A survey to analyze the Current development ofAI/ML in Healthcare Applications

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***Abstract*- Artificial intelligence has been growing rapidly in healthcare applications. It was mainly used in software algorithms and hardware implementation, but now artificial intelligence is freshly emerging in healthcare. Many different multidisciplinary pieces of research with different AIs and their functions recommend the mandatory and primary gaps. Healthcare requires the use of modern technologies like Artificial Intelligence and Machine Learning, mainly used to fight against advanced diseases and used for proper monitoring. AI research has been developed for proper treatment regimes and improves health innovation. This review paper outlines the current development of AI applications in healthcare and its future benefits to upgrade patient care using different machine learning algorithms. This paper also studies various machine learning algorithms for the detection of diabetics based on accuracy parameters. An increase in accuracy helps to invent the machine learning models and yields the best results. Needy patients in the near future will benefit from artificial intelligence.**

Keywords*— *Healthcare, Machine Learning, AI algorithms, supervised learning, reinforcement learning, unsupervised learning

I. INTRODUCTION

Artificial Intelligence (AI) and related technologies are increasingly widespread in society and are now emerging in the field of healthcare. AI is an agent or the study of any device that can understand and recognize its environment and start taking relevant decisions to achieve its objectives [1] [2]. Here we analyze the status of AI applications in healthcare and speculate on future benefits for patient care. In healthcare, both structured and unstructured data can be used. For structured data, machine learning (ML) methods are used, as is modern deep learning for unstructured data. In recent years, AI & ML algorithms have been very powerful to track the diagnosis and tracking of lots of diseases in recent years in health care applications [3-6].

Machine learning is a computer program that adapts to a new environment without any human instructions or being programmed. Machine Learning is grasped as a subcategory of AI applications [7].

Machine learning is active in various areas, such as risk estimation in patients, medical conditions, etc. ML algorithms are used in medicine to find patterns and make predictions using built-in data from large patient databases [8]. In the combination of structured and unstructured data, data inputs are surely used [9].

ML classifies four major learning algorithms that can be segregated into supervised, unsupervised, semi-supervised, and reinforcement learning. For imaginative or wise data collection, analysis, and storage, machine learning works as a marketable tool.

Medical datasets are extensively used with machine learning concepts. To assassinate a machine learning algorithm, patients' rigorous diagnosis and database are entered into a computer program. The resulting classifiers for machine learning methods further help physicians to investigate new patients.

The intent of this survey paper is to demonstrate how AI and ML in healthcare have tremendously secured medical resources, provided a great journey for patients and doctors, and facilitated patients' lives.

This study points out how the machine-learning model provides exact and vigorous predictions and improves patient care. It emphasizes the current developments in the health care sector.

II. LITERATURE REVIEW

AI research and models have been conducted in different areas, especially in healthcare. It provides

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a good framework for the literature review to find the gap from previous research as a basis of the new AI model.

Guoguang Rong et al. demonstrate the latest developments in various applications of AI in disease diagnostics, biomedicine, etc. The most recent artificial intelligence provides novel insights for biomedicine. In the foreseeable future, supply and demand will be coupled with significant development [10].

David et al. outline the proof-of-concepts approach to impingement patient care and describe the utilization of machine learning in clinical medicine as reflective or retrospective in nature. This article, however, uses markedly different inclusion criteria and does not focus exclusively on studies that address a clinical problem as we have defined it [11].

Hamdan O. Alanazi et al. determine that the existing ML methods prove to have peculiar accuracies when applied to a wide dataset of a similar type. In upcoming work, a new ML model should be developed to provide a dynamic and exact prediction of values [12].

According to Tran et al., the author creates three virtual nurse models to assist patients. This article recommended some screens on a mobile platform to present these models of AL. Earlier models used one type or function of artificial intelligence to analyze disease prognosis and provide assistance to doctors and patients [13].

Kushal Rashmikant Dalal describes how healthcare companies have to target accessing their full organisation scenario while providing the deployment of artificial intelligence for clarifying explicit issues like readmission of a hospital or fraud of claims. At an institutional level, consistent steps should be taken to upgrade the success opportunities in healthcare [14].

