ejpmr, 2024, 11(7), 705-717

SJIF Impact Factor 7.065

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

ARTIFICIAL INTELLIGENCE: A MODERN TOOL TO CONQUER OVER THE MEDICAL SCIENCES

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Article Received on 21/05/2024 **Article Revised on 11/06/2024** **Article Accepted on 01/07/2024**

ABSTRACT

Artificial intelligence in medicine is the use of machine learning models to help process medical data and give medical professionals important insights, improving health outcomes and patient experiences. Thanks to recent advances in computer science and informatics, artificial intelligence (AI) is quickly becoming an integral part of modern healthcare. AI algorithms and other applications powered by AI are being used to support medical professionals in clinical settings and in ongoing research. Currently, the most common roles for AI in medical settings are clinical decision support and imaging analysis. Clinical decision support tools help providers make decisions about treatments, medications, mental health and other patient needs by providing them with quick access to information or research that's relevant to their patient. In medical imaging, AI tools are being used to analyze CT scans, x-rays, MRIs and other images for lesions or other findings that a human radiologist might miss. The challenges that the COVID-19 pandemic created for many health systems also led many healthcare organizations around the world to start field-testing new AI-supported technologies, such as algorithms designed to help monitor patients and AI-powered tools to screen COVID-19 patients. The research and results of these tests are still being gathered, and the overall standards for the use AI in medicine are still being defined. Yet opportunities for AI to benefit clinicians, researchers and the patients they serve are steadily increasing. At this point, there is little doubt that AI will become a core part of the digital health systems that shape and support modern medicine.

KEYWORDS: Artificial intelligence, deep convolutional neural network, medical use.

OVERVIEW: Artificial intelligence in medicine is the use of machine learning models to help process medical data and give medical professionals important insights, improving health outcomes and patient experiences. The use of AI, inclusive of Generative AI, in healthcare is evolving rapidly and has the 'potential to enhance healthcare outcomes by improving clinical trials, medical diagnosis and treatment, self-management of care, and personalized care. Gen AI could help accelerate the process of identifying targets, developing validation assays to test compounds, singling out the most promising leads, and assisting in preclinical testing to determine their effectiveness. Pharmaceutical manufacturers are already using foundational models for these purposes.[1]

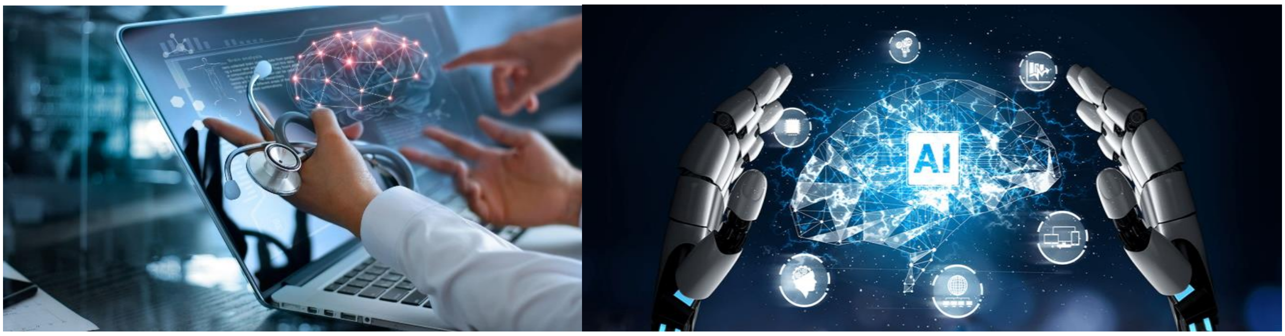

Figure-1: Artificial Intelligence in Medical Sciences.

AI Doctor is the chatbot feature of Docus AI Health Assistant, designed to provide health-related information, recommendations, and support. It analyzes your medical history, symptoms, and other relevant factors to assist you with preliminary guidance through interactive communication. Artificial intelligence is shaping the future of healthcare technology by assisting clinicians with its advanced algorithms. From robotic surgery to highly accurate cancer detection, artificial intelligence is being threaded throughout a variety of vital procedures and shaping the future of surgery. However, integrating AI into medical education comes with advantages and obstacles. The advantages include objective student assessment, better clinical simulation organization, and enhanced education transparency. From conversational AI to clinical applications, Manipal Healthcare is also making strides. “We are using conversational AI to interact with our patients and families. In clinical areas, current applications include early alerts on patients who could require intensive care. Gen AI could help accelerate the process of identifying targets, developing validation assays to test compounds, singling out the most promising leads, and assisting in preclinical testing to determine their effectiveness. Pharmaceutical manufacturers are already using foundational models for these purposes. Recently, researchers from Tsinghua University have developed the AI hospital called "Agent Hospital." In this virtual world, all doctors, nurses and patients are driven by large language model (LLM)-powered intelligent agents, capable of autonomous interaction. One of the key ways in which AI is used in robotics is through machine learning. This technique enables robots to learn and perform specific tasks through observing and mimicking human actions.

Figure-2: Robotics & Artificial Intelligence.

