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Use of Artificial Intelligence for Healthcare Purposes: A Structured Review

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Abstract- Artificial intelligence, which is widely defined as a machine's ability to mimic intelligent human behaviour, includes the subfield of machine learning. Artificial intelligence systems are employed to carry out difficult jobs in a manner a kin to how people solve problems.
Data mining is a method of automatically discovering information from massive databases or data sets. Data mining is a technique for locating the information that is concealed in a large, challenging-to-access database using only standard queries.
Additionally, machine learning demonstrates its close ties to data mining. Making software that teaches computers to get smarter as they encounter new data is the core objective of machine learning. Prediction systems, image identification, Speech recognition, medical diagnosis and other applications employ machine learning. Numerous areas, including research, engineering, health care, and business, produce and a vast volumes of data every day. In this study, a few data mining approaches, algorithms, and applications are discussed. Also, application of artificial intelligence in the field of healthcare industry such as Oral Pre-Cancerous Lesions and Oral Cancer Detection, Neurodegenerative disorders, Medical Disorders, Drug Discovery are discussed.

Keywords-Machine Leaning, Healthcare, Artifical intelligence, Data mining.

I. INTRODUCTION

The information industry has access to a vast amount of data. Until it is transformed into meaningful information, this data is useless. This vast volume of data must be analysed in order to draw out relevant information. Data mining requires other processes in addition to information extraction, including data cleaning, data integration, data transformation, pattern evaluation, and data presentation. Data Mining is also known as knowledge extraction, knowledge mining from data, knowledge discovery process, or data/pattern analysis. [1] The objective of the data mining activity is to gather a variety of highly valuable information or knowledge that can be put to use for the good of the company and the community.

While employed by IBM in 1959, "Arthur Samuel" created the phrase "machine learning." Artificial intelligence's field of machine learning "enables machines to learn without having to be specifically programmed." Machine learning is often used interchangeably with Artificial Intelligence. Some machine learning systems are being developed to either completely replace or at the very least significantly reduce the need for human participation in the analysis and management of data, while others promote a collaborative approach between computers and humans. However, because the system's designers must specify how the data must be represented and must also identify the methods that will be used to seek for hidden patterns in the data, human association cannot be completely eradicated.[2]

The following categories best describe machine learning algorithms:
a) Supervised learning: In this category, a domain-specific model is created by training an algorithm using training data. The correctness of this model is then evaluated using the test data. Once the model's veracity has been confirmed, new, unclassified data is subsequently categorised using it.

b) Unsupervised learning: This method is employed when labelled data is unavailable, and the data is clustered according to how similar the various data pieces are to one another. Typically, clustering is used, where many clusters are created based on how similar they are. Making a bunch of abstract things into classes of related objects is the process of clustering. A cluster is a group of records that are incompatible with records in other clusters yet have similarities with one another.

c) Reinforcement learning: In this type of learning, the agent and environment interact, and the agent adapts its behaviour in response to feedback from the environment. Typically, the criticism takes the form of reward.

d) Deep Learning: Deep Learning is primarily based on the Artificial Neural Network design, where deep simply

denotes a network with more layers (the depth between the output and input layer can be interpreted as "Deep"). Deep learning can take place under supervision, unsupervision, or even reinforcement.

Finding relevant data by logically searching through a lot of data is called data mining. Finding previously unidentified patterns is the aim of this technique. Once these patterns are identified, they can be used to help business owners decide on a certain course of action.

Three basic steps are
- Exploration
- Pattern identification
- Deployment Exploration:

Exploration: Data is cleansed and changed into a different form in the first step of data exploration, and then significant factors and the nature of the data based on the issue are identified.[3]

Pattern identification: Pattern identification is the second phase after data has been examined, clarified, and specified for the particular variables. Find and select the patterns that offer the most reliable predictions.
Deployment: Patterns are used to achieve desired results.

