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Impact of Artificial Intelligence in Healthcare

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ABSTRACT:

Artificial intelligence (AI) refers to computers or systems that simulate intelligence in order to carry out tasks and have the ability to continuously improve themselves based on data they gather. AI is being used successfully in many different contexts, including clinical labs, hospitals, and research methodologies. The Treatment management and diagnosis are two fundamental or noteworthy aspects of AI in the medical domain. AI systems in healthcare are thriving due to sophisticated algorithms that can learn a wide range of traits from vast amounts of medical data, which aids in problem-solving at a pace and volume that is ineffective for humans. Auto-learning can be added to the algorithms to increase accuracy and performance.

Artificial intelligence is made powerful by combining deep learning and machine learning algorithms with fast processors. According to research, digitization will enable medical practitioners to make judgments and discoveries far more quickly than they could in the past. This essay explores the operation of artificial intelligence algorithms. Additionally, it examines the effects of AI on the healthcare industry, including chatbots driven by AI, automated image diagnostics, personal health companions, radiology, cardiology, oncology, and virtual medical assistants.

KEYWORDS: Artificial Intelligence, Healthcare, Oncology , Radiology, Chatbot , Machine learning.

INTRODUCTION :

As new technology develop Research in artificial intelligence (AI) is booming . Without a question, AI has a huge impact on medicine and healthcare. It is due to the development of learning algorithms, which are getting more exact and precise every day. Second, the AI has even become more potent because to the quick advancements in parallel processing and computing power. Thirdly, a significant benefit that aids in the creation of several AI applications is the availability of enormous volumes of data backed by limitless cloud storage. The learning algorithms are trained using this data to increase their accuracy. By interacting with the training data, the algorithms enable fresh perspectives on diagnosis and therapy.Thus, it enhances patients' results .According to Frost & Sullivan, AI will reduce treatment costs by 50% while improving patient outcomes by 30% to 40% . According to studies, the AI healthcare market is estimated to develop at a 40% compound annual growth rate (CAGR) to reach $6.6 billion by 2021.[1]

- ✓ Questions mostly asked about AI is ,
    - a. *What is AI ?*
    - b. *How AI used in health care ?*
    - c. *Types of AI in Healthcare ?*

➢ **What is AI ?**

There isn't a single, accepted definition of AI. In general, the phrase describes to computer systems that mimic human cognitive functions including reasoning, learning and adaptation, sensory perception, and interaction. The majority of AI applications available now are limited in that they can only do particular jobs or address pre-established issues. AI uses techniques and principles from a variety of fields, such as biology, logic, and mathematics.[2] One significant aspect of modern.

One advantage of AI technology is their growing capacity to interpret a wide range of unstructured data types, including text and images in natural language. The most popular form of artificial intelligence in recent years is machine learning, which serves as the foundation for many of the applications that are currently in use. When given data and fresh experiences, machine learning enables systems to find patterns and create their own rules instead of adhering to pre-programmed instructions.[2]

- **How AI used in Healthcare ?**

In order to replicate human intelligence and carry out intricate automated operations in the medical field, artificial intelligence (AI) uses computers and machine processes. While AI-enabled computers aim to mimic human intelligence, they can also surpass it in a variety of ways, most notably by effectively sorting through massive amounts of big data to find patterns, anomalies, and trends.

It should come as no surprise that artificial intelligence (AI) offers a plethora of potential for the healthcare industry. These prospects include the ability to improve a wide range of routine medical procedures, from detecting illnesses to determining the most effective treatment plans for patients with life-threatening conditions like cancer. Artificial intelligence (AI)-equipped robotic surgical instruments can improve surgical performance by reducing physical oscillations and delivering real-time information throughout the procedure.

- **Types of AI in Healthcare ?**

AI is an umbrella term covering a variety of distinct but interrelated processes. Some of the most common forms of AI used within health care include:

1. **Machine learning (ML):** Using data sets, such medical records, to train algorithms to produce models that can categorize data or forecast results, among other things. [3]
2. **Deep learning:** A branch of machine learning that creates neural networks that can perform increasingly complicated tasks by using larger data sets, longer training periods, and layers of ML algorithms.
3. **Natural language processing (NLP):** The application of machine learning to comprehend written or spoken human language. NLP can assist in the interpretation of published research, notes, reports, and documentation in the healthcare industry. [3]
4. **Robotic process automation (RPA):** The application of AI to computer algorithms that automate clinical and administrative processes. RPA is used by several healthcare companies to enhance the daily operations of their facilities and the patient experience. [3]

How AI Algorithm works ?

