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A Review on Applications of Machine Learning in Healthcare

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***Abstract*—Machine Learning has become a huge tendency in the modern and highly experienced technological purpose in the industry sector. The impact of Machine Learning [ML] techniques is witnessed in many areas like medical, industry and security sectors. ML has the potential to detect patterns from the data and also it has the ability to predict disease from medical information sources. This research study has reviewed many types of machine learning algorithms and some techniques in the methodology section is useful for developing healthcare applications. The proposed study also discusses how healthcare domain uses machine learning and its properties. This review paper is mainly considered as an overview of how machine learning is being used to further improve the healthcare sector by making it easier to diagnose and cure diseases too early and also reduce its cost. In this pandemic situation, everyone is working to improve the healthcare sector by using some of machine learning methods and techniques. Form the research literature, it observed that the the Machine Learning [ML] techniques can predict a huge change in the health sectors by making our daily lives more easier.**

***Index Terms*—Machine Learning, Healthcare, Disease Prediction, Medical Science, DSR, SLR.**

I. Introduction

We know that now machine learning is very important for AI. Its concept is to acquire the ability of machines to learn by itself, instead of humans teaching computers everything they need to know. Machine learning applications consist of algorithms. Those algorithms have the power that where these algorithms can learn from the data, also it works without human interference. In machine learning, the development of the fundamental algorithms mainly depend on computational statistics. The data actually teaches the computer by declaring its difficult patterns and fundamental algorithms [1] [2].

Mainly ML algorithms help for development of healthcare applications. Now healthcare is very important in the industrial sector also, because every year in many countries people earn a lot. US is one of them. Now in 21st century we can see that many professionals who works in healthcare sectors are very satisfied with these advantages of healthcare applications [3] [4]. Also many of physicians and many of nurse are used these for medical sectors, also they used it for recorded all medical data [1] [5].

We can separate machine learning in some categories like [6]. Unsupervised Learning, Supervised, Semi-supervised, Reinforcement. These all are the different kinds of machine learning modules and also some methods in healthcare applications [7].

The 1st machine learning technology that is referred to as unsupervised learning that is utilized as training data in healthcare applications or excluding unlabeled data. And the most useful example suggests an approach as a cluster which is used to segment larger data sets in smaller groups based on similarities and some features between every piece of data as a data set. Anomaly detection can also be carried out via unsupervised learning, the moral of this case is that it tries to identify a ray and suspicious item within the data sets. And the example for the healthcare application of the unsupervised learning in real worth is clustering and categorization of data sets can be put to use predict cardiac diseases.

After that the 2nd type of machine learning used in healthcare applications is supervised learning.Supervised learning models use label data as a training material. And from these label data sets the model learning is the association between input as well as the output [8]. In the event that the object detection the given input can be a picture and the output can be a name of an object. So, we feel our model has a large number of examples to train on. And after the training process with models hit the objects and any pictures can take that because of the huge number of examples. An example of supervised learning in healthcare application in the real world can be seen in classification of lines and also recognition of multi organ from medical images.

And the 3rd type is semi-supervised learning. So, A semi-supervised learning that accommodate and hold labeled as well as unlabeled data in the data sets used to train the models. And this approach is very useful to use within the data sets that contains huge number of label examples, so it can be used to acquire sufficient amount of label data to be used in the training supervised learning models.

The 4th type is reinforcement learning. In this reinforcement

learning the model tries to shift a complex objective of goal to maximize the aggregate function programs.
By using machine learning applications and algorithms it can easily improve the healthcare system protocol for improving medical sectors [9]. Also by using machine learning we can speed up our medical sectors by using some latest technologies that are used to detect diseases in healthcare analysis protocol. Now Health monitoring in real time like crucial and hazardous situations also gathering of information from patients using some smartphone as well as some wearable gadgets, which is then sent to the cloud for examination before being returned to the device with the necessary guidelines and that is possible with the help of ML [10].

To extract clinical information from electronic health data, machine learning based algorithms are utilized to make the diagnosing process more easier [11]. Machine learning models employ MRI, CT-scan, Ultra Sound also the others forms of medical pictures to give the anatomical as well as the functional data about various bodily organs as well as to aid in the identification also analysis various aberration [10] [12].

