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Evaluation of Artificial Intelligence Application in Health Services

[1]Ale Felix, [2,*]Abudllahi Ayegba, [3]Shaibu Mustapha, [4]Edgar Ehimare Ukhurebor, [5]Ibrahim Zubairu Dogo, [6]Bashir Sanusi Yusuf,
[1,2,3,4,5,6]Engineering and Space Systems Department, National Space Research and Development Agency, Abuja, Nigeria
[*]Correspondence author: Abudllahi Ayegba

Abstract: The aim of this research work was to investigate the application of Artificial intelligence in health services. The research adopted the review research method, making use of secondary data comprising online published materials and library documents. From the results, it was observed that AI has various application areas in health services or medical services as a whole. AI has found its application in health delivery in areas such as Clinical Decision Support Systems, Robotics-assisted surgery, Electronic Health Records with AI-powered analytics, AI-assisted diagnostic tools, Predictive analytics for patient outcome, Telemedicine platforms with AI-powered diagnostics, Chatbots for patient triage and support, Virtual nursing assistants, AI-driven medication management, and Personalized medicine and treatment planning. It was also discovered that the integration of AI with health delivery or services has so many advantages, such as reduced healthcare costs, predictive analytics and disease prevention, improved diagnostic accuracy, increases in efficiency and productivity of services, and enhanced patient experience. The result of this work will be beneficial to health service providers, the general public, as well as some people with some form of illness that may require constant or regular contact with the health personnel. It was recommended that the application of AI in security, which is one of the challenges faced by our country and many other parts of the world today, be investigated in future works.

Keywords: *Artificial intelligence, Computer, Electronic Health Records, Health, Machine learning.*

I. INTRODUCTION

Artificial intelligence is defined as the science of making machines do things that would require intelligence if done by men (Minsky, 1968). It is defined as a system that has the capability to perform the task that can be performed by humans. Artificial Intelligence is generally identified as the ability to imitate human cognitive functions using machines. Artificial Intelligence is made up of any system with the ability to sense, engage, reason, and learn that can be used for various human-like functions, such as understanding digital images, planning, motion, voice recognition, and organization (S'tefan et al., 2022). Artificial Intelligence is being used or "trialled" for different healthcare and research purpose, including detection of disease, delivery of health services, drug discovery and management of chronic conditions (www.nuffieldbioethics.org). AI can be used to analyse and identify patterns in large and complex datasets more precisely and faster than has previously been possible or done. It can also be used to search the scientific literature for relevant studies and to combine different kinds of data, for instance, to aid drug discovery (O'Mara-Eves et al., 2015; Leung et al., 2016). These AIs (machines) have the capability to interpret the speech of humans, learn from data, solve the problems of users, plan and take the required action, etc. Artificial Intelligence can also be used to perform surgery through a robot. Some organs in which such surgeries can be done are Heart Thoracic General Surgery Gastrointestinal Gynecology Bone Spine Transplant Surgery Urology (Henna et al., 2023). According to Andras (2020), Artificial Intelligence systems entail computers that are trained to solve problems by mimicking human cognition. Machine learning (ML) and deep learning (DL) models are subfields of artificial intelligence that allow the computer to make predictions based on underlying data patterns. These are two important aspects of Artificial Intelligence used for this task. From evidence, it was found out that the interaction between medical professionals and ML algorithms improves the decision-making process by decreasing the error rate. The current work was done to summarise some application areas of AI in healthcare services or some aspects of medical services.

II. RESEARCH METHODOLOGY

This research made use of secondary materials or research data. These were published materials in the research area and other relevant areas. The method used in the work was the review research method. This was to enable us to look critically into the various works, methods used, and results gotten, including the setbacks observed, if any, in the various works.

III. RESULTS AND DISCUSSIONS

This section deals with the application areas of Artificial Intelligence in health services.