Given the developments in AI, medical practice may change in the years to come to the point where a patient must first consult a computer for a diagnosis before seeing a physician. The accumulating data generation in clinics recorded in EMR makes applications of highly data driven.

These generated data are used to train AI algorithms to perform the task. Both structured and unstructured data may be produced. Only structured data can be processed by AI systems. Converting all unstructured data into structured format is hence the first duty. Converting unstructured data to structured format involves labeling or tagging each data point so that algorithms can identify it. After then, the algorithm is presented with significant collections of data points together with their labels. [1]

The algorithm is trained to produce the intended result. Until the algorithm meets its requirements, this process is repeated. The operation of the AI algorithm is depicted in Figure 1.

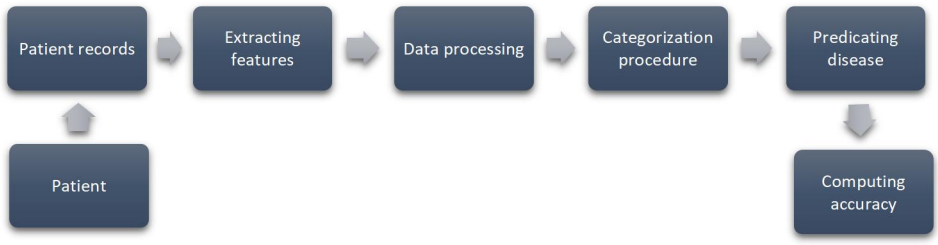

Figure 1

Machine Learning (ML)

The most advanced AI method in the creation of modern diagnostics is machine learning. Data processing is used to train ML technologies to find potentially obscure or intricate patterns. Large volumes of data are necessary for ML's training procedure. Many recent improvements in machine learning, including picture identification, have been made possible by the growing availability of such data.

Selected methods to train ML algorithms

Supervised ML. Labeled data is given to an algorithm to look for and apply logical patterns in the data. to forecast a predetermined solution to an issue. For instance, an algorithm that was trained on several annotated pictures of cancer (malignant) or benign lesions could then determine if a fresh unidentified picture showing a malignant lesion.

Unsupervised ML. Unlabeled data is given to an algorithm so that it can find structure in the data, for instance by grouping related data together without a an expectation of what clusters to anticipate. Using this method, an algorithm might combine photographs according to shared characteristics, such as a set of pictures of benign lesions and a set of pictures of malignant lesions, without the training set's images being classified as cancerous or not.

Available ML Diagnostic Technologies

In the US, a number of ML diagnostic technologies are accessible. These tools support healthcare providers by enhancing the diagnostic procedure, which has advantages such as improved access to treatment, especially for marginalized groups; more consistent analysis of medical data; and earlier illness diagnosis. For the disorders we looked at, we found a range of machine learning diagnostic tools, the majority of which depended on imaging data. But generally speaking, these technologies have not been broadly embraced. [4]

- **ML diagnostic technologies by disease**

Although most ML technologies rely on medical pictures, they can assess a range of medical data, according to agency officials. Participants in our expert conference and interviewers stated that as radiological picture data is usually standardized and digitalized, numerous technologies are made to leverage it. According to NIH authorities, the bulk of these imaging technologies have been used for cancer, but there are also increasingly many uses for neurological and cardiovascular imaging. Due to extra procedures like data collection and digitization, other forms of medical data are less accessible for ML technology training. One cancer researcher, for instance, pointed out that obtaining data from tissue samples is more challenging as pathologists must first prepare microscope slides before scanning and digitizing the pictures.

Because of this, there are ML technologies available to assess pathology specimens, although they are not as developed as ML-based Technology for medical imaging. [4]

1. **CANCER**

MRI, CT, and pathology slide data are used by available machine learning tools for cancer detection. X-rays and microscopy—to assist experts in identifying, quantifying, and evaluating malignancies. The ML system of one business analyzes breast MRI data and gives doctors details on the sizes and densities of lesions. According to a business representative, radiologists can utilize this data to investigate questionable characteristics or assess if a lesion is malignant. [4]

According to interviewers and experts at meetings, ML technologies may also be used to monitor the course of some tumors over time, which can assist medical practitioners in more accurately evaluating therapies.

