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Medical Diagnostic Systems Using Artificial Intelligence (AI) Algorithms

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Abstract – *Disease diagnosis is that the identification of an health issue, disease, disorder. Early identification of diseases ends up in to start early diagnosis and correct treatment of diseases. Disease diagnoses may well be sometimes very easy tasks, while others is also a touch trickier. Medical diagnosis is difficult for humans it actually takes a plenty of your time without the assistance of intelligent machines. The normal methods which are wont to diagnose a disease are manual and error-prone. Usage of computer science (AI) predictive techniques enables auto diagnosis and reduces detection errors compared to exclusive human expertise. We further discuss various diseases along with corresponding techniques of AI, including Fuzzy(formal) Logic, Machine Learning, and Deep Learning.*

Key Words: **Artificial intelligence(AI), machine learning, deep learning, chronic disease, health care prediction**.

1.INTRODUCTION

The definition of AI in medical sciences came in 1984, when AI was just concerned with the AI programs that performed analysis, treatment recommendation and suggestion. Within the field of healthcare, the study of disease diagnosis plays a vital role. Any cause or circumstances that cause to pain, illness, dysfunction, or eventually, a human being's death is termed a disease. Diseases may affect an individual physically and mentally, and it considerably manipulates the living type of the affected person. The causal study of disease is name the biological process. Diagnosis has been defined as the method of identifying a disease from its signs and symptoms to conclude its pathology. Unfortunately, the knowledge chain and datasets in health have critical flaws at many points and then experts are forever making decisions on the premise of 'least bad' knowledge and adding their own intuition (combining wisdom with case experience). In these scenarios, the direct insertion of AI, without interoperability with human intuition, will have unpredictable consequences. Hence, there was a requirement of automatic diagnostic system that gives benefits from both human knowledge and accuracy of the machine. An appropriate decision support system is required to attain accurate results from the diagnosis process with reduced costs. Classification of diseases depending upon various parameters may be a complex task for human experts but AI would help to detect and handle such type of cases. In this article, a broad range of applications of AI in health are described, and examined with the uncertainty context in mind. Using case studies, the goal is to interrupt the AI versus human dialogue into thing that is less binary, insight based mostly and helpful.

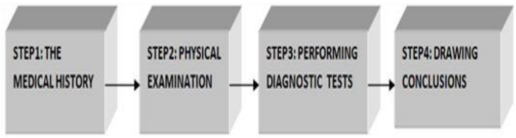

FIGURE -1: Block diagram of the diagnosis process

2.Related Work

In this half we will discuss the techniques and strategies that are already in use or underneath review. Van Mourik et al. [14] administrated out a survey on machine-driven surveillance techniques for healthcare-associated infections. Luo et al. [15] reviewed this malady together with metastasis syncytial virus (RSV), an infection which will be the root explanation for bronchiolitis. Bhattacharjee et al. [16] performed a scientific review to research this current trend in infection detection in hospital. Another analysis on infection was performed by Sinha et al. [17]. They reported some drawbacks in blood culture testing for infection detection. To the simplest of the information, this can be an endeavor that give a comprehensive survey for malady prediction by the techniques of machine learning and deep learning. Addition, contrary to existing survey articles out there within the literature, this work has centered on a selected vary of sicknesses including cardiovascular disease, nervous disease, prostate, liver disease and renal disease

2. FUZZY LOGIC AND DISEASE DIAGNOSIS

Logic could be a type of many-valued logic during which the reality worth of variables could also be that's in decimal or any complex number between zero and one each comprehensive. Generally, the Fuzzy logic process to malady identification as delineate in Fig two is created by the subsequence steps.

1) Fuzzifier: The Fuzzification method is finish by a Fuzzifier. It is a method of adjusting a crisp input worth to the fuzzy set. Therefore, Fuzzifier is employed as a mapping from observant input to fuzzy value.

2)Inference engine: When finishing the fuzzification method, fuzzy value processed by the reasoning engine employing a set of rules act as a set of rules to the cognitive content.

3)Knowledgebase: This is the main component of the fuzzy logic system. The overall fuzzy system depends on the

cognitive content. Basically, it consists of rules, structured and unstructured information also named the database.
4) Defuzzifier: The method of changing the output from the logical thinking engine into crisp logic. Fuzzy value is associate input to the defuzzification that fuzzy value .