AI has various application areas in health services or medical services as a whole. AI has found its application in health services in areas such as Clinical Decision Support Systems, Robotics-assisted surgery, Electronic Health Records (EHRs) with AI-powered analytics, AI-assisted diagnostic tools, Predictive analytics for patient outcome, Telemedicine platforms with AI-powered diagnostics, Chatbots for patient triage and support, Virtual nursing assistants, AI-driven medication management, and Personalized medicine and treatment planning. In a very simple terms, Clinical Decision Support Systems is defined as the Computer-based systems that provide healthcare providers with clinical decision-making guidance; Robotics-assisted surgery is defined as Surgical systems that utilize AI and robotic arms to enhance precision and minimize invasive procedures; Electronic Health Records with AI-powered analytics is defined as Digital patient records that utilize AI to analyze and provide insights on patient data; AI-assisted diagnostic tools is defined as Software that uses AI algorithms to analyze medical images, lab results, or patient data to aid diagnosis; Predictive analytics for patient outcome is defined as statistical models that use AI to forecast patient outcomes, such as readmissions or complications; Telemedicine platforms with AI-powered diagnostics is defined as Remote healthcare platforms that utilize AI to diagnose and treat patients virtually; Chatbots for patient triage and support is defined as AI-driven conversational interfaces that assess patient symptoms and provide basic care guidance, Virtual nursing assistants is defined as AI-powered virtual

assistants that provide patients with personalized care guidance and support, AI-driven medication management is defined as Systems that use AI to optimize medication dosing, monitor side effects, and prevent adverse interactions, and Personalized medicine and treatment planning is defined as tailored treatment plans based on individual patient characteristics, genetic profiles, and medical history.

According to Elhaddad and Hamam (2024), Clinical Decision Support Systems (CDSS) are very important tools in contemporary healthcare, as they help in enhancing clinicians' decisions and patient outcomes. This observation was made in their review work, which delves into how AI technologies are transforming Clinical Decision Support Systems, their applications in healthcare decision-making, associated challenges, as well as the potential trajectory toward fully realizing AI-CDSS's potential. It was stated that one of the most impactful applications of AI-driven CDSS is in providing diagnostic support. AI algorithms, especially deep learning models, have shown commendable capabilities in analyzing medical images, such as X-rays, MRIs, and histopathology slides, thereby assisting clinicians in making accurate diagnoses. According to Komorowski (2018), as quoted by Elhaddad and Hamam (2024), AI-CDSS extends beyond simply analyzing data support in the diagnosis, but it also reveals its potential for personalized treatment recommendations tailored to individual patient characteristics. By analyzing diverse patient data, including genetic profiles, medical histories, and treatment outcomes, AI algorithms can identify optimal treatment strategies that optimize efficacy and minimize risks. This algorithm continuously learns from patient data and treatment responses to dynamically adjust therapeutic regimens, resulting in improved patient outcomes compared to standard protocols. Serdar *et al.* (2024) stated that Artificial intelligence-based clinical decision support systems (CDSSs) are systems that support complex decision-making processes by using AI techniques such as data analysis, foresight, and optimization. Artificial intelligence-based CDSSs play an important role in patient care by providing more accurate and personalized information to healthcare professionals in risk assessment, diagnosis, treatment optimization, and monitoring and early warning of cardiovascular disease. It was further stated that Clinical decision support systems (CDSSs) offer patient-tailored, evidence-based guidance on cardio- vascular risk factor screening, diagnosis, and management and therefore have a great deal of promise to fill in the gaps in the implementation of cardiovascular disease prevention guidelines and facilitate the workflows of clinicians.

In the work by Udegbe et al. (2024), on the topic "AI's impact on personalized medicine: tailoring treatments for improved health outcomes," it was stated that AI technologies, such as data analysis and interpretation to diagnostic tools and treatment planning, provide unprecedented opportunities for tailoring medical interventions to individual patient characteristics, as it will facilitate the analysis of complex biological data, predict disease risks, and enhance diagnostic accuracy. It was further asserted that AI-powered personalized medicine promises to expand access to high-quality healthcare and address global health disparities.

