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Applications of Artificial Intelligence Based Technologies in The Healthcare Industry

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Abstract : The purpose of this research was to better comprehend the current state of artificial intelligence (AI) technology and its effects on the health care industry.This study did more than just review the prior literature on the topic; it also dug deeply into several specific medical uses of AI. According to the findings, some of the best hospitals are already making use of AI-enabled tools to help doctors diagnose and treat patients with a wide variety of diseases. It's anticipated that this tendency will keep going strong. Also, it's encouraging to see AI systems improving the effectiveness of hospital management and nursing duties. While healthcare professionals generally have a positive outlook on AI, its applications bring both exciting new possibilities and daunting new obstacles. We address the potential and the difficulties of AI in healthcare in order to provide the reader a more well-rounded picture of the field's future. As AI and associated technologies continue to advance at a rapid pace, it is becoming increasingly clear that they will help healthcare providers enhance the efficiency of their operating operations and provide more value to their patients.

1. Introduction

ICT, or information and communication technology, plays a significant role in modern businesses because of its potential to boost productivity and profitability [1]. In this age of the Fourth Industrial Revolution (4IR), firms of all stripes are increasingly turning to state-of-the-art digital tools and infrastructure to promote innovation and create new forms of value [2]. This problem is affecting all sectors of society, including the healthcare sector. In order to provide better care at a lower cost, hospitals and other medical facilities around the world, especially in industrialised nations, are progressively integrating innovative digital technologies [4]. AI, ML, smart sensors and robots, big data analytics, and the IoT are just some of the other cutting-edge digital technologies currently in use. Aruba [3], a division of Hewlett-Packard Enterprise, found that this number jumps to more than 60% in hospitals around the world. IoT has been deployed in their facilities. So, it's important to investigate how the use of advanced digital tools affects communication within healthcare systems [4].

The usage of artificial intelligence-backed technology in hospitals has increased in recent years, with the goal of improving the quality of treatment provided and the efficiency with which medical resources are used. Opportunities for advancement in the knowledge-intensive healthcare sector are greatly enhanced by AI-based technology [5]. This is due to the fact that AI encompasses all of these fields, including ML, NLP, and SR. Artificial intelligence (AI) initiatives for imaging devices were presented by dozens of firms, both new and old, during the Radiological Society of North America (RSNA) conference in Chicago, Illinois, in December 2018. These initiatives were designed to improve diagnostic accuracy. These projects help ensure patients receive correct diagnoses and treatments based on the results of clinical examinations. These initiatives were supported by data obtained from clinical examinations.

Artificial intelligence (AI) programmes that aid in or augment medical diagnosis, treatments, and surgeries have led some to speculate that doctors will soon be obsolete. First, an examination of AI's potential function in healthcare must be conducted so that the benefits and challenges of applying AI in this field may be better understood. The vast number of existing AI applications demonstrates the field's vast potential, from simple process changes to complicated medical therapies for emergency patients [6].

There are many obstacles that need to be overcome before widespread adoption of AI and digital devices can take place. These include worries about privacy, cybersecurity, data integrity, data ownership, the problem of data-sharing among different organisational silos, medical ethics issues, responsibility for medical

errors, and risks of system failures [7]. Ethical concerns have emerged as a major roadblock in healthcare advancement due to the potential for AI technology to jeopardise patients' right to autonomy, security, and privacy. Artificial intelligence (AI) and its medical applications are now behind the curve when it comes to adhering to legal and ethical requirements. In addition to being able to solve problems in novel ways, AI-based technology should also prioritise the needs of its users. AI-based solutions are still the subject of heated arguments in the healthcare sector due to their restricted availability. Understanding the potential future uses of AI-based technologies in terms of diagnoses, quality of care service, and operational strategy necessitates a careful examination of existing examples of such technologies and their applications.