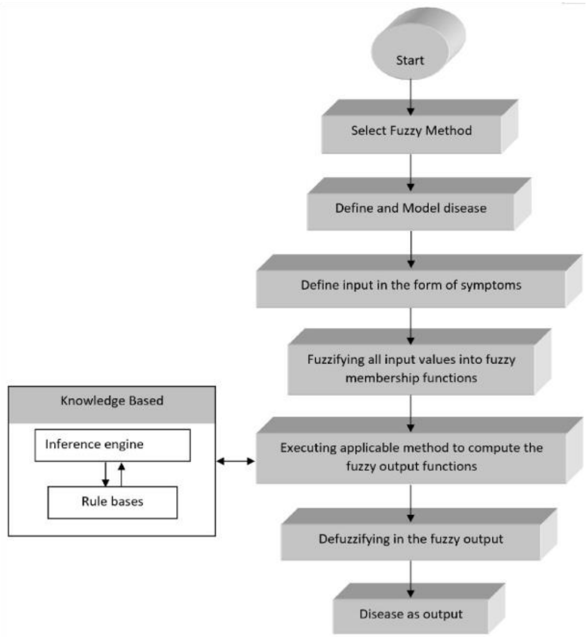

FIGURE -2: Flow chart of the Fuzzy logic process.

Fuzzy Logic is taken under consideration among the techniques for AI, wherever intelligent behavior is achieved by making fuzzy categories of some parameters. The principles and criteria are graspable by humans. These rules and also also the fuzzy categories are outlined by a site professional largely. Therefore, an excellent deal of human intervention is needed in mathematical logic. The particular process of information primarily provides a presentation of the information in fuzzy logic. One of such representations can be done using machine learning in the medical field even in a much better way than fuzzy logic. The statistical model used for estimation is not capable to produce good performance results. Statistical models fail to detect missing values, large data values and hold categorical data. All the above-mentioned reasons can be achieved through machine learning (ML). ML plays an essential role in numerous applications such as natural language processing, information mining, image detection, and disease detection. In all the above-mentioned domains, ML provides appropriate solutions as per the problem. Thus, ML also facilitates advanced diagnosis systems and treatment options in healthcare. In the following section, we describe how ML was used for disease diagnostic systems.

3. MACHINE LEARNING AND DISEASE DIAGNOSIS

In machine learning, there are algorithms for supervised learning the algorithms hunts for information patterns and makes higher choices. The key goal is to permit the machines to learn automatically without human interference and adjust the response accordingly. We focused on the prediction of some chronic diseases like kidney disease, diabetes, heart disease, and breast cancer, lung disorders, etc. Machine learning has granted computer systems new abilities that we could have never thought of. Machine learning is a field of AI that gives machines to power to learn itself by examples in order to analyze how to different models perform in ML without using human judgment. The working of ML are explained step by step as follow as shown in Fig.3 Data Collection: The very first step is to collect data. It is a very critical step as quality and quantity affect the overall performance of the system. Basically, it is a process of gathering data on targeted variables. 2) Data Preparation: After the collection of data, the second step is data preprocessing. It is a process to change raw data to useful data, on which a decision could be made. This process is also called data cleaning. 3) Choose a Model: To represent preprocessed data into a model, one chooses an appropriate algorithm according to the task. 4) Train the Model: ML use supervised learning to train a model to increase the accuracy of decision making or doing predictions. 5) Evaluate the Model: To evaluate the model, a number parameters is needed. The parameters are driven from the defined objectives. Also, one needs to capture the performance of the model with the previous one. 6) Parameter Tuning: This step may include: numbering of training steps, performance, outcome, learning rate, initialization values, and distribution, etc. 7) Make Predictions: To evaluate the developed model with the real world, it is indispensable to predict some outcome on the test dataset. If that outcome will match with domain expert or opinions nearer to it, then that model can be used for further predictions. The basic steps of for disease detection using ML is described as follows 1) Collect test data with patient details. 2) The feature extraction process picks attributes which are useful for disease prediction 3) Afterward, the selection of attributes, then select and process the dataset. 4) Various classifications methods as mentioned in the diagram can be applied to preprocess dataset to evaluate the accuracy of prediction of disease 5) The performance of different classifiers compared with each other in order to select the best classifier with the highest accuracy.