AI gives robots a computer vision that enables them to navigate, detect and determine their reactions accordingly. There are many good uses for AI in the medical device industry, such as data management, remote surgery, diagnostic and procedural assisting, clinical trials, and more. AI can improve medical device manufacturing efficiency and reduce risk through. Drug Discovery and Development: AI accelerates the drug discovery process by analyzing vast datasets to identify potential drug candidates and predict their efficacy. Artificial intelligence (AI) affects 100% of physicians and other health care providers, but three out of four patients do not trust AI in a health care setting. AI has become ubiquitous in health care, but a new survey found nearly 80% of patients don't know if their doctor is using it or not. The scope of AI in healthcare amplifies diagnostic precision and expedites decision-making processes, facilitating a seamless workflow that ultimately enhances patient care outcomes. According to a Morgan Stanley report released in August, 94% of the health care companies surveyed said they are now employing artificial intelligence or machine learning in some capacity. Based on how they learn and how far they can apply their knowledge, all AI can be broken down into three capability types: Narrow AI, general AI and super AI.[2]

Figure-3: Artificial Narrow Intelligence.

Artificial narrow intelligence (ANI) refers to the goal-oriented version of AI designed to better perform a single task such as tracking weather updates, generating data science reports by analyzing raw data, or playing games such as poker, chess, etc. Artificial general intelligence (AGI) is a field of theoretical AI research that attempts to create software with human-like intelligence and the ability to self-teach. The aim is for the software to be able to perform tasks that it is not necessarily trained or developed for. Artificial superintelligence (ASI) is a hypothetical software-based artificial intelligence (AI) system with an intellectual scope beyond human intelligence. At the most fundamental level, this superintelligent AI has cutting-edge cognitive functions and highly developed thinking skills more advanced than any human. 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. AI is also Query revolutionizing the field of surgical education. One of the key ways in which AI is used in robotics is through machine learning. This technique enables robots to learn and perform specific tasks through observing and mimicking human actions. AI gives robots a computer vision that enables them to navigate, detect and determine their reactions accordingly. To operate using the Robotic system, your surgeon makes tiny incisions in your body and inserts miniaturized instruments and a high-definition three-dimensional camera, and sometimes skin incisions are not required at all. Then, from a nearby console, your surgeon manipulates those instruments to perform the operation. During the surgery, many surgical applications like ultrasound, NIRF (Near-Infrared Fluorescence), OCT (Optical Coherence Tomography), probe-based confocal laser endomicroscopy, electromagnetic sensors, and many other devices use AI techniques to provide computer-assisted surgery. In sensitive surgical procedures, augmented reality integrated through an AI can overlay important information such as vitals and hemodynamic state of a patient in real time to the surgeons, which may help them optimize their techniques, as well as decision-making during the surgery. However, given that AI tools have the ability to improve patient safety, clinical outcomes, quality of care, and clinical documentation, according to AMA President Jesse Ehrenfeld, MD, “Physicians who use AI will replace those who don't.” Da Vinci Software | Elevating the Possibilities for Robotic Surgery. One of the most significant developments in robotic surgery tools is the enhancement of robotic arms. These arms are now more dexterous, mimicking the movements of a human hand with greater precision. This advancement allows surgeons to perform intricate procedures in hard-to-reach areas with minimal incisions.

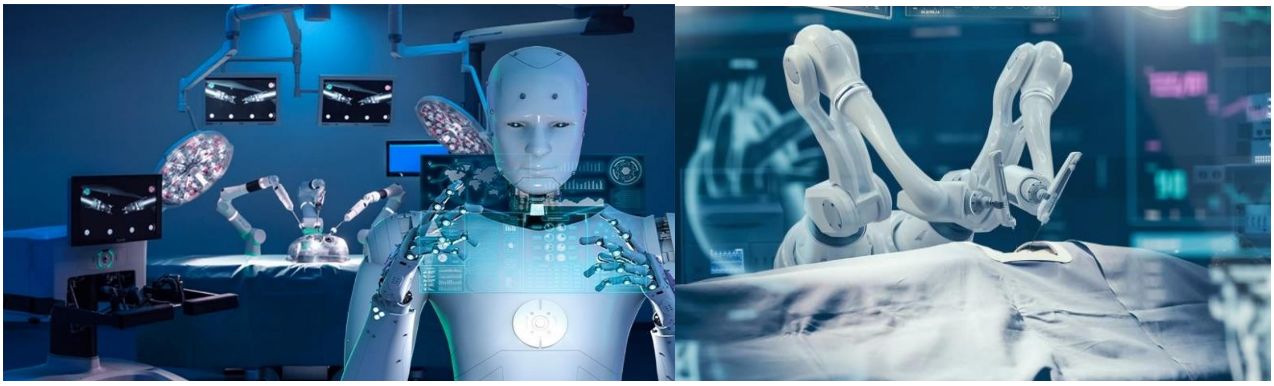

Figure-4: Artificial Intelligence in Robotic Surgery.

AI applications in medicine: There are numerous ways AI can positively impact the practice of medicine, whether it's through speeding up the pace of research or helping clinicians make better decisions. AI in disease detection and diagnosis: Unlike humans, AI never needs to sleep. Machine learning models could be used to observe the vital signs of patients receiving critical care and alert clinicians if certain risk factors increase. While medical devices like heart monitors can track vital signs, AI can collect the data from those devices and look for more complex conditions, such as sepsis. One IBM client has developed a predictive AI model for premature babies that is 75% accurate in detecting severe sepsis. Personalized disease treatment: Precision medicine could become easier to support with virtual AI assistance. Because AI models can learn and retain preferences, AI has the potential to provide customized real-time recommendations to patients around the clock. Rather than having to repeat information with a new person each time, a healthcare system could offer patients around-the-clock access to an AI-powered virtual assistant that could answer questions based on the patient's medical history, preferences and personal needs. AI in medical imaging.