Traditional diagnostic processes, often reliant on the subjective interpretation of medical images and tests, are inherently prone to error and variability. On the other hand, AI algorithms excel in the consistent and unbiased analysis of complex diagnostic data, from high-resolution imaging scans to intricate patterns of symptoms (Habuza et al., 2021). In the findings by Ahemed and Al-Bagoury (2022), AI has the capacity to plan treatment for a patient as well as predict some medications. In their words, AI's role extends into treatment planning and predictions, where it assists in crafting individualized treatment regimens. By integrating and analyzing data from a variety of sources, including patient medical histories, genetic profiles, and responses to previous treatments, AI algorithms can predict how a patient might respond to certain medications or treatment protocols.

According to Rastogi (2024), as reported by Udegbe (2024), AI can be integrated with wearable technology and remote monitoring devices equipped with sensors and AI algorithms, which will continuously collect and analyze health data in real-time, from heart rate and blood pressure to glucose levels and sleep patterns, and the constant stream of personalized health information enables proactive management of chronic conditions, timely interventions in the face of emerging health issues, and tailored lifestyle recommendations to promote overall well-being. As observed by Kassahun (2016), several apps that use AI to offer personalised health assessments and home care advice are currently on the market. The app Ada Health Companion uses AI to operate a chatbot, which combines information about symptoms from the user with other information to offer possible diagnoses.

In the work entitled "Artificial-Intelligence-Based Clinical Decision Support Systems in Primary Care: A Scoping Review of Current Clinical Implementations" by Cesar et al. (2024), it was observed that AI-CDSSs have the capability of improving clinical management, patient satisfaction, and safety while reducing physician workload, taking into cognizance the fact that Primary Care Physicians (PCPs) are the first point of contact in healthcare, and always face the challenge of managing diverse patient populations while maintaining up-to-date medical knowledge and updated health records. In the same way, Carla et al., (2020) have this to say regarding the Electronic Health Records Exploitation Using Artificial Intelligence. According to them, the exploitation of electronic health records (EHRs) has multiple utilities, from predictive tasks and clinical decision support to pattern recognition, bearing in mind that Artificial Intelligence (AI) allows to extract knowledge from EHR data in a practical way. In this study, we aim to construct a Machine Learning model from EHR data to make predictions about patients. It was reported in the work by the authors that they will construct a Machine Learning model to predict whether a patient will have a recurrence in less than 6, 12, or 18 months (depending on diagnosis). This model will allow them to identify the characteristics that seem to increase the relapse risk in those patients. At the same time, we will carry out exploratory analysis in search of hidden patterns among the data. Abed et al. (2023) propose a comprehensive review of AI-powered approaches that detect and incorporate the underlying skills-related features of surgical trajectories to classify and improve the levels of expertise of users in surgical training platforms. In the work, it was also explained how to create an optimized trajectory with minimal reconstruction loss compared to the initialized novice trajectory while having more skillful features. The optimized trajectory can be used as a control reference command to generate a virtual corrective force on the RAS platform and guide the participant's hand toward more dexterous stylistic behavior. The enhancement metrics over the trainee's trajectory were introduced to measure the functionality and performance of the skills assessment algorithm. These metrics include but are not limited to motion predictability, reduction in hand tremor, and noise cancellation.