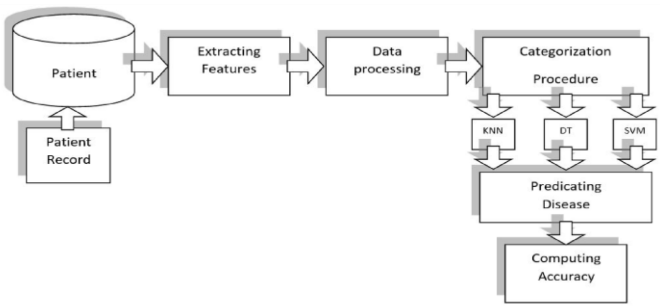

FIGURE -3: Machine Learning System.

4. DEEP LEARNING AND DISEASE DIAGNOSIS

Artificial intelligence technique that mimics the workings of the human brain and making patterns for higher cognitive process is thought as Deep Learning. Whereas machine learning strategies needed to interrupt down a haul statement into completely different component initial and so their outcome to be integrated at the ultimate stage; the Deep Learning method's objective is to unravel the problem end to end. Deep learning has got great interest in every field and especially in medical image analysis. The AANs (artificial neural networks) and deep learning may be differentiated by the variations in an exceedingly range of hidden layers and also their inter-connectivity and the potency to yield an appropriate result of the inputs. Deep learning is a type of machine learning, which is a subset of artificial intelligence. Machine learning is about computers being able to think and act with less human intervention; deep learning is about computers learning to think using structures modeled on the human brain. The distinction can be understood from figure four.

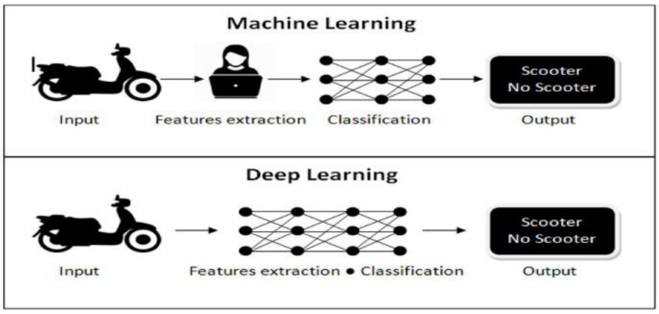

FIGURE -4: Distinction between Machine Learning and Deep Learning.

As mentioned earlier, the standard automated diagnostic technique used a machine-learning algorithm in that clinical expert manually fetched features in diagnosis reports. But sometimes it became difficult to extract features from large dataset. Hence, those methods suffered with accuracy and efficiency as depicted in Fig. 4

absence of necessary data is a considerable obstacle for deep learning models. Presently, medical research uses electronic health records, but there is no predictable technique to evaluate the EHRs, which means that accuracy of diagnostic process using automated system could be limited. If the system fails to collect accurate data, the model will not able to diagnose a disease precisely, which makes it complicated to show accurate prediction. To tackle this type of drawback, the authors in developed effective deep learning model for early & correct detection of varied diseases. In standard approach, a Deep CNN model is employed to sight diseases. Then the neural system utilizes approaches to information expansion. Every layer within CNN filters the raw info within the image to induce a particular pattern. The few initial layers find the large feature set like diagonal lines and also the next few layers are used to get better details, organize them into sophisticated option. The foremost final layer works as an standard neural network and also the network becomes totally connected. Then it is place along together highly specific features like varied symptoms of the illness and as a result, perform the prediction of the illness. The authors in rectified so as to unravel the problem the of lacking information or missing values. Afterward, a deep learning model trained by the processed information have verified their potency as shown in Fig 5