After focusing on the past of machine learning in medicine and its advanced applications, Hanyu Dou describes the important methods of machine learning and outlines various ideal applications. Advanced methods used in machine learning are planned, but in terms of technology, laws, or ethics, machine learning is not perfect. So, it is quite difficult to strike a balance between machines and manpower that everybody must face [15].

Ricardo Buettner et al. described how for cancer diagnostic and heart diseases, machine learning methods are extensively applied. We saw a shuffle from historical approaches (SVM model, decision tree algorithms) to novel convolutional neural networks. As the search was based on peer-reviewed publications, a bit of research publication with some fascinating material was totally removed from the paper, and this prohibited material would probably create a problem in publication bias [16].

Demonstrate the rap of emerging overtures in the data analytics domain and how simple it can be for healthcare in predictive and visualization applications with precise intensity. In the context of general and predictive analytics, a model has been designed and reaches its goal using medical datasets by providing an effective platform. The pros of the model described here are that it places a constraint on the latest Artificial Intelligence technologies that incorporate real and useful medical data [17].

III. COMPARATIVE STUDY/METHODOLOGY USED

[10] This article describes the application of AI in biomedicine. Applications are used mainly to deal with elderly and disabled people for their livelihood assistance, primary research activities, natural language programming (NLP) techniques, and forecasting diseases. For unsighted people, RUDO (ambient intelligent system) is mainly used in practise [18]. The Sparse Bayesian classifier and Radar Doppler time-frequency signature can reduce the fall risks and complications of seniors [19].

BioQA (Biomedical Question Answering) is the process of identifying quick and accurate answers to user-generated questions from a reservoir of collected documents and various types of datasets. NLP techniques are used for explanatory answers [20].

Artificial Intelligence in biomedicine uses biochips or biosensors for the diagnosis of diseases. In-vitro diagnostics used in healthcare applications in artificial intelligence occupy primary space [21]. For bladder volume prediction, both qualitative and quantitative monitoring methods (ML algorithm) were recommended. The Pearson correlation coefficient is replaced by Spearman's rank correlation as the latter estimate has a monotonic dependence and the former upgrades the durability of the estimation method.

[11] In this systematic review, the author identified 386 publications to address a specific clinical problem that implemented an ML strategy. They distinguish between retrospective and prospective studies as a surrogate for the maturity of ML integration into healthcare workflow [22]. This research discussed how easily information flows via a given model and enhances our understanding of the rationale behind its output. Developers of machine learning algorithms utilize more explainable algorithms by making new design choices and employing different techniques such as deep learning important features (Deep LIFT),

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local interpretable model-agnostic explanations (LIME), and layer-wise relevance propagation to increase the interpretability of their algorithm [23].

[12] For prediction or classification, supervised learning methods are widely used [24]. Recent research studies stated that DT, SVM, ANN, and NB ML algorithms are used extensively. The research was done by Vink and de Haan [25] to determine the AdaBoost algorithm, which is mainly used to upgrade the performance of any machine learning method. Indeed, for the same dataset, other ML methods provide distinct levels of veracity or accuracy [26–28].

[13] This paper builds three AI models consisting of main functions based on AI, I, which are considered primary: booking an appointment, surgery result analysis, and announcing to patients and stakeholders how much fee they have to submit for surgery. At the end of the 3 models, some screens on the mobile app can demonstrate these AI functions as a nurse for patients and an assistant for a doctor. We have three different levels of AI, so we have three different outputs.

Output1-: Supervised learning; Conclusion with doctor's comment

Output2: Unsupervised learning: automatic conclusion if diagnostic and prognostic information is 100% the same as the precision healthcare platform.

Output3: Reinforcement learning: compared to feedback/results of post-surgery to make the conclusion more exact.

[14] Analyzing and diagnosing diseases and their treatments are crucial to identifying them during the initial stages. The combination of cognitive computing with tumor sequencing is an example of IBM Watson for Genomics, mainly used for genome analysis and vital for rapid diagnostics. ML is mainly used by pharmacies in the detection of drugs and manufacturing practices [29]. Unsupervised learning is a comprehensive set of machine learning techniques in recent development. Customized medicines and treatments can be developed by machine learning techniques for targeting explicit diseases in individual patients by using their medical patient history.