AI is already playing a prominent role in medical imaging. Research has indicated that AI powered by artificial neural networks can be just as effective as human radiologists at detecting signs of breast cancer as well as other conditions. In addition to helping clinicians spot early signs of disease, AI can also help make the staggering number of medical images that clinicians have to keep track of more manageable by detecting vital pieces of a patient's history and presenting the relevant images to them.

Clinical trial efficiency: A lot of time is spent during clinical trials assigning medical codes to patient outcomes and updating the relevant datasets. AI can help speed this process up by providing a quicker and more intelligent search for medical codes. Two IBM Watson Health clients recently found that with AI, they could reduce their number of medical code searches by more than 70%.

Accelerated drug development: Drug discovery is often one of the longest and most costly parts of drug development. AI could help reduce the costs of developing new medicines in primarily two ways: creating better drug designs and finding promising new drug combinations. With AI, many of the big data challenges facing the life sciences industry could be overcome.

Benefits of AI in medicine: Informed patient care. Integrating medical AI into clinician workflows can give providers valuable context while they're making care decisions. A trained machine learning algorithm can help cut down on research time by giving clinicians valuable search results with evidence-based insights about treatments and procedures while the patient is still in the room with them. Error reduction: There is some evidence that AI can help improve patient safety. A recent systemic review (link resides outside ibm.com) of 53 peer-reviewed studies examining the impact of AI on patient safety found that AI-powered decision support tools can help improve error detection and drug management.[3]

Reducing the costs of care: There are a lot of potential ways AI could reduce costs across the healthcare industry. Some of the most promising opportunities include reducing medication errors, customized virtual health assistance, fraud prevention, and supporting more efficient administrative and clinical workflows.

Increasing doctor-patient engagement. Many patients think of questions outside of typical business hours. AI can help provide around-the-clock support through chatbots that can answer basic questions and give patients resources when their provider's office isn't open. AI could also potentially be used to triage questions and flag information for further review, which could help alert providers to health changes that need additional attention.

Providing contextual relevance: One major advantage of deep learning is that AI algorithms can use context to distinguish between different types of information. For example, if a clinical note includes a list of a patient's current medications along with a new medication their provider recommends, a well-trained AI algorithm can use natural language processing to identify which medications belong in the patient's medical history.

Artificial intelligence in healthcare is the application of artificial intelligence (AI) to copy human cognition in the analysis, presentation, and understanding of complex medical and health care data, or to exceed human capabilities by providing new ways to diagnose, treat, or prevent disease. Specifically, AI is the ability of computer algorithms to arrive at approximate conclusions based solely on input data.

Figure-5: Artificial Intelligence in Neurology.

The primary aim of health-related AI applications is to analyze relationships between clinical data and patient outcomes. AI programs are applied to practices such as diagnostics, treatment protocol development, drug development, personalized medicine, and patient monitoring and care. What differentiates AI technology from traditional technologies in healthcare is the ability to gather larger and more diverse data, process it, and produce a well-defined output to the end-user. AI does this through machine learning algorithms and deep learning. Because radiographs are the most common imaging tests conducted in most radiology departments, the potential for AI to help with triage and interpretation of traditional radiographs (X-ray pictures) is particularly noteworthy. These processes can recognize patterns in behavior and create their own logic. To gain useful insights and predictions, machine learning models must be trained using extensive amounts of input data. AI algorithms behave differently from humans in two ways: (1) algorithms are literal: once a goal is set, the algorithm learns exclusively from the input data and can only understand what it has been programmed to do, (2) and some deep learning algorithms are black boxes; algorithms can predict with extreme precision, but offer little to no comprehensible explanation to the logic behind its decisions aside from the data and type of algorithm used.

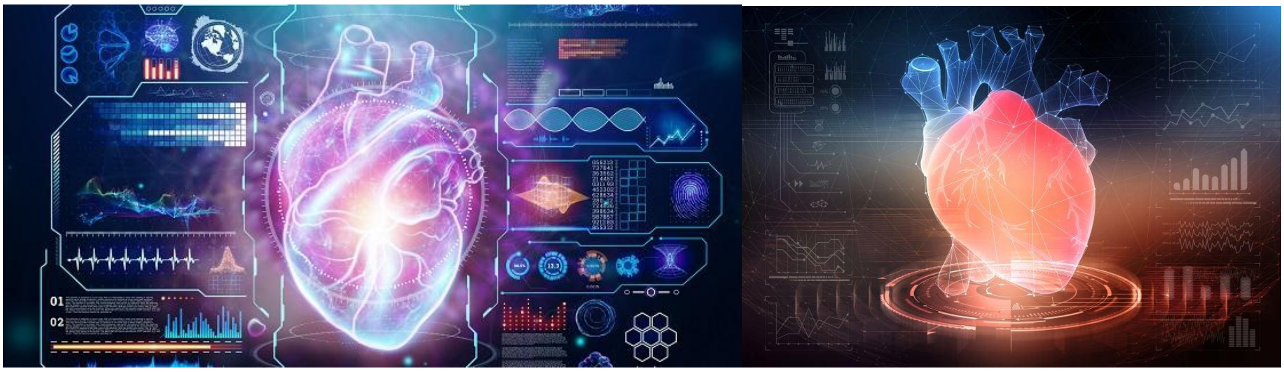

Figure-6: Artificial Intelligence in Cardiology.