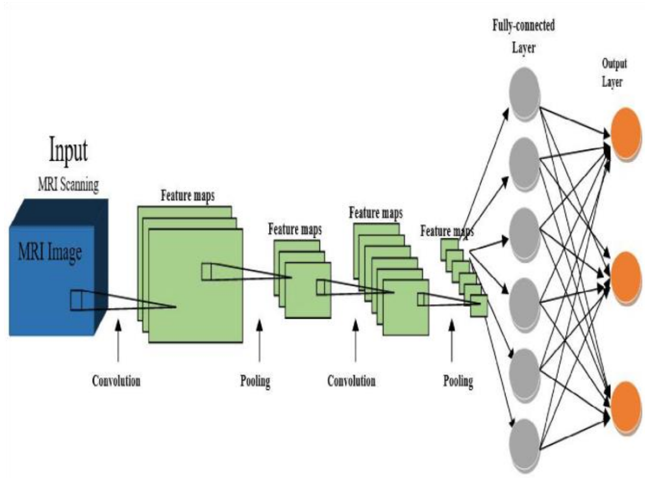

FIGURE -5: Deep Process to diagnosis a disease

5. OPEN PROBLEMS AND FUTURE TRENDS

As evident from the progress and discussion given during this paper, AI algorithms are potential to produce a significant contribution to medical diagnostic systems. Nonetheless, so as to get the utmost potential of AI for mining novel insights from the associated medical information, AI-based diagnostic systems must address some major issues as follows

1) EXPLAINABLE DIAGNOSIS AI models are usually criticized because of its internal unclear decision-making process. In this regard, interpretable AI deals with the implementation of clarity and reasoning of the behaviors of applied math black-box AI learning strategies, significantly deep learning in and of itself ,addition to uncovering the pattern recognition issues, AI systems ought to go together with causative models of the world supporting clarification and understanding.
2) QUALITY OF TRAINING The performances of machine learning and deep learning algorithms mostly rely upon the availability of high-quality training models to achieve the required diagnostic capability. Moreover, the problem of data scarcity is very central since data are at the key of AI-based medical applications. There exist some efforts to create additional annotated information by utilizing various strategies, like data augmentation and picture synthesis. However, it is not fully clear

whether they are suitable for AI-based medical diagnostics.

3) CLINICAL TRANSLATION The development in AI analysis employed in medical specialty is so fast, and their attainable adoption has been shown by systems as well as the detection of varied cancer metastasis, brain recognition, and diagnosing diseases in retinal photos. Nonetheless, the adoption of AI-based system in clinical settings can bear numerous transformations and phases and many methods still to come. As mentioned before, present studies focus principally on optimizing the performance of advanced machine learning models, whereas disregard less their make a case for ability. As a result, physicians struggle to interpret these models, and feel it is hard to trust them. Therefore, reliable and trustworthy communications between medical experts and AI model experts is also highly important to transform the AI-based diagnostic potentials into clinical practice.
4) MEDIAL DATA CHARACTERISTICS Since the medical knowledge is that the final basis of mining data needed for disease identification, the information ought to be of top quality. Moreover, the amount of medical information is usually very high, the info sources are square measure numerous, and also the data is usually returning from time period sensors.
5) STANDARDIZATION AND INTEROPERABILITY In the identification context, there square measure many ways that vendors will manufacture a various vary of diagnostic merchandise whereas desegregation a collection of AI algorithms handpicked from several attainable ways . However, they will not follow standard rules and regulations for compatible interfaces and associated protocols across diverse computing frameworks.
6) SECURE DIAGNOSIS AI methods in general and deep learning techniques in particular are vastly application-specific where a model trained for diagnosing one disease might not be able to work well for another diagnosis. The algorithms usually need to be retrained with respective medical data to be utilized for other diseases; otherwise, false diagnosis will be unavoidable.

Conclusion

Recent advancements in AI techniques result in undefeated applications of AI in health care. Even it become a hot topic of debate whether or not AI data systems can eventually replace human doctors. Still, we tend to contemplate the very fact that AI expert system can assist the human doctor to make a better decision or even replace human judgment in some cases. Different AI techniques can help to find out relevant information from a large amount of clinical data. Also, AI methods are trained in such a way that can have the ability of self-learning, error-correcting, and they produce results with high accuracy. AI in healthcare provide beneficial results by improved diagnosis process and to detect the disease in early stages which follows to pick the suitable treatment plan. The other key concept to keep in mind is that we investigated three AI techniques (Fuzzy logic, machine learning, and deep learning) that are widely used in healthcare and we produce our results using these three methods. In this study we observe that AI is not limited to identify any specific disease, we can utilize various AI techniques to detect any kind of disease or to improve the diagnosis process for all diseases. The efficiency to detect disease by AI cannot be ignored.

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