2. Review Of Relevant Literature

"Artificial intelligence" (AI) describes software or hardware that can perform cognitive tasks in a manner similar to a human being. Machines like these can learn and solve problems, two cognitive skills that people typically attribute to human brains. Artificial intelligence is used in products like Google's DeepMind and IBM's Watson supercomputer. These days, the terms machine learning (ML) and deep learning (DL) are bandied about with the same frequency as the term artificial intelligence (AI). Figure 1 demonstrates how AI covers a far larger area than the other two categories combined. For machine learning to be effective, algorithms need to be trained on data in order to carry out operations like regression, grouping, and others. The more information you offer your algorithm, the better it will function. A recent branch of artificial intelligence study, deep learning relies on software implementations of neural networks. Similarly, deep learning algorithms can't learn how to tackle issues without access to data.

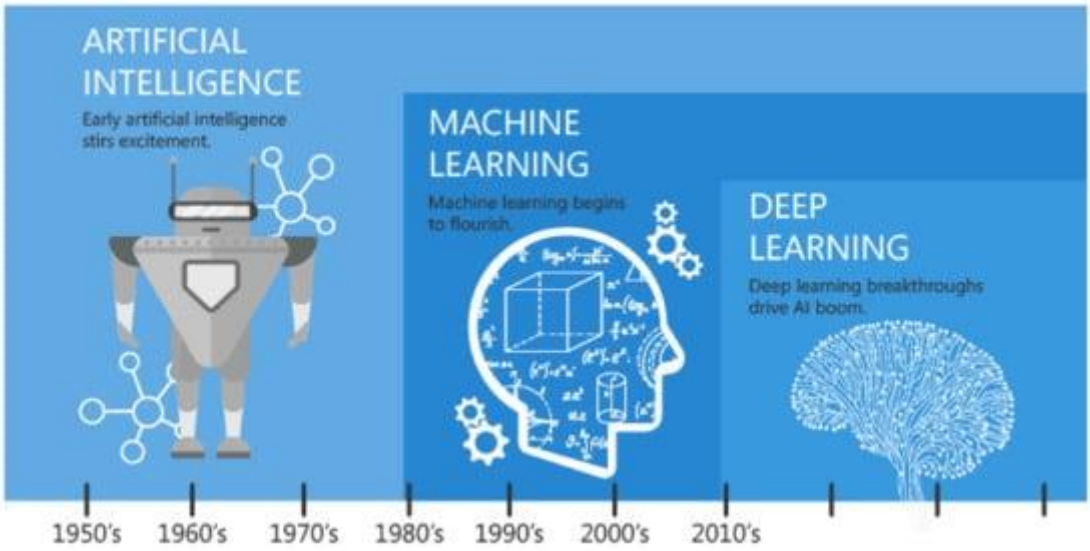

Fig 1: Evolution of Artificial Intelligence.

Knowledge is power in the healthcare industry, which is why AI-based technologies like machine learning, natural language processing, and smart robotics have the potential to make significant advances there. At the RSNA convention in Chicago in December 2018, [8] artificial intelligence (AI) efforts were presented to aid in the precise diagnosis of patients and the efficient treatment of them using data gathered from clinical examinations.

According to the authors of [9], Wi-Fi-enabled armbands are now being used by a network of hospitals in southeast England to remotely monitor vital indicators like respiration rate, oxygen levels, pulse, blood pressure, and body temperature for a patient population of half a million. The hospitals in southeast England discharged these patients after treating half a million people. Artificial intelligence programmes that perform real-time data analysis on patient information greatly reduced the incidence of hospital readmission and visits to emergency rooms in this situation. The requirement for time-consuming and costly house calls was cut by 22% as a result. Longitudinally, patient adherence to therapy increased by 96%, well above the 50% observed in the

medical field generally. The percentage of readmissions at Grady Hospital, a public facility in Atlanta, Georgia, dropped by 31% after two years after the hospital began using an AI-enabled tool to identify patients who might be "at risk." The outcome was a savings of $4,000,000.

