments. Robotic surgery is often used in gynecological, prostate, and head and neck surgeries [14].

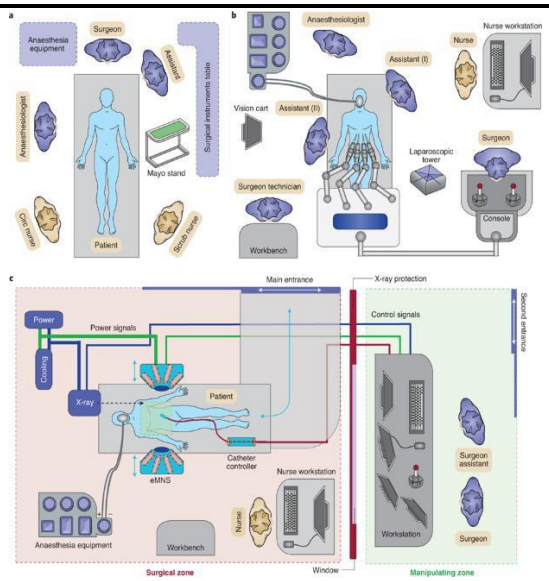

Fig i: Physical robots in the surgical environment

C. Automation of robotic processes

Using this technology, organized digital tasks for administrative reasons, such as those requiring information systems, may be completed as if they were being completed by a human user who is following a script or set of rules [14]. When compared to other kinds of artificial intelligence, they are less costly, simpler to build, and more transparent in their activities. Robotic process automation (RPA) is a technology that does not use robots, but rather computer programs running on servers. For it to operate as a semi-intelligent user of information systems, it depends on a mix of workflow, business requirements, and a 'presentation layer' interface with the systems. In the healthcare industry, they are utilized for repetitive processes such as prior authorization, patient record updating, and invoicing. Together with other technologies such as image recognition, they may be used to extract information from faxed photographs, for example, to feed such information into transactional systems [15]. These technologies are separate entities, but they're increasingly being blended and combined; robots are acquiring artificial intelligence-based "brains," and image recognition is being connected with robotic process automation. Someday, these technologies may become so intertwined that composite solutions may become more possible and viable.

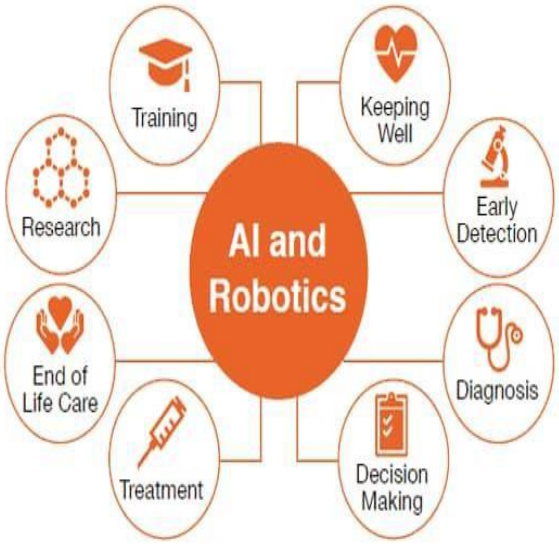

Figure ii: Illustration of the advantages of artificial intelligence and robots in healthcare.

D. Insights into the healthcare industry

Before AI systems can be used in smart healthcare, they must be 'trained' using data produced during clinical operations such as screening, diagnosis, and therapy assignment, to identify comparable groups of patients, relationships between subject attributes, and desired results. In addition to demographic information, medical records and digital inputs from devices, physical exams, and diagnostic testing and imaging data are common sources of clinical data [15]. In particular, a significant component of the AI literature analyzes data from diagnostic imaging, genetic analysis, and electrodiagnosis during the diagnosis stage. According to researchers, radiologists should use AI technology while analyzing diagnostic pictures since they include a lot of data. These findings are supplemented by information obtained from physical examination notes and laboratory tests. They differ from imaging, genetic, and electrophysiology (EP) data in that they include vast amounts of unstructured narrative material, such as clinical notes, that are not immediately analyzed. As a result, the relevant AI applications prioritize translating unstructured text to machine-readable electronic medical records (EMR). When analyzing case reports, researchers employed artificial intelligence (AI) to derive phenotypic traits that improved their ability to accurately diagnose congenital abnormalities [15].