Nevertheless, depending on the kind of cancer, several ML methods can be validated for its diagnosis. For instance, a representative from a VA medical center informed us that because lung and breast cancers are more distinct than prostate cancer, image-based machine learning techniques for their diagnosis are simpler to validate.

2. **Diabetic retinopathy**

By analyzing retinal pictures, current machine learning systems may identify symptoms of diabetic retinopathy taken with a specialized camera. Medical practitioners can also receive a diagnosis recommendation from the technology. As previously said, these technologies enable healthcare providers to screen patients more effectively and reliably than they could with traditional approaches, potentially improving patient outcomes and informing therapy. According to one company's website, the technology may provide a result in under a minute. Additionally, this technology may be scaled up more successfully than manual screening to assist meet the demands of a growing population with diabetes, according to a study article released by personnel from this firm.[4]

3. **Alzheimer's Disease**

By examining brain pictures, available machine learning tools help a doctor diagnose Alzheimer's disease. These MRI-based studies are meant to assist medical professionals in differentiating between structural alterations in the brain brought on by normal aging and those caused by Alzheimer's disease. One business, for instance, created machine learning (ML) technology that automatically assesses and identifies brain regions from a collection of MRI images; but, it does not offer a diagnosis. According to some interviewees, the unclear clinical description and diagnostic standards of Alzheimer's disease might make it challenging to verify technology for its detection and diagnosis.

A representative of an industry group clarified that certain technologies concentrate on warning physicians about certain aspects of closely see or examine, like a plaque in the brain, yet these characteristics might not necessarily indicate the illness.

According to a VA medical clinic administrator, there is frequently disagreement among professionals over the characteristics, biomarkers, and criteria used to diagnose Alzheimer's disease. [4]

4. **Heart disease**

Gadgets that measure a person's electrocardiogram (ECG) to identify diseases like atrial fibrillation are among the available technologies. These gadgets are supplied directly to customers. For instance, wearable technology or other smartphone-enabled gadgets can be used by people to record and monitor their ECGs. Three IT firms that have created wearables to track ECGs were discovered. Furthermore, one smartphone-enabled device captures an ECG, uses an ML algorithm to evaluate it, and identifies a number of cardiac disorders, including bradycardia (slow heart rate), tachycardia (rapid heart rate), and atrial fibrillation. By delivering ECG data in between visits, these devices are meant to assist medical professionals in diagnosing patients more accurately rather than allowing customers to self-diagnose certain medical ailments. Apart from ECG monitoring technology, the FDA has approved devices that look at According to FDA authorities, radiological pictures can segment the amount of plaque accumulation in blood arteries,

score the amount of calcification in blood vessels, and provide radiologists an early warning that a patient could be experiencing a pulmonary embolism. [4]

5. COVID-19

In order to enhance COVID-19 detection techniques, technology developers are promoting machine learning technologies. For instance, one business developed machine learning (ML) technology as a non-diagnostic screening tool to evaluate a patient's arm pulse characteristics in order to identify asymptomatic individuals who could be infected with COVID-19.

Company officials claim that their technology is beneficial because it can identify active infection in the early stages of infection when the viral load may not be high enough for other tests to reliably detect it, and it is quicker than a standard molecular test, which may require samples to be shipped to a laboratory for processing. [4]

According to officials, patients might use this technology to rapidly assess if they need to isolate themselves, which would help stop the sickness from spreading. The technique developed by another business utilizes laboratory blood sample biomarkers to identify people who could have contracted SARS-CoV-2, the virus that causes COVID-19.29. With just a drop of blood, this device can test antibodies against the virus in a patient's blood and produce findings in a matter of minutes, according to business executives. According to a research done by corporate personnel, this technology's accuracy was on par with or superior than three other tests.

Furthermore, according to firm representatives, this technology could distinguish between those who were vaccinated and those who recovered from COVID-19 illness. Such knowledge might improve our comprehension of how to prevent infection by COVID-19 virus subtypes.