II. DATA MINING APPLICATIONS

Data mining is a very young technology that has not yet reached its full potential. Despite this, it is already utilised often in a variety of industries. Retail businesses, medical facilities, financial institutions, and insurance firms are a few of these entities. Many of these businesses combine data mining with other crucial techniques like statistics, pattern recognition, and others. Finding patterns and relationships that would be challenging to find without the use of data mining is possible. Many companies utilise this technology because it helps them understand their clients better and make wise marketing choices. [3]

a) Bioinformatics

The collection of diverse computer-based techniques for managing, storing, and studying biological data is known as bioinformatics. The amount of data in this subject was growing daily and was heavily utilised in the study. Applications of data mining in this area include disease detection, DNA sequencing and alignment, protein and gene communication network design, gene and protein sequence analysis, and discovering gene sequences. Bioinformatics makes use of sequence data sets. This sequence dataset is provided to the appropriate data mining tool according to the application type to acquire the desired results.[4]

The Basic Local Alignment Search Tool (BLAST), FASTA, and CS-BLAST are some of the data mining tools used in bioinformatics. Other tools include GenScan, GeneMark for discovering genes, Pfam, BLOCKS, and ProDom for protein analysis.

b) Education

The development of techniques to extract necessary data from diverse educational fields is the focus of the emerging topic of educational data mining.[5] Applications of data mining in this area include discovering poor students, predicting students' learning behaviours, and forecasting exam results.[5] Teaching strategies are created using the students' learning patterns. Education application uses a record data set. Tools for data mining in education include SPSS, KEEL, Weka, Spark MLLib, etc.

c) Criminal Investigation

Criminal analysis is figuring out how crimes are connected to certain criminals. We receive huge amounts of criminal datasets from various crimes, including cybercrimes, violent crimes, fraud detection, and narcotics offences. For purposes including counterterrorism efforts, crime matching, crime patterns, etc., data mining is used in this field. Data mining tools like Weka, H2o, Orange, and others are employed in this industry.[6]

d) Manufacturing Engineering

A manufacturing company keeps the information about the goods it sells. To anticipate product development time and cost, the relationship between product architecture, customer needs, job dependencies, etc., data mining techniques including classification, association rule mining, and regression are utilised. Rapid miner, Data melt, Board, and Weka are some of the data mining technologies utilised in this area.[7]

e) Medical Care

These days, a lot of people utilise electronic health records, and we collect a lot of patient data. Data mining methods including classification, association rules, and clustering are used to find connections between illnesses and treatments, find novel medications, uncover fraud and abuse, and cut expenses in this area. Rapid miner, R programming, Weka, Orange, and NLTK are some of the data mining tools utilised in the healthcare industry (Natural Language Tool Kit).[14]

III. USAGE OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE

The term "artificial intelligence" has recently gained popularity. Who or what is AI? Now, AI simply refers to any artificial agent that behaves as intelligently as our brain, as the term suggests. There is barely an area left where artificial intelligence has not demonstrated its presence when it comes to application. One such area where AI has demonstrated promising applicability is the healthcare sector. However, the question of why AI arises. It is clear that the availability of data in every field has increased significantly as a result of the major technological advances. It now takes a considerable amount of time to manually process this enormous amount of data in order to derive useful insights from it. AI can help with diagnosis, clinical decision making, and

personalized medicine because of its strong capacity to integrate and learn from enormous volumes of clinical data[14,17].

The field of machine learning as a whole can be divided into classification, clustering, and reinforcement learning. While the healthcare business uses all three domains to address various issues, classification accounts for the lion's share of usage. The main uses of classification are in diagnostic and prognostic procedures. In order to find new drugs or uncover novel infections, clustering may be used. Robotics, which is built on the reward and penalty mechanism, is where reinforcement learning is most commonly applied.

a) Early Oral Pre-Cancerous Lesions and Oral Cancer Detection

Over the past few decades, there has been a steady evolution in cancer research. To identify specific cancer types before they cause any noticeable symptoms, researchers have employed a number of procedures, such as early-stage screening. They have also developed novel techniques for estimating early cancer therapy outcomes and survival durations. Thanks to the advancement of modern medical technology, huge amounts of data about cancer have been acquired and are now accessible to the scientific community. Making a precise prognosis of the development of an illness, however, is one of the most exciting and challenging topics facing doctors today. Thus, the use of artificial intelligence techniques by scientists working in the field of medicine has grown.[13,16]

Researchers employ strategies in relation to cancer prognosis and prediction due to the importance and developing trend of artificial intelligence technology. Prognostic and predictive indicators, which may be independent of a specific treatment or are combined to suggest therapy for cancer patients, are taken into consideration in machine learning-based cancer diagnosis. It is clear that the application of machine learning techniques could improve the accuracy of predictions for survival, susceptibility to cancer, and recurrence. [13,15]

The main goal of machine learning in medicine is to create systems that can support a doctor's ability to diagnose a condition expertly.