As widespread use of AI in healthcare is relatively new, research is ongoing into its application in various fields of medicine and industry. Additionally, greater consideration is being given to the unprecedented ethical concerns related to its practice such as data privacy, automation of jobs, and representation biases. Furthermore, new technologies brought about by AI in healthcare are often resisted by healthcare leaders, leading to slow and erratic adoption.[4]

In recent years, AI has played a leading role in the use and valuation of extensive collections of data, Google and the Mayo Clinic, for example, have announced a partnership to solve complex medical problems using data-driven medical innovation, or a team from the University of California, San Diego was able to create a diagnostic program by training AI on medical records from 1.3 million patients under the age of 18.80.

Cardiovascular: Artificial intelligence algorithms have shown promising results in accurately diagnosing and risk stratifying patients with concern for coronary artery disease, showing potential as an initial triage tool. Other algorithms have been used in predicting patient mortality, medication effects, and adverse events following treatment for acute coronary syndrome. Wearables, smartphones, and internet-based technologies have also shown the ability to monitor patients' cardiac data points, expanding the amount of data and the various settings AI models can use and potentially enabling earlier detection of cardiac events occurring outside of the hospital. Another growing area of research is the utility of AI in classifying heart sounds and diagnosing valvular disease. Challenges of AI in cardiovascular medicine have included the limited data available to train machine learning models, such as limited data on social determinants of health as they pertain to cardiovascular disease.

Figure-7: Artificial Intelligence in Dermatology.

A key limitation in early studies evaluating AI were omissions of data comparing algorithmic performance to humans. Examples of studies which assess AI performance relative to physicians includes how AI is noninferior to humans in interpretation of cardiac echocardiograms and that AI can diagnose heart attack better than human physicians in the emergency setting, reducing both low-value testing and missed diagnoses.

In cardiovascular tissue engineering and organoid studies, AI is increasingly used to analyze microscopy images, and integrate electrophysiological read outs.

Dermatology: Dermatology is an imaging abundant speciality and the development of deep learning has been strongly tied to image processing. Therefore, there is a natural fit between the dermatology and deep learning. There are three main imaging types in dermatology: contextual images, macro images, micro images. For each modality, deep learning showed great progress. Han et al. showed keratinocytic skin cancer detection from face photographs. Esteva et al. demonstrated dermatologist-level classification of skin cancer from lesion images. Noyan et al. demonstrated a convolutional neural network that achieved 94% accuracy at identifying skin cells from microscopic Tzanck smear images. A concern raised with this work is that it has not engaged with disparities related to skin color or differential treatment of patients with non-white skin tones.

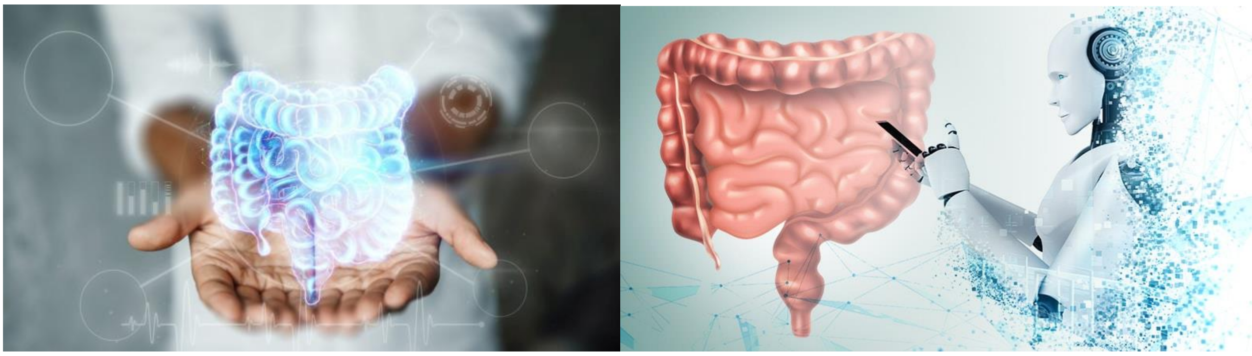

Figure-8: Artificial Intelligence in Gastroenterology.

According to some researchers, AI algorithms have been shown to be more effective than dermatologists at identifying cancer. However, a 2021 review article found that a majority of papers analyzing the performance of AI algorithms designed for skin cancer classification failed to use external test sets. Only four research studies were found in which the AI algorithms were tested on clinics, regions, or populations distinct from those it was trained on, and in each of those four studies, the performance of dermatologists was found to be on par with that of the algorithm. Moreover, only one study was set in the context of a full clinical examination; others were based on interaction through web-apps or online questionnaires, with most based entirely on context-free images of lesions. In this study, it was found that dermatologists significantly outperformed the algorithms. Many articles claiming superior performance of AI algorithms also fail to distinguish between trainees and board-certified dermatologists in their analyses.

It has also been suggested that AI could be used to automatically evaluate the outcome of maxillo-facial surgery or cleft palate therapy in regard to facial attractiveness or age appearance.