- **Machine Learning Tools**

A. Robot Pharmacy:

To improve patient safety, UCSF Medical Center uses robotic technology to track and prepare drugs. They assert that 3,50,000 doses of medicine have been perfectly manufactured by the technique. In terms of size and medicine administration precision, the robot has shown to be noticeably better than humans.[5]

B. MEDi Robot:

MEDi is an abbreviation for medical and engineering designing intelligence. AI tools The initiative that led to the creation of the pain management robot was directed by Tanya Beran, an Albertan professor of community health sciences at the University of Calgary. She got the idea from working in hospitals where children cry while receiving treatment. The robot first builds a relationship with the children before explaining to them what to anticipate during a medical treatment. [5]

C. TUG Robot:

Delivering supplies, food, medicine, specimens, and bulky objects like garbage and linen, Aethon TUG robots are designed to navigate hospitals autonomously. Racks, bins, carts, and fixed and secured carts may all be moved using its interchange baseplatform, which is available in two variants. [5]

D. Erica Robot:

Developed by Professor Hiroshi Ishiguro of Osaka University in Japan, Erica is a new care robot. It was developed in collaboration with the Japan Science and Technology Agency, Advanced Telecommunications Research Institute International (ATR), and Kyoto University. It speaks Japanese and has a combination of European and Asian facial traits. Like any other person, it likes to watch animated films, hopes to visit Southeast Asia, and desires a life partner with whom it can converse. [5]

Applications and Causes of AI in Healthcare

- **Applications**

Artificial intelligence's introduction into the healthcare industry has created new opportunities to improve patient care, streamline operations, and further public health campaigns. This section thoroughly examines the essential uses of AI in the healthcare industry across a range of fields.

1. Support Using information from genetic tests, biometric sensors, and medical imaging, AI systems have greatly increased the precision and effectiveness of illness detection.
2. AI-driven technologies, for instance, analyze X-rays, MRIs, and CT scans in medical imaging to precisely identify abnormalities including tumors, fractures, and indications of neurological disorders—often outperforming human capabilities. [7]
3. "Healthcare might be revolutionized by artificial intelligence (AI) in a number of ways. It can provide leaner, quicker, and more focused research and development, enhance public health surveillance, speed up health responses, and transform vast volumes of patient data into useful information.
4. Descriptive: This entails measuring past occurrences and using the information to identify patterns and other insights.

5. Predictive: This entails forecasting the future based on descriptive data; and Prescriptive: This not only identifies trends and forecasts the future but also makes recommendations for potential public health therapies or clinical trials in research and development.

- **Causes of AI in Healthcare**

1. **Greater access to healthcare:** Professional management of the human body is necessary to avoid incorrect diagnosis, improper handling, or inappropriate treatment. However, there are not enough doctors in developing and underdeveloped countries. These countries can thus use AI-algorithm-based diagnostic tools. [8]
2. **Enhances record-keeping:** Hospitals can store and manage record data more easily when they employ Electronic Health Records (EHR). The documentation process is further enhanced by AI technology such as voice recognition and dictation. [8]
3. **Advanced immunotherapy:** AI is crucial to the development of immunotherapy as a cancer treatment. Immunotherapy is being used as a treatment because there is no specific cure for cancer. However, not every patient benefits from immunotherapy. As a result, AI is effectively utilized to identify patients who stand to gain from immunotherapy. [8]
4. **Enhances service quality:** AI helps save time since the machines it uses are quicker than people. As a result, diagnosis, treatment, and record keeping are made simple, completed faster, and require less effort. This results in lower treatment costs and higher-quality services. [8]

Opportunities and Challenges of AI in future

- **Opportunities**

1. **Improved Diagnosis:**

AI may assist medical professionals in making faster and more accurate diagnoses, lowering the possibility of human mistake.

2. **Personalized Medicine:**

AI may assist in customizing treatment regimens for each patient according to their lifestyle, medical history, and genetic profiles.

3. **Simplified Clinical Workflows:**

AI can automate repetitive administrative duties, allowing medical personnel to concentrate on more difficult and valuable activities.

4. **Enhanced Patient Engagement:**

Chatbots and virtual assistants driven by AI may offer patients individualized help and direction, enhancing their entire experience.

5. **Reduce Healthcare expenditures:**

By reducing needless testing, operations, and hospital stays, AI can lower healthcare expenditures.

6. **New Discoveries and Insights:**

AI can assist academics in examining big datasets and spotting trends, which might result in fresh findings and insights in the medical field.

- **Challenges and Risk of AI in Healthcare**

1. **Data security and privacy:**

AI in healthcare necessitates access to private patient information, which needs to be shielded from online attacks and security lapses. Many people would consider the data used by AI applications in healthcare to be private and sensitive. There are legal restrictions on these. However, information regarding the user's and people around them's health status may be revealed through various types of data that are not directly related to health status, such as social media activity and internet search history.AI has the potential to safeguard

healthcare computer systems and identify cyberattacks.AI systems could, however, be compromised to obtain private information or bombarded with erroneous or biassed data in ways that may be difficult to identify more extensive and at a lesser monetary cost. [2]

2. **Data Bias and Discrimination:**

Artificial intelligence (AI) applications might potentially lessen human prejudice and error, but they can also mirror and reinforce biases in the training data. AI's potential to cause covert or non-compliant discrimination against constitutionally protected traits like gender, race, age, and disability has drawn criticism.