Artificial intelligence (AI) programmes that aid in or augment medical diagnosis, treatments, and surgeries have led some to speculate that doctors will soon be obsolete. Exploring the potential role of AI in the healthcare sector is the first step towards understanding the benefits and drawbacks of deploying AI in this industry. Numerous real-world AI applications attest to the technology's vast potential in a variety of settings, from basic improvements to operational operations to complex therapies for emergency patients [10].

Many new firms are employing AI-based technology to provide healthcare solutions and services, including Freenome, a San Francisco-based AI genomics biotech company; Recursion Pharmaceuticals, based in Salt Lake City; Benevolent AI, based in the United Kingdom; and OrCam, based in Israel. IBM's "Watson for Oncology" AI software has found widespread use in the healthcare industry. It aids doctors by suggesting treatments that are likely to be effective. Mesko [11] advocated integrating multiple AI-enabled technologies to develop medical software. These apps have the potential to be used to deliver drug warnings, patient education resources, and health status measures. The Journal of Medical Informatics and Decision Making included Mesko's suggestion.

3Billion can perform diagnostic tests for up to 7,000 diseases simultaneously, making it ideal for use in infectious disease investigation. A doctor gave a patient a new diagnostic that differed from what the AI-based technology had predicted.Because "the medical staff is not specialised in all diseases," the CEO of 3Billion says, "they have to focus on just a few of the diseases they know." Patients may waste time going from one hospital to another as part of the process, a phenomenon known as "diagnosis wanderings." People who suffer from uncommon diseases face this challenge on a regular basis all around the world. There is a limit to how many patients one doctor can see at once. Hundreds of millions of people's lives could be saved by applying AI to the healthcare industry [12].

Using artificial intelligence (AI), doctors at London's Moorfields Eye Hospital have created a system for diagnosing eye diseases. For more than 50 different eye diseases, our technology can make treatment suggestions with a 94% success rate [13]. In China, artificial intelligence (AI)-based technology is being utilised to detect colon polyps. The detection rate of polyps increased by 20% when detected with the assistance of AI in one clinical research compared to another clinical trial where just an expert analysed the patient.

Researchers at the University of Southern California (USC) used a computer simulation of a study subject named Ellie to carry out an experiment. According to the results, patients were more likely to tell Ellie their most private thoughts and feelings than they were to tell their closest friends [14]. WeBot, a company based in the United States that has created an artificial intelligence-powered therapy software, has also published identical results from their own research. In May of this year, the Catholic University of Korea's Eunpyeong St. Mary's Hospital hosted the world debuts of Robot Paul and Robot Maria. Medical staff can take Robot Paul with them as they visit patients in their rooms, and patients can use Robot Maria to find their way throughout the facility. In addition to self-driving capabilities, chatbots, and blockchain, Robot Paul is also equipped with speech electronic medical records (EMR) technologies.

3. Challenges Faced By AI Utilization In Healthcare

3.1. Ethical and Social Challenges

A number of legal issues arise when AI is put to use, including who is responsible when AI is used in making decisions, whether or not AI is flawed, whether or not verifying AI results will be difficult, whether or not sensitive data will be sufficiently protected, and so on. One could have similar reservations regarding the upsides of 'telehealth' and other helpful technologies, as well as the increasing prevalence of such things as automation, data utilisation, and so on. It's also possible that there will be issues with safety and reliability when utilising AI to provide care, make judgements, or operate medical devices. There is a risk that AI will make mistakes, and that these mistakes will be difficult to identify or could have unintended repercussions. For instance, the AI programme developed to foresee problems from pneumonia incorrectly recommended that

doctors dismiss patients who also suffered from asthma. The development of artificial intelligence raises questions regarding who is responsible for the outcomes and who should be compensated when people are negatively impacted. In particular, ML technologies, which may be largely opaque due to the process by which they constantly assess their own limitations and standards as they learn, present challenges for authenticating AI output and recognising error or data bias. Furthermore, explainability is a significant challenge for AI in terms of its potential applications across fields. One important area of AI study is "Explainable artificial intelligence (XAI)," which aims to remedy the general public's lack of familiarity with and trust in AI-powered solutions for problems requiring decisive action.