On the other hand deep learning approaches in machine learning are being applied to enhance the sector of data, and it provide a faster diagnosis process and also it is faster to recovery diseases. There are also some applications in healthcare system like, medical image diagnosis, diseases identifications, surgery, many of patient support task by using robots, medicines sectors personalized. And also sharing any information about patients and their safety and outcomes all the ethics of AI in healthcare system. After analyzing some papers we find that using machine learning in healthcare makes huge changes in healthcare technologies. Virtual reality, augmented reality, wearable tech, genome sequence, nanotechnology, 3D painting all are the examples of some technologies that help our healthcare system rapidly.

II. METHODOLOGIES DISCUSSION IN HEALTH CARE

Nowadays traditional system development and such other evaluations and some analytic systems are a little support system in healthcare protocols. Also can see many types of issues in this protocol like lack of increased knowledge and lack of concerns. DSR methodologies distributes such analytical solutions and for developing new knowledge design that's help to improve future solution by modifying internal concepts and issues.

Hevener and Chatterjee briefly discussed how design science supports an 'example study' that used to improve real life problems by the use of certain innovations. For this reason design IT science sectors are always concerned to give priority to domain applications for developing IT architecture [13]. DSR give such types of advantages for Is architecture where they can work for its improvement and new innovations that is a contemporary methodology. Where these development maintain knowledge based activities that is totally different from the present Is methods [13].

In DSR we can see many similarities in thematic increases and conventional techniques and methods that are used, mainly it is very difficult and referenced for its clear focus and the need for guided reporting contributes to a free knowledge in software engineering methods [13].

This approach supports efficient collaboration methods and tries to maintain analytical design solutions [14] [15]. Mainly the stage of application design and implementations are based on traditional thematic in software engineering methods.

Many procedures allow involvement or characterized by participation in design, for this reason physicians can engage themselves for developing these healthcare protocols and its proper evaluations [16].

So our main motive of the study is to evaluate methodological terms where the analytical compositions and the methods of design are used to predict healthcare problems using these methodological logic's.

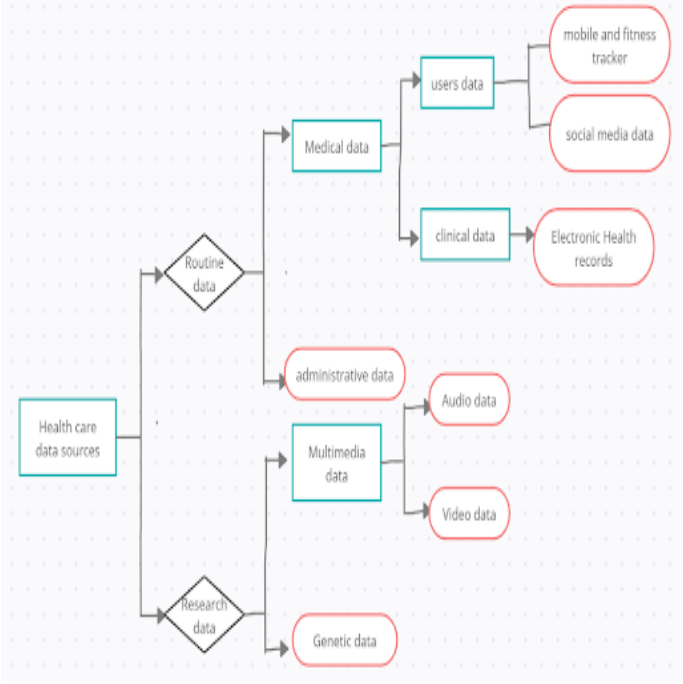

Fig. 1. Process of collection samples and its proper analysis.

SLR can express the patterns for directions and also it is used to improve the knowledge field that is not only provided to cognitive study but also can continue the evidence based guideline that can evaluate bargainers [17]. Here we used

SLR to adopt deep knowledge for IS design in planning and review documents papers and manage its level of phase where health explores it by search [18]. Here the major objective is to develop design methods for healthcare analytical solutions. Also sample articles taken a multiple approach. So in Fig 1 that shows the process of collection samples and its proper analysis [19].