AI's advantages in healthcare might not be shared equally. Where data is limited or more challenging to get or portray digitally, AI may perform less well. This may have an impact on those with uncommon medical disorders or those who are under-represented in research data and therapeutic trials, including Asian, Black, and minority ethnic. [2]

3. **Over dependence on Technology:**

When healthcare practitioners rely too much on AI, their ability to think critically and use clinical judgment may suffer.

4. Liability and Accountability:

As AI grows more independent, questions have been raised regarding accountability and culpability in the event that AI malfunctions or does damage. In the healthcare industry, safety and dependability are crucial

concerns when using AI to operate machinery, administer care, or make decisions. Artificial intelligence has the potential to make mistakes, which could have major repercussions if they are hard to identify or have repercussions. There have been concerns raised about the effectiveness of AIpowered symptom checker apps. For instance, it has been discovered that app recommendations may be unduly conservative, which could lead to a rise in the demand for unnecessary examinations and therapies. [2]

5. Regulatory Challenges:

As AI in healthcare advances quickly, there are regulatory obstacles to overcome, especially in making sure AI systems adhere to safety and effectiveness requirements.

6. Data Integration and Quality:

AI needs well-integrated and high-quality data to generate accurate findings, which can be difficult in the healthcare industry because data is frequently fragmented and siloed.

7. Cybersecurity:

To safeguard private patient information from online attacks, AI-powered healthcare systems need strong cybersecurity defenses.

8. Patient Engagement:

AI-powered healthcare solutions require patient engagement and education to ensure they are used effectively and safely.

Critical Evaluation of both sides

- **Positive Aspects of Artificial Intelligence in Healthcare**

Positive treatment outcomes and the prevention of transmission are significantly impacted by early discovery of NCP. Furthermore, the AI model employed demonstrated a 93.8% diagnostic accuracy in identifying the v-raf murine sarcoma viral oncogene homolog B1 (BRAF) V600E mutation in colorectal carcinomas. These findings demonstrate that AI models may be what doctors require in order to reliably move on with a treatment plan. Additionally, AI can help nurses with superfluous paperwork and regulatory obligations .Rapid adaption is another benefit of AI in the healthcare industry. An AI system could detect bacterial strains or a rare mix of symptoms far more quickly than a doctor or lab. A University of Oxford study that used AI to identify viruses by examining their fluorescent markers provides evidence of this possibility. Consequently, within 5 minutes, strains of respiratory viruses, including the flu and COVID-19, were identified with >97% accuracy. An AI system created by a group of researchers was able to identify new coronavirus pneumonia (NCP) with 92.49% accuracy, 94.93% sensitivity, and 91.13% specificity. Given the SARS-CoV-2 epidemic, this point is evident. Perhaps the effects of the COVID-19 pandemic could have been lessened if this technology had been available and helpful. [6]

- **Negative Impacts of Artificial Intelligence in Healthcare**

One could argue that, when examining the capabilities of AI now, the drawbacks outweigh the advantages. It has been demonstrated that ChatGPT, the most widely used AI platform, is not authentic when it comes to references cited in medical literature. One 30 brief medical papers with at least three references were produced by ChatGPT, and a worse result was discovered. Out of the 115 references in those medical journals, 47% were fake, 46% were real but wrong, and only 7% were real and correctly analysed the data. Given its current accuracy, it is extremely difficult to defend the use of AI in the medical field. The widespread usage of electronic health records and their preferential targeting in data breaches are the main ethical issues with AI in healthcare. More private information about a patient may be included in these electronic health records if they are completed by a comprehensive AI rather than a medical practitioner. The possibility that this all-encompassing AI will take quantitative data and extrapolate it into a probability of health hazards and worries raises serious privacy concerns because it would provide bad actors with more knowledge about a patient's medical history, which they might then sell. Concerns regarding clinical implementation are also raised by the use of AI in healthcare. As seen in movies and science fiction, people worry that robots and artificial intelligence will eventually replace them in various occupations. This happened during the Industrial Revolution and could happen again in the future. In terms of efficiency, this might eliminate human office work, but computers and artificial intelligence will always be superior because of their speed of processing. [6]

- **Way to Make Artificial Intelligence a Pillar of Healthcare**

AI has encountered several problems that make it challenging to establish itself as a cornerstone of the healthcare industry. Future challenges will include issues like access to pertinent data, clinical implementation concerns, and moral conundrums. Implementing data accessibility for AI solely for participants who are ready to provide their health information to machine learning systems that may protect data privacy is one suggested solution.