E. Disease focus

Although the literature on artificial intelligence in healthcare is becoming more extensive, much of the research is focused on a small number of illness types: cancer, central nervous disease, and heart disease [16].The concentration of these three illnesses is not entirely surprising. Because these three illnesses are primary causes of mortality, early diagnosis is critical to preventing patients' health from deteriorating. Improved imaging, genetic, EP, or EMR analysis processes may also help with early diagnosis, which is one of the AI system's strongest suits.

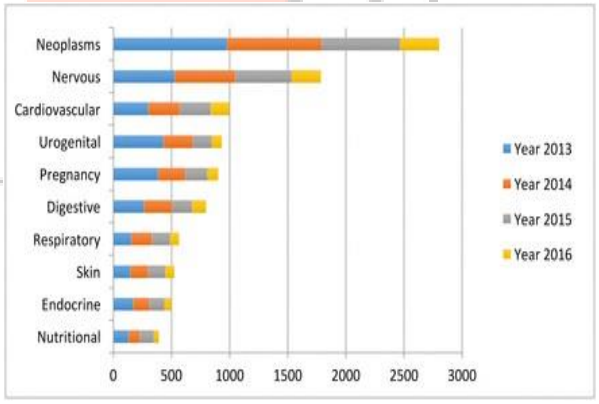

Figure iii: Types of diseases taken into account in artificial intelligence (AI)

F. Applications for diagnosis and therapy

In artificial intelligence, the care and management of diseases have been a primary emphasis since at least the 1970s, when MYCIN was created at Stanford to aid in the diagnosis of blood-borne microorganisms. However, despite its potential for precise illness diagnosis and treatment, rule-based systems like this one were never put into practical use [1]. Clinical processes and medical record systems did not interact well with these systems because of their limitations. More lately, IBM's Watson has gotten a lot of press for its emphasis on precision medicine, namely cancer detection, and treatment. Watson makes use of a mix of machine learning and natural language processing (NLP). However, clients' excitement for this use of the technologies has waned as they realized how difficult it is

to educate Watson on how to handle certain kinds of cancer and integrate Watson into care procedures and systems. Rather than just one product, IBM's Watson suite includes "cognitive services" delivered through APIs, covering voice and language as well as vision and machine learning-based data analysis [16]. Most experts agree that the Watson APIs are technically feasible, but tackling cancer therapy was a lofty goal. Free 'open source' software from certain manufacturers, like Google's TensorFlow, has put pressure on Watson and other proprietary systems, including IBM's.

Many healthcare organizations are befuddled by AI implementation challenges. Even though rule-based solutions integrated into EHR systems are extensively utilized throughout the country, including in the NHS, they lack the accuracy of more algorithmic solutions like machine learning algorithms. As medical knowledge evolves, these rule-based clinical practice guidelines become more difficult to maintain. Furthermore, they are typically incapable of dealing with the influx of data and information resulting from genomic, proteomic, metabolic, and other 'omic-based' strategies to patient care that are becoming increasingly common [16].

This scenario is changing, although it is more prevalent in research laboratories and IT corporations than in clinical practice. Almost every week, a research lab claims to have devised a method for leveraging AI or big data to diagnose and cure diseases with equal or higher accuracy than human practitioners. However, other forms of imaging, like retinal scanning or genomic-based precision medicine, have been used to support many of these conclusions. Because these sorts of discoveries are based on statistically significant machine learning techniques, they herald in an age of evidence- and probability-based medicine, which is usually considered beneficial but has numerous issues in medical ethics and patient/clinician interactions.

Tech companies, as well as new ventures, are focusing on the same problems. Google, for example, is cooperating with health delivery networks to develop big data prediction models to alert physicians of high-risk situations like sepsis and heart failure. Google, Enlitic, and many other firms are working on AI-based picture interpretation algorithms. As part of its "clinical success machine, physicians identify patients who are in danger and those who would benefit most from treatment programs. Each of these might help professionals make better decisions about patient diagnosis and treatment [17]. Various companies specialize in the detection and treatment of certain tumors based on their genetic profiles. Because many malignancies have a genetic foundation, it has become more difficult for human practitioners to grasp all genetic variations of cancer and their response to novel medications and regimens. This strategy is specialized by companies like Foundation Medicine and Flatiron Health, both of which are now owned by Roche.