According to findings, computer-controlled surgery has a very big advantage, that it can be performed by the person performing the surgery, irrespective of where he or she is in the world. The person performing the surgery does not need to be physically present in the room where the surgery is actually being performed. He or she just needs to provide the necessary input through the computer and watch that it gets done by the machine by seeing the results in the monitor (Galasso and Hong, 2018). The growing public concern regarding surgeon proficiency as well as the widespread implementation of robotic surgery have led to an increased need for adequate structured training models and objective evaluation tools of clinical competence. Apart from the applications in surgical skills assessment and prediction of outcomes, AI systems can provide help to already proficient surgeons by improving the visualization of the intraoperative anatomy through the use of augmented reality (Andras et al., 2020). It was further stated that the preliminary results of the implementation of AI in clinical settings are encouraging. By providing a readout of the full telemetry and a sophisticated viewing console, robot-assisted surgery can be used to study and refine the application of AI in surgical practice. Machine learning approaches strengthen the feedback regarding surgical skill acquisition, efficiency of the surgical process, surgical guidance, and prediction of postoperative outcomes. When ML can compensate for the motility of the organs during surgery and can provide tissue and instrument recognition, a more accurate connection can be made between preoperative 3D imaging data sets and the patient. This will also support the implementation of "GPS-like" surgical navigation strategies (Zhao et al., 2019). According to Knudsen et al. (2024), artificial intelligence (AI) is revolutionizing nearly every aspect of modern life, and as such, in the medical field, robotic surgery is the sector with some of the most innovative and impactful advancements. It was stated that AI modeling is allowing surgeons to have advanced intraoperative metrics such as force and tactile measurements, enhanced detection of positive surgical margins, and even allowing for the complete automation of certain steps in surgical procedures.

Some advantages of AI integration in health services are

1. It Enhances Patient Experience: Artificial intelligence integration in health services allows patients to engage virtually as he or she likes, and will help in quick recovery as changes at any point are reported by the patient accordingly for proper or immediate actions. For instance, AI-driven chatbots, virtual assistants, and personalized care plans enhance patient engagement, empowerment, and satisfaction.

2 It increases the efficiency and productivity of services: The automation of administrative tasks will reduce paperwork and manual errors. Streamlining clinical workflows, optimizing resource allocation and patient scheduling, thereby enhancing diagnosis accuracy and speed, and enabling timely interventions

3. It results in improved diagnostic accuracy: AI-powered algorithms analyze medical data, images, and lab results to aid diagnosis, reducing errors and improving patient outcomes. AI enables real-time analysis of patient data, which helps in reducing errors and delays. The analysis of large amounts of medical data, identifying patterns and anomalies, thereby enhancing diagnostic precision, reducing false positives and negatives

4. It helps in Data-Driven Insights and Decision-Making: AI analyzes vast amounts of healthcare data, providing actionable insights for clinicians, administrators, and policymakers to inform decision-making. The large amount of data available for analysis gives enough room for the technology to make proper decisions from the data of the patience or the historical records of the patients or a group of patients.

5. It brings about predictive analytics and disease prevention: AI analyzes patient data, identifying high-risk patients and predicting disease progression, enabling proactive interventions.

6. It leads to reduced healthcare costs: The automation of administrative tasks will reduce labour costs and paperwork. It will help in optimizing resource allocation, minimizing waste, and improving supply chain management. It will help in enhancing patient engagement, reducing hospital readmissions, identifying high-risk patients, enabling early interventions, reducing costly complications, and reducing overhead costs.

CONCLUSION

The research on how AI is bridging the gap between technology and human potential has been conducted using the review research method. From the review of various published works, especially the recent ones, it was observed that AI has various application areas in health services or medical services as a whole. AI has found its application in health delivery in areas such as clinical decision support systems, robotics-assisted surgery, electronic health records (EHRs) with AI-powered analytics, AI-assisted diagnostic tools, predictive analytics for patient outcome, telemedicine platforms with AI-powered diagnostics, chatbots for patient triage and support, virtual nursing assistants, AI-driven medication management, and personalised medicine and treatment planning. It was also discovered that the integration of AI in healthcare delivery or services has so many advantages, such as reduced healthcare costs, predictive analytics and disease prevention, improved diagnostic accuracy, increases in efficiency and productivity of services, and enhanced patient experience. The result of this work will be beneficial to healthcare service providers, the general public, as well as some people with some form of illness that may require constant or regular contact with the health personnel.

Recommendation

It is recommended that the application of AI in security, which is one of the challenges faced by our country and many other parts of the world today, be investigated in future works.

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