3.2. Governance Challenges

The rising use of AI technology in healthcare has brought forth regulatory, ethical, and trust problems that must be addressed through proper governance. Hospital-level active governance offers a chance to effectively address difficulties associated with AI adoption and use. A recent study also came to the conclusion that managing AI technology at the level of healthcare systems is crucial for protecting patients and keeping accountability high. The confidence of clinicians is boosted as a result of such governance, which also helps improve acceptance and paves the way for major health implications. To deal with issues in the clinical, operational, and leadership fields, the governance structure for deploying AI-powered apps should be all-encompassing.

3.3. Technical Challenges

To ensure that HCPs can effectively use AI models, it is important that the models' technical components, such as their characteristics and operations, be kept as straightforward as feasible. However, there are several challenges to overcome when introducing AI into the healthcare sector. A few examples of these challenges include the high expense of enhancing data validity, the difficulty of storing and backing up data for research, and the inability to construct and maintain IT infrastructure to support the AI process. The disadvantages of AI algorithms include their limited applicability outside of the training environment, their inherent partiality, and their susceptibility to trickery. There are many things to consider when testing generalizability, including changes in datasets, confounders matched at random rather than true signals, the prevalence of unintentional biases in clinical practise, the availability of interpretability for algorithms, the development of reliable measures of confidence in the model, and the testing of generalisation to different populations. Cost, technological infrastructure, and HCPs' use of AI technologies are all issues that can be mitigated with a well-thought-out and implemented strategic strategy for integrating AI in healthcare.This should be done in order to integrate AI in a manner that is beneficial to patients.

4. Role Of AI In Healthcare

AI is being used in a variety of fields, including radiology and the treatment of chronic diseases such as cancer, in order to develop more effective and accurate medical tools that can be used to treat patients who are afflicted with these conditions and, hopefully, one day find a cure for them. Artificial intelligence offers a number of benefits over more conventional approaches to analytical work and clinical decision-making. When given the chance to learn from training data, AI algorithms improve accuracy. This ultimately aids people in gaining knowledge about treatment variation, care processes, diagnostics, and patient outcomes that was previously impossible.

1. Accurate Cancer Diagnosis

One of the most promising medical uses of machine learning and artificial intelligence, Path AI helps pathologists make more accurate diagnosis. PathAI helps reduce the number of errors made during the process of diagnosing cancer and provides a wide variety of innovative approaches for personalised medical therapy. Because cancer can now be diagnosed with greater precision, the vast majority of patients can receive treatment or be cured at an earlier stage when the disease is still curable, so preventing the loss of many lives.