Many insurance companies of care are adopting 'population health' machine learning algorithms to forecast populations at risk of certain diseases, accidents, or readmission rates. These models can be excellent predictors, but they don't always include all of the necessary variables that may help them forecast, like the patient's socioeconomic position [17]. AI-based diagnostic and treatment suggestions, whether rules-based or algorithmic, may be hard to incorporate into clinical practices and EHR platforms. Such integration challenges are likely to be a larger impediment to widespread AI application than any failure to deliver accurate and effective suggestions, yet many AI-based technologies for management and therapy from tech businesses are independent or cover just a specific component of care. Some EHR companies have started to include some AI functionalities (beyond rule-based clinical decision support) into their products, although this is still in its early stages. Providers must either undertake significant integration initiatives on their own or wait for EHR suppliers to offer additional AI capabilities [18].

IV. FUTURE IN THE U.S

The use of artificial intelligence in enhancing healthcare in the United States has expanded significantly. AI has the potential to significantly affect the interpretation of medical pictures in digital pathology, including the detection, diagnosis, and monitoring of many pulmonary, cardiac, and oncological disorders. It may also help with image capture and reconstruction, as well as video processing to direct surgeons during surgeries and 3D imaging [18]. Healthcare might be transformed and some of the most pressing challenges can be addressed with the help of artificial intelligence (AI), which is built on automation. The ability of a computer program to do activities or think in ways that we associate with intelligence in humans is referred to as AI. In addition to improving patient outcomes, artificial intelligence has the potential to increase the efficiency and quality of healthcare delivery. Having the ability to spend more time taking care of patients will enhance the mood of healthcare personnel and help keep them on the job longer. It may potentially hasten the development of life-saving treatments. Innovation in the healthcare business revolves around the Automation System [18]. Human error is almost eliminated by robots and artificial intelligence in healthcare, despite the declining staff-to-patient ratio. Robots and AI are filling the gap and offering accuracy and precision.

V. ECONOMIC BENEFITS IN THE UNITED STATES

Virtual health aid (VHA) solutions based on artificial intelligence (AI) might save up to 1,154 million hours annually. AI has the potential to have a significant socio-economic effect on healthcare by enhancing patient outcomes and access while also optimizing resource usage. Another significant consequence might be enhanced utilization of financial resources, mostly as a result of significant cost savings in metabolism pathology areas [19]. In the long run, robotics has the potential to save hospitals a lot of money by reducing labor costs. Furthermore, robots may relieve part of the pressure on medical personnel, allowing them to concentrate on more vital tasks such as patient relations. AI-enabled wearables have great potential in the prevention of falls among the elderly. Accelerometer bracelets or smart belts paired with an AI system provide a reliable pre-and post-impact prediction of fall occurrences. This technology offers the potential to save 1,800 lives annually and reduce the expenses associated with falls. Despite extensive continuing study into the advantages and advancements of AI in healthcare, there are just a handful of real-world application instances that have been documented in academic research or have been publically published. Among them are big projects such as IBM's investment of more than USD 4 billion in IBM Watson [19], and Amazon's agreement with Cerner to establish a joint venture [19].

VI. CONCLUSION

This study looked at how artificial intelligence is enhancing healthcare outcomes. AI implementation is required to improve the efficiency of healthcare administration and medical decision-making. Medical decision-making, particularly predictive analysis, necessitates the use of artificial intelligence (AI), which may be used for health services in particular. The constraints include enabling early acceptance, long-term deployment in the medical system, a lack of respect for the user's viewpoint, and technology that is not properly employed yet are required for AI adoption in the public health system. AI clinical applications confront many ethical problems, including safety, effectiveness, privacy, information, and permission, as well as the freedom to choose and the "right to try," as well as the associated costs and availability. Artificial intelligence may not only help in the discovery of new medications but also increase the effectiveness of existing ones once they have been produced. Although the use of artificial intelligence in healthcare is presently limited, the medical and economic advantages are too tremendous to ignore. High-cost industries will become opportunities for forward-thinking healthcare organizations to adopt cutting-edge technology and maintain their competitive advantage over their competitors. Regardless matter how innovative these new technologies are, they must be seen in the light of our present healthcare transformation. The introduction of smart health into medicine is driving enormous changes in the healthcare business, and the decisions we make today will have long-term ramifications for patient care. These technologies are presently being developed by scientists and developers with the assumption that contemporary medicine is the primary framework, notwithstanding the field's lengthy tradition of discriminatory practices, biases, and medical blunders.

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