Predictive analytics can undeniably be useful in healthcare, obtaining a wide range of data that reduces the cost and time required for experiments in the medical field, and by implementing predictive analytics to clinical trial candidates, doctors will be aided [30].

[15] SVM is a commonly used method for breast cancer treatment. SVM partitions the tumor into malignant and benign and further designs them in multidimensional space to pacify hard analysis in two-dimensional space.

HUANG describes in MRI image segmentation how to reduce the error using the Gray forecast model. He constructs authentic sequence X_0 by collecting data and stabilizing the G(1,1) model [31]. This method weakens false positives precisely and cultivates the segmentation of tumors by achieving accuracy, reducing the authentic data randomness, and determining the region of a tumor.

[16] Peer-reviewed work was published in IEEE Xplore, Springer Link/AI, ACM, and AIS Basket of 88 journals, and systematic forward and backward literature searches were finalized with the following search pattern: "disease" AND "profile" AND ("machine learning" OR "deep learning").

To learn the support vector machine (SVM) classifier, the multi-kernel SVM method was used. Using a linear combination of fixed primary kernels, each kernel coefficient was achieved and then correlated against the decision tree, K-Nearest Neighbour (kNN), and Naive Bayes (NB). An accuracy of 83.46% was achieved by combining ML with SVM. Retinal blood vessel segmentation and classification (RBVSC) grant different disorders such as diabetes mellitus and serve patients before an inaccurate state occurs.

SVM is primarily used in machine learning to distinguish between vessels and non-vessels.ML was used with SVM, so an accuracy of 97.775% was achieved and was refined to a range of 2–4%. Convolution Neural Networks (CNN) are used in a wide range of critical problems. CNNs (a modern ML method) outperform classical statistical methods. Tan et al. demonstrate 99.85% accuracy in diagnosing coronary heart disease (CHD) [32,33]. Decision Tree classifier algorithms are occasionally implemented in disease profiling. The decision tree algorithm provides a high accuracy of 86.7%

Rajamohana et al. correlated enforcement of four machine learning algorithms. These were Random Forest (RF), SVM, Decision Tree, and k-NN. Out of all these algorithms, the RF algorithm exceeds the others in terms of the equations of precision algorithm, accuracy factor, and recall algorithm [34].

In terms of sensitivity, the Bayesian network was the only one that had an exceptional performance. Christopher & Banu used a Bayesian Network, NB algorithm, and J48 classifier algorithm to

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investigate the predictions of lung cancer problems [35].

K-Nearest Neighbour (kNN) is generally used for breast cancer detection. One test was executed by Nusantara et al. In the test 209 normal images and 113 abnormal images accepted by radiologists were implemented, and then the accuracy achieved was 96.8% [36].

The following table summarizes the accuracy achieved by using different ML algorithms.

TABLE I. Algorithms and Accuracy detection

Method Used	**Diseases**	**Accuracy achieved**
SVM & RBVSC	Diabetes-mellitus	97.775%
CNN	Coronary heart disease	99.85%
CNN & SVM	Coronary heart disease	97.775%
Decision Tree	Breast cancer	86.7%
kNN	Breast cancer	96.8%
Naïve Bayes	Breast cancer	82.6%
Naïve Bayes & J48	Breast cancer	94.2%
kNN	Breast cancer	96.8%

[17] The expected system involves numerous tiers, user-defined data, processing methods, and different models. This model chiefly serves a user interface pertinent to importing extant datasets in standardised formats such as CSV. This data is further stacked internally in a structure based on the format given by NeHA (National e-Health Authority) [37].

The system still further permits the new and advanced researcher to manually join the entire document records formerly used in the neural network model that is positioned on routine parameters as shown in figure 1.