Gastroenterology: AI can play a role in various facets of the field of gastroenterology. Endoscopic exams such as esophagogastroduodenoscopies (EGD) and colonoscopies rely on rapid detection of abnormal tissue. By enhancing these endoscopic procedures with AI, clinicians can more rapidly identify diseases, determine their severity, and visualize blind spots. Early trials in using AI detection systems of early gastric cancer have shown sensitivity close to expert endoscopists.[5]

Obstetrics and gynaecology: Artificial intelligence, or AI, utilises massive amounts of data to help with predicting illness, prevention, and diagnosis, as well as patient monitoring. In obstetrics, artificial intelligence is utilised in magnetic resonance imaging, ultrasound, and foetal cardiotocography. AI contributes in the resolution of a variety of obstetrical diagnostic issues.

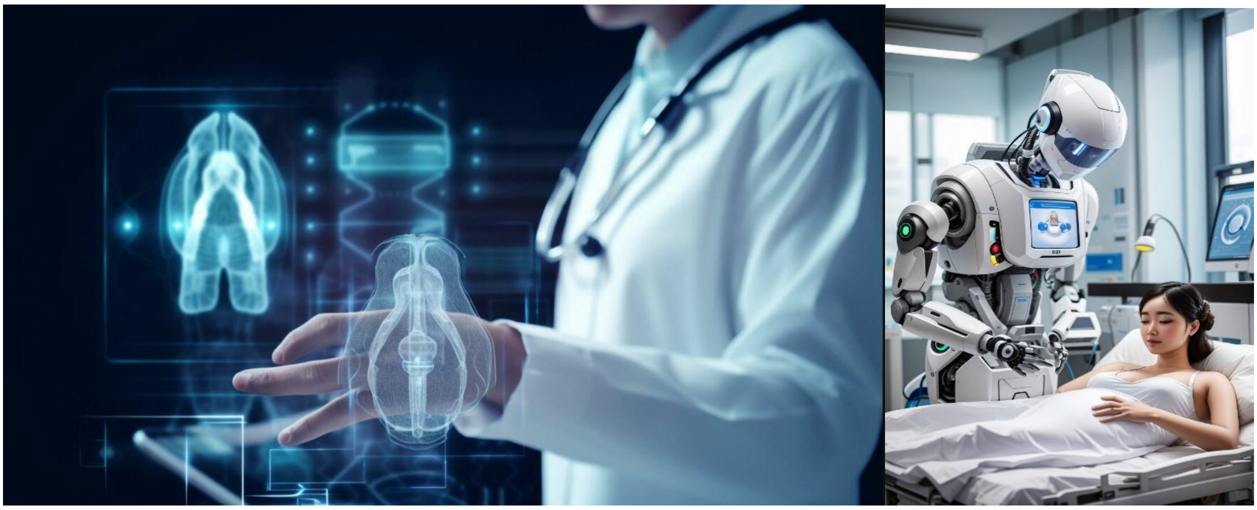

Figure-9: Artificial Intelligence in Gynaecology.

Infectious diseases: AI has shown potential in both the laboratory and clinical spheres of infectious disease medicine. As the novel coronavirus ravages through the globe, the United States is estimated to invest more than

$2 billion in AI-related healthcare research by 2025, more than 4 times the amount spent in 2019 ($463 million). While neural networks have been developed to rapidly and accurately detect a host response to COVID-19 from mass spectrometry samples, a scoping review of the literature found few examples of AI being used directly in clinical practice during the COVID-19 pandemic itself. Other applications include support-vector machines identifying antimicrobial resistance, machine learning analysis of blood smears to detect malaria, and improved point-of-care testing of Lyme disease based on antigen detection. Additionally, AI has been investigated for improving diagnosis of meningitis, sepsis, and tuberculosis, as well as predicting treatment complications in hepatitis B and hepatitis C patients.[6]

Figure-10: Artificial Intelligence in Musculoskeletal.

Musculoskeletal: AI has been used to identify causes of knee pain that doctors miss, that disproportionately affect Black patients. Underserved populations experience higher levels of pain. These disparities persist even after controlling for the objective severity of diseases like osteoarthritis, as graded by human physicians using medical images, raising the possibility that underserved patients' pain stems from factors external to the knee, such as stress. Researchers have conducted a study using a machine-learning algorithm to show that standard radiographic measures of severity overlook objective but undiagnosed features that disproportionately affect diagnosis and management of underserved populations with knee pain. They proposed that new algorithmic measure ALG-P could potentially enable expanded access to treatments for underserved patients.

Neurology: The use of AI technologies has been explored for use in the diagnosis and prognosis of Alzheimer's disease (AD). For diagnostic purposes, machine learning models have been developed that rely on structural MRI inputs. The input datasets for these models are drawn from databases such as the Alzheimer's Disease Neuroimaging Initiative. Researchers have developed models that rely on convolutional neural networks with the aim of improving early diagnostic accuracy. Generative adversarial networks are a form of deep learning that have also performed well in diagnosing AD. There have also been efforts to develop machine learning models into forecasting tools that can predict the prognosis of patients with AD. Forecasting patient outcomes through generative models has been proposed by researchers as a means of synthesizing training and validation sets. They suggest that generated patient forecasts could be used to provide future models larger training datasets than current open access databases.