Additionally, there is the risk of individual prejudice against AI systems, whereby humans may start to rely entirely on automated processes and lose the ability to make their own decisions .Healthcare professionals should be able to easily understand AI education, which should also allow for individual choices made by medical professionals. [6]

Conclusion

AI is a rapidly developing technology that significantly impacts healthcare and medicine. Its development is driven by learning algorithms, computer power, parallel processing, and the availability of vast amounts of data. These algorithms are trained to become more accurate, leading to improved patient outcomes. AI is projected to enhance health outcomes by 30% to 40% while lowering treatment costs by 50%. The AI healthcare industry is projected to reach $6.6 billion by 2021, growing at a 40% compound annual growth rate (CAGR).

Machine learning (ML) is a sophisticated AI technique used in diagnostics, with ML tools relying on medical images like X-rays, microscopy, MRI, CT, and pathology slide data. ML can also help diagnose diseases like diabetic retinopathy, Alzheimer's disease, and heart problems.

UCSF Medical Center tracks and prepares medications using robotic technologies to increase patient safety. A pain management robot called MEDi Robot develops bonds with kids while they receive medical care. Aethon TUG Robots autonomously transport large items, food, medication, supplies, and specimens. Professor Hiroshi Ishiguro created Erica, a care robot with a mix of European and Asian face features that speaks Japanese. These robots are designed to explore hospitals, enhance patient safety, and offer company.

AI has transformed the healthcare sector by improving public health surveillance, expediting health responses, providing faster research and development, and turning massive patient data into actionable insights. However, there are risks and challenges, such as cybersecurity, patient participation, responsibility and accountability, over-reliance on technology, data security and privacy, data bias and prejudice, and regulatory issues.

AI holds great promise for transforming healthcare by improving treatment strategies, quicker adaptation, and helping nurses with regulatory requirements and paperwork. However, ethical questions, privacy concerns, and the potential displacement of human jobs are raised. Data accessibility for AI should only be implemented for participants who are ready to provide their health information to machine learning systems.

References

1. Impact of Artificial Intelligence in the field of Health care. Ragavi, V. 2021, Journal of Physics, p. 6.

2. Artificial intelligence (AI) in healthcare and research. Alison Hall, Johan Ordish , Sobia Raza ,Brent Mittelstadat and Reema Patel. May 2018, Nuffield Council on Bioethics, p. 7.

3. What Are The Main Types Of AI And Their Applications In Healthcare. R, Rajeev. Dec,13 2021, Managed Outsource Solotion , Solution and Beyond.

4. Artificial Intelligence in Health Care. September 2022, Artificial Intelligence in Health Care GAO-22-104629 .

5. A Review on Artificial Intelligence in Pharma. Nikhil Singh, Sunil Kumar , Aman Shukla , K. Prabhu , Ashish Yadav. 15 January 2024, International Journal of Pharmaceutical Sciences Review and Research International Journal of Pharmaceutical Sciences Review and Research.

6. Impact of Artificial Intelligence (AI) Technology in Healthcare Sector: A Critical Evaluation of Both Sides of the Coin. Md. Ashrafur Rahman1, Evangelos Victoros1, Julianne Ernest1, Rob Davis1, Yeasna Shanjana2 and Md. Rabiul Islam3. Clinical Pathology Volume 17.

7. THE ROLE OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE: A SYSTEMATIC REVIEW OF APPLICATIONS AND CHALLENGES. Francisca Chibugo Udegbe, Ogochukwu Roseline Ebulue ,Charles Chukwudalu Ebulue , Chukwunonso Sylvester Ekesiobi. issue 4, s.l. : International Medical Science Research Journal,, april 2024, Vol. volume 4.

8. ARTIFICIAL INTELLIGENCE IN HEALTHCARE: A PROSPECTIVE APPROACH. Ekampreet Kaur, Akash bans, , Uwom Okereke Eze ,Jaskaran Singh4. issue 1, s.l. : Multidisciplinary Journal of Geeta University, 2023, Vol. volume 1.