The majority of medical domain experts reject these machines; regardless of how effectively we create and train them in the medical domain, because they believe that these machines cannot perform the exact same tasks that they have spent years learning or training to perform. This is an even more crucial and likely the most crucial point in the deployment of artificial intelligence machines. The majority of specialists debate their unreliability and the absence of an accurate portrayal of the logical process that the system employs to resolve a problem..

b) Neurodegenerative disorders

Parkinson's disease, Huntington's disease, and dementia are examples of neurodegenerative diseases. Alzheimer's disease, vascular cognitive impairment, Lewy body dementia, and fronto-temporal dementia are some of the different kinds of dementia. Medical Diagnosis refers to the procedure of identifying the reason behind patient's sickness or uneasiness i.e. determining the disease which he is suffering from using the facts and findings obtained from his history and symptoms occurred on his body[14] Learning approaches can become more precise and accurate during their interaction with training data, thus allowing humans to obtain unprecedented insights into diagnosis and prognosis of medical disorders along with treatment variability and patient outcomes.

Numerous AI techniques, including support vector machines, neural networks, fuzzy logic, decision trees, etc., have been applied in the field of medicine to help doctors improve the various diagnostic techniques. All of these strategies improve the system's accuracy, but they are only partially capable of handling data that is ambiguous and multidimensional. Thus, in order to create diagnostic models that perform better than those created using a single methodology, researchers have begun to use hybrid methodologies such as Neuro-fuzzy systems (NFS). NFS is an example of an intelligent hybrid system that combines fuzzy logic and neural networks. A neural network is a distributed network of artificial neurons used to do simultaneous calculations and recognise patterns. It is a simplified mathematical model of a brain-like system. However, the neural systems do a poor job of describing how they arrive at their judgments. Fuzzy inference systems, on the other hand, are effective at explaining their decisions and can reason with imperfect knowledge, but they are unable to independently arrive at the rules that are applied to those decisions. By combining these two methodologies, the intelligent hybrid systems known as NFS have been developed, which have solved the individual drawbacks of these two AI approaches. Fuzzy systems' ability to think like humans and neural networks' capacity for learning are combined in such a way that fuzzy system parameters are determined by neural network algorithms.

Robots also play an important role in medical domain as they assist doctors in performing surgery, expediting supply delivery and cleaning, and allowing clinicians to spend more time with patients. Hospitals and clinics started adopting robots for a much wider range of tasks during the COVID-19 pandemic to help reduce pathogen exposure. Operational cost savings and risk mitigation brought about by health robots have shown to be advantageous in a number of ways.

c) Medical Disorders

An organismic malfunction that, in its fully developed or extreme form, is directly and organically related with distress, impairment, or certain other sorts of disadvantage is known as a medical disorder.There are many medical disorders such as cardiovascular and endocrine disorders, social anxiety disorder with Parkinson’s disease, obsessive-compulsive disorder with striatal

disorders, posttraumatic stress disorder with head injury and pain, generalized anxiety disorder etc.[15]

It can be seen that with the great advancements in technology, there has been tremendous growth in the availability of data in healthcare . Now to manually process this huge amount of data to carve out meaningful insights from this data requires a significant amount of time. We wouldn't be able to match this procedure with the rate at which this data is being generated if we continued to manually handle the data. Additionally, if we slightly quicken the manual processing, it would be more prone to errors because a radiologist must spend a lot of time carefully reviewing a patient's MRI. There is a higher likelihood of overlooking critical MRI findings if the radiologist does not go into depth, which could result in a wrong diagnosis for a particular patient. Here comes artificial intelligence. To identify medical disorders, researchers have employed a variety of AI-based methods, including machine learning and deep learning models.

d) Drug Discovery

Life expectancy has increased globally due to significant advancements in medical technology, but as people live longer, healthcare systems must contend with expanding patient demand, rising expenditures, and a staff that is stretched thin. With the development of AI in medical science, these issues can be resolved. Healthcare professionals' experiences may have been enhanced by AI, which has allowed them to devote more time to providing direct patient care. Drug discovery process has benefited from AI's capacity to recognise and analyse patterns in massive datasets in an effective and efficient manner. The Institute of Cancer Research in London combines patient genetic and clinical data to forecast new cancer treatment targets. Eve, an AI-based "robot scientist," accelerates and greatly reduces the cost of the drug discovery process. The philosophy of AI involves advice to practitioners of AI about what they can and cannot do. AI depends on digital data; consistency in the availability and quality of data potentially affect.

Millions of molecules make up the dataset used in pharmaceutical companies for medication discovery. It takes a long time to screen these million chemicals using conventional techniques. To address these issues, large data modelling and analysis techniques based on AI, such as DL and pertinent modelling, are used to evaluate the safety and efficacy of pharmacological compounds. The potential of AI in predicting physicochemical qualities has been investigated.