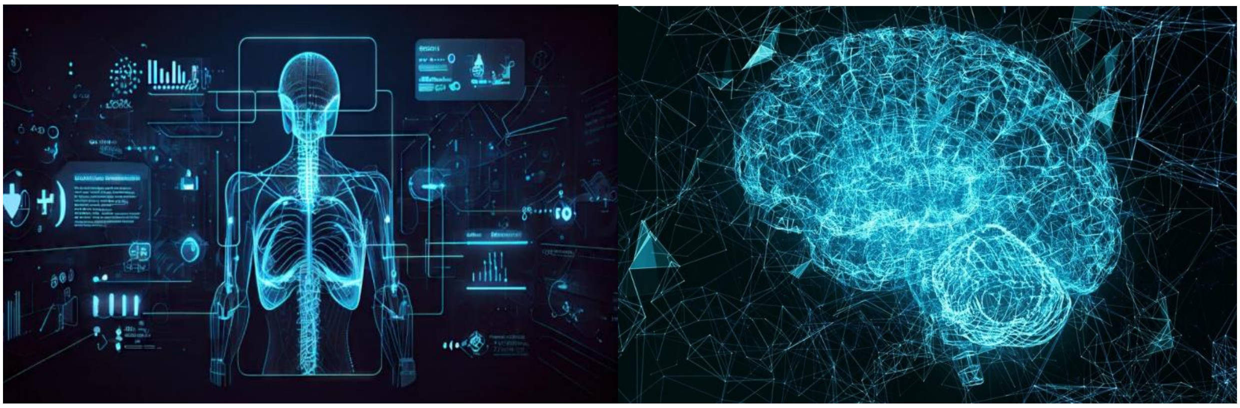

Figure-11: Artificial Intelligence in Neurology.

Oncology: AI has been explored for use in cancer diagnosis, risk stratification, molecular characterization of tumors, and cancer drug discovery. A particular challenge in oncologic care that AI is being developed to address is the ability to accurately predict which treatment protocols will be best suited for each patient based on their individual genetic, molecular, and tumor-based characteristics. AI has been trialed in cancer diagnostics with the reading of imaging studies and pathology slides.

Figure-12: Artificial Intelligence in Oncology.

Ophthalmology: Artificial intelligence-enhanced technology is being used as an aid in the screening of eye disease and prevention of blindness. In 2018, the U.S. Food and Drug Administration authorized the marketing of the first medical device to diagnose a specific type of eye disease, diabetic retinopathy using an artificial intelligence algorithm. Moreover, AI technology may be used to further improve "diagnosis rates" because of the potential to decrease detection time.[7]

Primary care: Primary care has become one key development area for AI technologies. AI in primary care has been used for supporting decision making, predictive modelling, and business analytics. There are only a few examples of AI decision support systems that were prospectively assessed on clinical efficacy when used in practice by physicians. But there are cases where the use of these systems yielded a positive effect on treatment choice by physicians.

Pathology: Ki67 stain calculation by the open-source software QuPath in a pure seminoma, which gives a measure of the proliferation rate of the tumor. The colors represent the intensity of expression: blue-no expression, yellow-low, orange-moderate, and red-high expression. For many diseases, pathological analysis of cells and tissues is considered to be the gold standard of disease diagnosis. Methods of digital pathology allows microscopy slides to be scanned and digitally analyzed. AI-assisted pathology tools have been developed to assist with the diagnosis of a number of diseases, including breast cancer, hepatitis B, gastric cancer, and colorectal cancer. AI has also been used to predict genetic mutations and prognosticate disease outcomes. AI is well-suited for use in low-complexity pathological analysis of large-scale screening samples, such as colorectal or breast cancer screening, thus lessening the burden on pathologists and allowing for faster turnaround of sample analysis.

Figure-13: Artificial Intelligence in Pathology.

Several deep learning and artificial neural network models have shown accuracy similar to that of human pathologists and a study of deep learning assistance in diagnosing metastatic breast cancer in lymph nodes showed that the accuracy of humans with the assistance of a deep learning program was higher than either the humans alone or the AI program alone. Additionally, implementation of digital pathology is predicted to save over $12 million for a university center over the course of five years, though savings attributed to AI specifically have not yet been widely researched.

Figure-14: Artificial Intelligence in Ophthalmology.

The use of augmented and virtual reality could prove to be a stepping stone to wider implementation of AI-assisted pathology, as they can highlight areas of concern on a pathology sample and present them in real-time to a pathologist for more efficient review. AI also has the potential to identify histological findings at levels beyond what the human eye can see, and has shown the ability to use genotypic and phenotypic data to more accurately detect the tumor of origin for metastatic cancer. One of the major current barriers to widespread implementation of AI-assisted pathology tools is the lack of prospective, randomized, multi-center controlled trials in determining the true clinical utility of AI for pathologists and patients, highlighting a current area of need in AI and healthcare research.[8]

Figure-15: Artificial Intelligence in Cell Culture.

Psychiatry: In psychiatry, AI applications are still in a phase of proof-of-concept. Areas where the evidence is widening quickly include predictive modelling of diagnosis and treatment outcomes, chatbots, conversational agents that imitate human behaviour and which have been studied for anxiety and depression. Challenges include the fact that many applications in the field are developed and proposed by private corporations, such as the screening for suicidal ideation implemented by Facebook in 2017. Such applications outside the healthcare system raise various professional, ethical and regulatory questions. Another issue is often with the validity and interpretability of the models. Small training datasets contain bias that is inherited by the models, and compromises the generalizability and stability of these models. Such models may also have the potential to be discriminatory against minority groups that are underrepresented in samples.

Figure-16: Artificial Intelligence in Radiology.