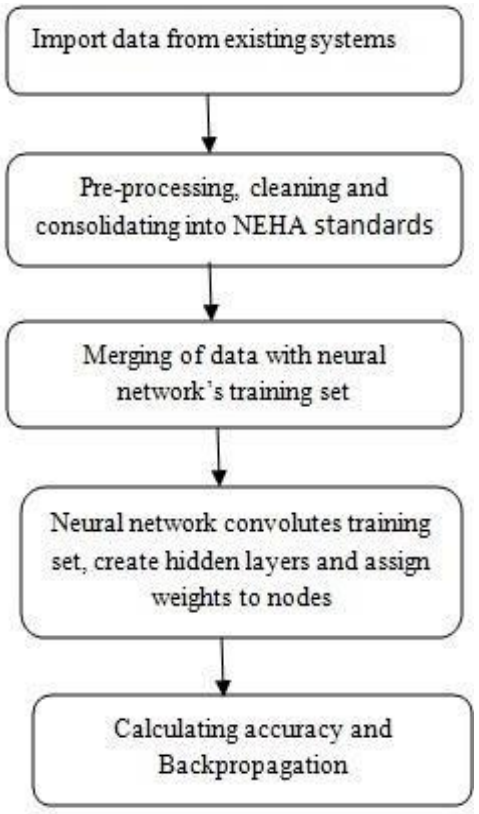

Figure 1. Predictive analytics process flow diagram

Now, the NN is perfectly trained based on the dataset so that it can be efficiently used for predictive analytics. Predictive with statistical functions can be consummated in the data sets, which can be managed by healthcare and researchers. By using back propagation, the accuracy of neural networks is upgraded.

IV. RESULTS

After studying machine learning algorithms such as support vector machine, k-nearest neighbour, decision tree, naive bayes, logistic regression, adaboost, and perceptron, we find accuracies based on the below mentioned confusion matrix [38–40].

TABLE II. Confusion Matrix

Actual	**Predicted**	
	Positive	**Negative**
Positive	True Positive (TP)	False Negative (FN)
Negative	False Positive (FP)	True Negative (TN)

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Accuracy for the matrix can be calculated by using below mentioned formula

$$Accuracy = \frac{\text{TN+TP}}{TN+TP+FN+FP} \qquad [41]$$

We got accuracies as mentioned below. Logistic Regression algorithm has the highest accuracy of 77.61%.

TABLE III. Accuracy Table

Algorithms	**Accuracy**
SVM	75.68%
KNN	75.10%
DT	67.57%
NB	76.64%
LR	77.61%
RF	72.61%
AdaBoost	74.00%
Perceptron	67.00%

Visualization of these accuracies makes us understand different variations among them, as mentioned below in figure 2.

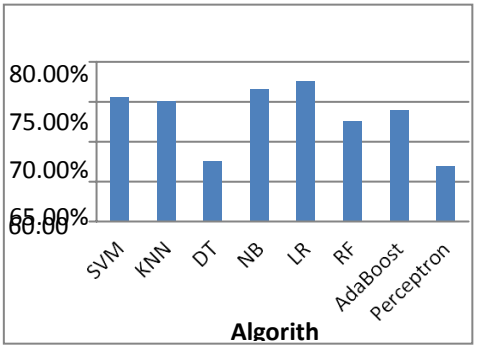

Figure 2. Machine learning algorithms comparisons based on accuracies

V. CONCLUSION

This survey paper analyses the main methods of machine learning and sums up distinct exemplary applications, including disease diagnosis and predictions.

After understanding artificial intelligence and machine learning in the medical sector and their modernistic applications, I focused on normal beliefs, ideas and algorithms and how they improve the quality of the patient's care.

The medicine field is retrospective as in the majority of literature. When using the dupe datasets, existing ML methods provide distinct accuracies. In further work, a new and advanced ML model has to be developed that provides a dynamic and accurate prediction.

AI advances unquestionably in the foreseen future, which definitively gives the essence of patient life. A robust model should be developed in the area of predictive and general analytics using medical datasets.

According to this paper, logistic regression gives the most accurate result for the detection of diabetic disease. Further work can be done to explore more machine learning algorithms for diabetic prediction.

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