The next stage after identifying a compound's Physiochemical properties is to anticipate how well the drug molecules will interact with the target protein or kinase. The drug molecule won't be able to provide a successful therapeutic response if it doesn't interact with the target protein. Drug molecules may occasionally interact with unexpected proteins to produce toxicity. The similarity between drug and target is considered in similarity-based interaction. [16]

Prediction of target protein structure plays important role in drug development life cycle. It is essential to correctly identify the right target for successful treatment. In some cases , overexpression of numerous proteins may lead to the development of the disease. Prediction of target proteins plays a vital role to design drug molecules. By anticipating the 3D protein structure, AI helps in the structure-based drug development process. Before their synthesis or manufacture, a compound's action on the target and safety issues can be predicted thanks to the drug molecule's design in line with the chemical environment of the target protein site.

IV. ETHICAL ISSUES

Despite the AI systems' demonstrated strengths, there are numerous problems that must be addressed when developing such systems. The ethical considerations come first and foremost.

I. To monitor patients, healthcare systems have widely used a variety of IOT technologies. The deploying organisation should place a high premium on the patient's safety and the security of the data produced by these devices.

II. Regular monitoring of the IOT devices is required.

III. In addition, hospitals or other institutions that give researchers access to medical information so they can conduct their research must take precautions to ensure that no patient's personal information is disclosed.

The experiments may not be carried out with any kind of biased presumption.

While carrying out any experiment, the consequences or any side or after-effects may be already conveyed to the patients. Nothing should be concealed from the patient.

Proper acknowledgement should be given to the funding institute or organization.

The AI system's acceptance by the medical profession is another issue it faces in a healthcare environment. The majority of the time, medical professionals are hesitant to acknowledge the accuracy of these AI systems. In order to acquire their trust and subsequently create an acceptable AI system for the specific healthcare issue, computer scientists must work in conjunction with medical practitioners when creating these types of systems. Healthcare workers frequently believe that AI systems will replace them, but they need to be reassured that these technologies are being built to support them rather than to take their place.

A very crucial point that needs to be made is that, as of right now, artificially intelligent systems are only effective at performing a limited range of tasks, and artificial general intelligence is still just a pipe dream. This poses the extremely important question of whether we can actually use AI systems in complex healthcare environments that demand not only domain expertise but

also sound reasoning skills that artificial agents presently lack. Although the AI system is devoid of the personal prejudices that a doctor would have for a particular patient. However, given that Sophia is one of the first emotionally intelligent robots to have been created, we may anticipate the development of some excellent AI-based healthcare robots that could perform independent procedures and diagnose patients without the assistance of medical experts.

However, this would take some time and would call for the fusion of several AI domains, such as IOT, Reinforcement Learning, along with the fundamental machine learning and deep learning techniques.

V. CONCLUSION

In various corporate fields, data mining is important for discovering patterns, forecasting, learning, etc. Classification, clustering, and other data mining techniques and algorithms aid in identifying patterns that can be used to predict future business trends. For analysis, data mining forecasts the future and explains the past. These days, every industry has gone digital, and as a result, a lot of data is produced every day. In order to manage, analyse, and extract the necessary information from these sizable databases, data mining is essential. Artificial intelligence has a lot of potential in the healthcare sector to save valuable human lives and increase the likelihood that people will survive. When compared to the traditional technologies utilised for creating similar models, the frameworks and models created and trained utilising artificial intelligence-based methodologies in the healthcare sector have demonstrated excellent accuracy. The models developed utilising machine learning methods, one of the subsets of artificial intelligence, have shown promise in resolving a number of issues in the medical field.

REFERENCES

[1] Solanki, H., 2013, " Comparative Study of Data Mining Tools and Analysis with Unified Data Mining Theory" in International Journal of Computer Applications, **75(16), pp.23-28, 2013.**

[2] S. L. Nalawade ,Dr. R.V. Kulkarni,"Application of Data Mining in Health Care" in International Journal of Science and Research (IJSR), **5(4), pp.262-268, 2016.**

[3] Ms.Dhwani Sondhi "Application of Data Mining in Census Data Analysis using Weka", International Journal of Engineering Trends and Technology (IJETT), V52(3),**157-161 October 2017**. ISSN:2231-53817.