Radiology: AI is being studied within the field of radiology to detect and diagnose diseases through computerized tomography (CT) and magnetic resonance (MR) imaging. It may be particularly useful in settings where demand for human expertise exceeds supply, or where data is too complex to be efficiently interpreted by human readers. Several deep learning models have shown the capability to be roughly as accurate as healthcare professionals in identifying diseases through medical imaging, though few of the studies reporting these findings have been externally validated. AI can also provide non-interpretive benefit to radiologists, such as reducing noise in images, creating high-quality images from lower doses of radiation, enhancing MR image quality, and automatically assessing image quality. Further research investigating the use of AI in nuclear medicine focuses on image reconstruction, anatomical landmarking, and the enablement of lower doses in imaging studies. The analysis of images for supervised AI applications in radiology encompasses two primary techniques at present: (1) convolutional neural network-based analysis; and (2) utilization of radiomics.[9]

Figure-17: Artificial Intelligence in Pharmacy.

Pharmacy: Artificial intelligence in pharmacy is the application of artificial intelligence (AI) to the discovery, development, and the treatment of patients with medications. AI in pharmacy practices has the potential to revolutionize all aspects of pharmaceutical research as well as to improve the clinical application of pharmaceuticals to prevent, treat, or cure disease. AI, a technology that enables machines to simulate human intelligence, has found applications in pharmaceutical research, drug manufacturing, drug delivery systems, clinical trial optimization, treatment plans, and patient-centered services.

Disease diagnosis: To demonstrate some specifics for disease diagnosis/classification there are two different techniques used in the classification of these diseases including using artificial neural networks (ANN) and Bayesian networks (BN). It was found that ANN was better and could more accurately classify diabetes and cardiovascular disease. Through the use of machine learning classifiers (MLCs), artificial intelligence has been able to substantially aid doctors in patient diagnosis through the manipulation of mass electronic health records (EHRs). Medical conditions have grown more complex, and with a vast history of electronic medical records building, the likelihood of case duplication is high. Although someone today with a rare illness is less likely to be the only person to have had any given disease, the inability to access cases from similarly symptomatic origins is a major roadblock for physicians. The implementation of AI to not only help find similar cases and treatments, such as through early predictors of Alzheimer's disease and dementias, but also factor in chief symptoms and help the physicians ask the most appropriate questions helps the patient receive the most accurate diagnosis and treatment possible.[10]

Figure-18: Artificial Intelligence in Disease Diagnosis.

Recent developments in statistical physics, machine learning, and inference algorithms are being explored for their potential in improving medical diagnostic approaches. Combining the skills of medical professionals and machines can help overcome decision-making weaknesses in medical practice. To do so, one needs precise disease definitions and a probabilistic analysis of symptoms and molecular profiles. Physicists have been studying similar problems for years, using microscopic elements and their interactions to extract macroscopic states of various physical systems. Physics inspired machine learning approaches can thus be applied to study disease processes and to perform biomarker analysis.

Figure-19: Artificial Intelligence in Telemedicine.

Telemedicine: An elderly man using a pulse oximeter to measure his blood oxygen levels. The increase of telemedicine, the treatment of patients remotely, has shown the rise of possible AI applications. AI can assist in caring for patients remotely by monitoring their information through sensors. A wearable device may allow for constant monitoring of a patient and the ability to notice changes that may be less distinguishable by humans. The information can be compared to other data that has already been collected using artificial intelligence algorithms that alert physicians if there are any issues to be aware of. Another application of artificial intelligence is chat-bot therapy. Some researchers charge that the reliance on chatbots for mental healthcare does not offer the reciprocity and accountability of care that should exist in the relationship between the consumer of mental healthcare and the care provider (be it a chat-bot or psychologist), though. Since the average age has risen due to a longer life expectancy, artificial intelligence could be useful in helping take care of older populations. Tools such as environment and personal sensors can identify a person's regular activities and alert a caretaker if a behavior or a measured vital is abnormal. Although the technology is useful, there are also discussions about limitations of monitoring in order to respect a person's privacy since there are technologies that are designed to map out home layouts and detect human interactions.

Electronic health records: Electronic health records (EHR) are crucial to the digitalization and information spread of the healthcare industry. Now that around 80% of medical practices use EHR, the next step is to use artificial intelligence to interpret the records and provide new information to physicians. One application uses natural language processing (NLP) to make more succinct reports that limit the variation between medical terms by matching similar medical terms. For example, the term heart attack and myocardial infarction mean the same things, but physicians may use one over the over based on personal preferences. NLP algorithms consolidate these differences so that larger datasets can be analyzed. Another use of NLP identifies phrases that are redundant due to repetition in a physician's notes and keeps the relevant information to make it easier to read. Other applications use concept processing to analyze the information entered by the current patient's doctor to present similar cases and help the physician remember to include all relevant details. Beyond making content edits to an EHR, there are AI algorithms that evaluate an individual patient's record and predict a risk for a disease based on their previous information and family history.[11]

Figure-20: Artificial Intelligence in Electronic Health Records

One general algorithm is a rule-based system that makes decisions similarly to how humans use flow charts. This system takes in large amounts of data and creates a set of rules that connect specific observations to concluded diagnoses. Thus, the algorithm can take in a new patient's data and try to predict the likeliness that they will have a certain condition or disease. Since the algorithms can evaluate a patient's information based on collective data, they can find any outstanding issues to bring to a physician's attention and save time.