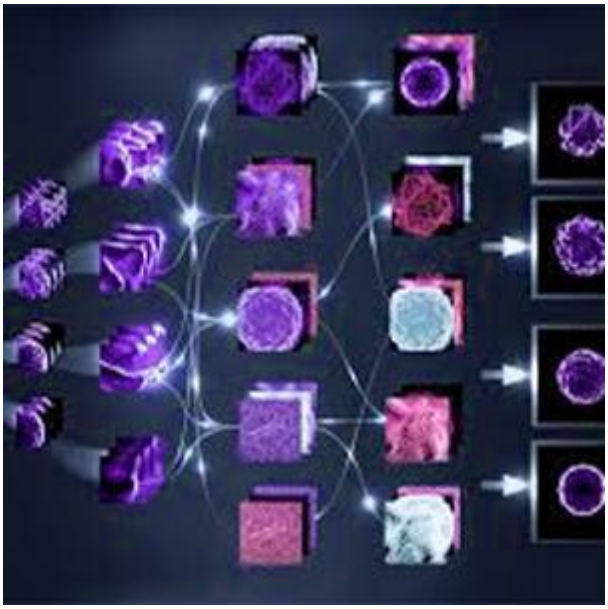

Fig 2: Image for cancer diagnosis**.**

2. Early Diagnosis of Fatal Blood Diseases

Early detection of potentially lethal blood-related disorders is greatly aided by artificial intelligence. AI-enhanced microscopes have greatly improved the speed at which doctors can examine blood samples for hazardous compounds and pathogens like Staphylococcus, E. coli, etc. Over 25,000 photos of blood samples were used by scientists to train machines to recognise dangerous microorganisms. Thanks to AI, robots have learned to recognise these germs in blood and can now reliably foretell whether or not they will be present in future samples, drastically lowering the mortality rate.

3. Customer Service Chatbots

Using natural language processing and other technologies, chatbots answer patient questions about appointments, bills, and more. Chatbots can also have conversations with patients about their ailments and symptoms, relieving pressure on human carers.

In addition, chatbots help provide patients with the answers they need, freeing up valuable time for healthcare professionals to attend to other matters. This healthcare solution not only keeps patients interested, but also provides them with cutting-edge care and improved outcomes.

4. Virtual Health Assistants

A virtual health assistant's responsibilities may include communicating with patients via phone and email, maintaining the confidentiality of their medical records, scheduling visits with doctors, reminding patients of follow-up and clinical appointments, and so on.

Cognitive computing, augmented reality, and the capacity to identify and respond to facial, physical, and verbal motions make this a reality. It's one of the best AI healthcare apps for giving patients control over their health and answering their questions in a way that's unique to them. Both patients and medical professionals benefit from less frequent hospital visits.

5. Treatment of Rare Diseases

In order to accelerate the development and production of revolutionary breakthrough medicines and vaccines, BERG, a clinical-stage AI-based biotech platform, is mapping diseases. This will change the way healthcare is delivered forever. Medical professionals are able to provide excellent medicines for people with unusual diseases thanks to the mix of R&D and inquiring biology.

In addition, BERG has made public its findings concerning Parkinson's disease treatment. This condition is a malfunction in the brain that causes rigidity, shaking, and difficulties completing simple movements such as balancing, coordinating, and walking. Parkinson's disease is one of the most debilitating conditions since its symptoms manifest themselves gradually but steadily worsen over time. BERG makes use

of artificial intelligence to uncover previously unknown connections between the chemicals found in the human body.

6. Automation of Redundant Healthcare Tasks

The automation of tedious and pointless tasks is another significant contribution that AI and its tools make to the healthcare sector. This results in administrators having some extra time on their hands, which they may use to work on other things that are equally as vital and critical. Olive is an AI-driven platform that streamlines processes like determining the viability of unadjudicated medical claims and sending that information along to the right specialists. Olive is able to readily interact with the instruments and software that are already present in a hospital, which eliminates the need for costly downtimes and integrations.

5. Conclusions

The field of medicine is seeing the development of many different uses of artificial intelligence technologies. These innovations have many applications and benefits, including medical imaging and diagnostics, pandemic preparedness, virtual patient care, patient engagement and adherence to treatment plans, administrative burden reduction, new drug and vaccine development, exercise compliance monitoring, gait analysis for technology-assisted rehabilitation, and more. The advancement of AI in healthcare, however, is met with a number of technical, ethical, and governance challenges.Because it makes use of sensitive and personal content that is compelled to be kept confidential by legal panels, it gives rise to problems surrounding data security and privacy. Before adopting AI-based systems, it is essential to collect and assess data of different types (for example, including ethnic and cultural traits of patients) to ensure that the underlying machine learning algorithms can make an accurate diagnosis. For instance, taking into account the patients' ethnic and cultural origins. There's no denying that AI has already made major inroads in the healthcare sector, and that pace of adoption is only set to quicken in the years to come. There's no denying that AI has made substantial advances in the healthcare sector, despite the fact that its use has both positive and bad connotations and that AI itself has multiple sides.

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