[4] Saima Anwar Lashari, Rosziati Ibrahim, Norhalina Senan, N. S. A. M. Taujuddin,"Application of Data Mining Techniques for Medical Data Classification: A Review"in MATEC Web of Conferences **150, 06003, 2018.**

[5] D.Usha Rani, "A Survey on Data Mining Tools and Techniques in Medical Field" in International Journal of Advanced Networking & Applications (IJANA), **Vol.08, Issue: 05 Pages: 51-54, 2017.**

[6] Manpreet Kaura, Shivani Kanga, "Market Basket Analysis: Identify the changing trends of market data using association rule mining" in International Conference on Computational Modeling and Security (CMS 2016), Procedia Computer Science **85, 78 – 85, 2016.**

[7] M. Dhanabhakyam, Dr. M. Punithavalli, "A Survey on Data Mining Algorithm for Market Basket Analysis"in Global Journal of Computer Science and Technology **Vol.11, Issue 11 Version 1.0 July 2011.**

[8] Solanki, H., 2013,"Comparative Study of Data Mining Tools and Analysis with Unified Data Mining Theory" in International Journal of Computer Applications, **75(16), pp.23-28, 2013.**

[9] Ashish Dutti, Maizatul Akmar Ismaili, Tutut Herawan, " A Systematic Review on Educational Data Mining"in IEEE ACCESS, **Vol.5, pp 15991-16005, 2017.**

[10] Stefano Lonardi, Jake Chen, ―Data Mining in Bioinformatics: Selected Papers from BIOKDD in IEEE/ACM Transactions on Computational Biology and Bioinformatics, **Vol.7, no. 2, April-June 2010.**

[11] V.K. Jha, R.K. Singh, "Application of Data Mining in Manufacturing Industry" in International Journal of Information Sciences and Application. ISSN 0974- 2255 **Vol.3, Number 2, pp. 59-64, 2011.**

[12] Uddin, Osemengbe O., P. S. O. Uddin, "Data Mining: An Active Solution for Crime Investigation in IJCST **Vol.5, SPl - 1, Jan - Mar 2014.**

[13] Kumar, Y., Koul, A., Singla, R. and Ijaz, M., "Artificial intelligence in disease diagnosis: a systematic literature review, synthesizing framework and future research agenda" in Journal of Ambient Intelligence and Humanized Computing.

[14] Han Y, Han Z, Wu J, Yu Y, Gao S, Hua D, Yang A, "Artificial intelligence recommendation system of cancer rehabilitation scheme based on IoT technology" IEEE Access. 2020;8.44924–44935.

[15] Guram, Harsimran and Sharma, Ashok, Comparing the Performance of Various Machine Learning Approaches in Identifying Different Classes of Dementia (April 25, 2021). Proceedings of the International Conference on Innovative Computing & Communication (ICICC) **2021.**

[16] Guram, Harsimran and Ashok, "improved dementia images detection and classification using transfer learning base convolution mapping with attention layer and xgboost classifier in Turkish Journal of Computer and Mathematics Education **Vol.12No.6, 217-224, 2021**

[17] Harsimran Guram Ashok Sharma," Identifying the Rules of Transition from AD to Dementia and MCI Using Machine Learning in International Journal of Control and Automation, **Vol.13 issue 4 Pp-718-729**

[18] Guram, H. and Sharma, A., 2021. Patch base segmentation for classification of dementia disorder with optimize feature weight and random forest-based approach. Materials Today: Proceedings, [online] Available <https://www.sciencedirect.com/science/article/pii/S221478532039893X> [Accessed 11 September 2022].

[19] Sharma, A., Singh, P. and Dhar, G., 2021. Artificial Intelligence and Machine Learning for Healthcare Solutions. 3rd ed. US: John Wiley & Sons, Inc., **pp.281-291, 2021.**

[20] SHarma, A., Bachate, R., V Pawar, M. and Shardoor, N., 2022. Artificial intelligence-based solutions for COVID-19. 3rd ed. US: Academic Press, **pp.167-189, 2022.**

[21] SHarma, A., Singh, P. and Dhar, G., 2021. Machine Learning and Data Analytics for Predicting, Managing, and Monitoring Disease. 5th ed. US: IGI Global, **pp.140-149, 2021.**

[22] Sharma, A. and Dhar, G., 2019. Deep Learning A Compass To Medical Sciences. Think India, **22(17), pp.1737-1746, 2019.**

[23] Sharma, A. and Gurram, H., 2022. Identifying the Rules of Transition from AD to Dementia and MCI Using Machine Learning. International Journal of Control and Automation, [online] 13(4), pp.718 - 729. Available at: <http://sersc.org/journals/index.php/IJCA/article/view/18865/9565> [Accessed 11 September 2022].