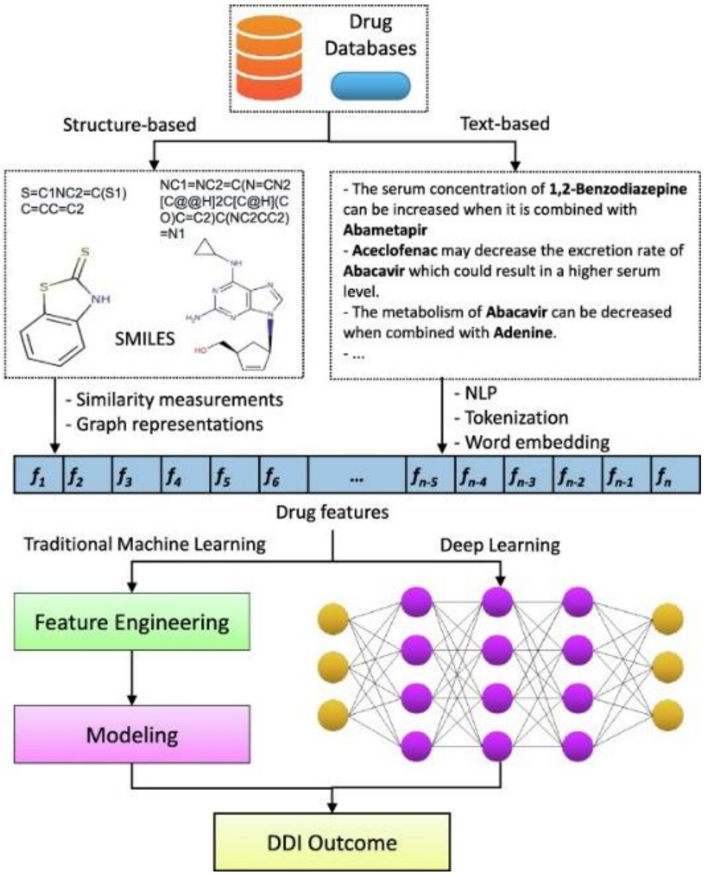

Figure-21: Artificial Intelligence in Drug-Drug Interaction.

One study conducted by the Centerstone research institute found that predictive modelling of EHR data has achieved 70–72% accuracy in predicting individualized treatment response. These methods are helpful due to the fact that the amount of online health records doubles every five years. Physicians do not have the bandwidth to process all this data manually, and AI can leverage this data to assist physicians in treating their patients.

Artificial intelligence continues to expand in its abilities to diagnose more people accurately in nations where fewer doctors are accessible to the public. Many new technology companies such as SpaceX and the Raspberry Pi Foundation have enabled more developing countries to have access to computers and the internet than ever before. With the increasing capabilities of AI over the internet, advanced machine learning algorithms can allow patients to get accurately diagnosed when they would previously have no way of knowing if they had a life-threatening disease or not. Using AI in developing nations that do not have the resources will diminish the need for outsourcing and can improve patient care. AI can allow for not only diagnosis of patient in areas where healthcare is scarce, but also allow for a good patient experience by resourcing files to find the best treatment for a patient. The ability of AI to adjust course as it goes also allows the patient to have their treatment modified based on what works for them; a level of individualized care that is nearly non-existent in developing countries.[12]

Regulation: While research on the use of AI in healthcare aims to validate its efficacy in improving patient outcomes before its broader adoption, its use may nonetheless introduce several new types of risk to patients and healthcare providers, such as algorithmic bias, Do not resuscitate implications, and other machine morality issues. AI may also compromise the protection of patients' rights, such as the right to informed consent and the right to medical data protection. These challenges of the clinical use of AI have brought about a potential need for regulations. AI studies need to be completely and transparently reported to have value to inform regulatory approval. Depending on the phase of study, international consensus-based reporting guidelines (TRIPOD+AI, DECIDE-AI, CONSORT-AI) have been developed to provide recommendations on the key details that need to be reported.

CONCLUSION

With the advent of the big data era, the interest of the international community is focusing on increasing the utilization of medical big data. Many hospitals are attempting to increase the efficiency of their operations and patient management by adopting artificial intelligence (AI) technology that enables the use of electronic medical record (EMR) data. EMR includes information about a patient's health history, such as diagnoses, medicines, tests, allergies, immunizations, treatment plans, personalized medical care, and improvement of medical quality and safety. EMR data can also be used for AI-based new drug development. In particular, it is effective to develop AI that can predict the occurrence of specific diseases or provide individualized customized treatments by classifying the individualized characteristics of patients. In order to improve performance of artificial intelligence research using EMR data, standardization and refinement of data are essential. In addition, since EMR data deal with sensitive personal information of patients, it is also vital to protect the patient's privacy. There are already various supports for the use of EMR data in the Korean government, and researchers are encouraged to be proactive. Various studies and projects have already been conducted to utilize EMR data. In recent years, EMR data have been used in various ways as a data source for AI, and several studies are being conducted on the methodology for additional multi-center expansion.40 However, in order to develop AI that can be used clinically, not only is the correct collection of data essential but also various efforts and policies for clinical use are required. Ultimately, to properly use EMR data for clinical research purposes, it is better to secure the data and check its characteristics in advance so that it can be used for new medical research. In addition, considering the characteristics of the medical field, while using medical data, research should be conducted with a sense of legal and ethical responsibility of the researcher.36 Only when all of these things are well harmonized and operated, will the use of EMR data be valuable, and consequently, it will be able to contribute to improving the medical services and ultimately, the health of the patients.

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