TABLE I
EIGHT KEY PURPOSES OF HEALTHCARE ANALYTIC STUDIES

Patient safety	21%
Enhance Service Quality	42%
Compute Platform	49%
Visual Analytic	36%
Real Time Monitoring	54%
Complex Event Processing	24%
Untold fact Revealing	31%
Clinical Decision Support	24%

In this table I, here in this sector we can see that the clinical and non clinical healthcare studies in this eight key purpose. On the other hand these eight main terms of the remaining study were categorized according to multiple feedback analysis, like, maintain priorities. In this clinical and non clinical terms we find some public healthcare issues [20] [19].

TABLE II
SIX METHODOLOGIES IN HEALTHCARE ANALYSIS

Analytical Methodology	28%
In House Methodology	24%
Software Engineering	23%
Prototyping	19%
Design science research	4%
Agile	2%

Basically here this analysis indicates the manual testing and describes the methods they used and how to design the analyzes the solution to classifying them. In this software engineering methods, analysis and In literature, designers used in-house methods vividly. Table II represents six important methods (including DSR) that have been identified in existing healthcare analysis studies [21] [22] [19].

Our main goal is to place systematic emphasis on healthcare analysis solution design Research from existing literature. Also by investigating the design tendency to create better perceptions in healthcare analytical solution. We could include big samples for improved results. For this future individual analysis we maintain this sample for healthcare analysis. Then used this articles for many process. And it is a human possibilities fault that cause possible risk in this review study.

For examination we use these six types of algorithms. By using these algorithms to ensure different types of data sets and instructions using models to classification test data sets.

Machine learning algorithms are like BFTree, Ridor, NBTree, IB1, MLP, SMO. Also we can use k-nearest neighbors, Fuzzy logic, CART, SVM(support vector machine). The BFT tree uses a built-in tree binary and is divided into characteristic. And it is a tree based algorithm. Training set size increases this algorithm increases the size and complexity of the tree [23] [24]. Ridor means ripple-down rule learner that is known as rule based algorithm and knowledge addition. After that then the knowledge of articles that is a set of rules. But it create an inability rule exclusion as a default rate [15] [14]. NThe algorithm BTree, that is often acknowledge as decision tree in conjunction with naive Bayes classifiers. But the characteristics are not conditionally self reliant [20] [25]. IB1 algorithm (nearest-neighbor classifier), that allow to help euclidean distance. On the other hand, Multi layer Perception algorithm (MLP), that is placed on neural network [26]. SMO determine the problem that's used into 2 dimensional that can be solved empirically, get rid of the need for a numerical development algorithm [27] [28] [29]. K-nearest neighbor, this approach is mainly used in classifications. By using this we can calculate some measures [30]. On the other hand Fuzzy logic mainly involved from fuzzy sets theory. Mainly its apply only two value like 1 and 0. Also CART is called as e classification and tree methodology. This is apply to value predict in this tree methods [31]. For ML task support we can see the uses of (SVM) that is called Support Vector Machine. SVM system are applied in Some categorization issues [32].

III. HOW HEALTHCARE USES MACHINE LEARNING

The Healthcare industry has a lot of data. Machine learning algorithms are built to detect patterns in this data and to predict results of something using these patterns with minimal human involvement [33]. And where in the healthcare industry we can apply machine learning to simplify, optimize or improve life and work of people connected to it. Machine learning algorithms can help people self-diagnose. For instance, they upload the photo of skin anomalies and receive a calculated assumption. How does the machine do it? It has already processed exabytes of photos with different skin disorders so the algorithm finds relevant features in the user's photos and compares it to conditions it stopped to recognize. That's what first damaged skin image search does. It is not the clinical diagnosis of course but it helps people to calm down and know more [12]. Another example in machine learning on the user side is using different bio markers as a way to detect disorders and monitor their development. A startup called aural analytic, analyzes speech to detect disturbances in people's brain. Health and research team from Cornell university proved it is possible to detect and measure depression stability through speech tone of voice and facial expression and in the consumer facing block. Let's mention p learning penalization machine learning algorithms create nutrition plans and recipes for people with diabetes

that fit into the personal requirements of their condition. What about clinical settings? According to the new survey from definitive healthcare, one-third of hospitals use machine learning ,deep learning and AI in the tasks related to patient care imaging of business operations [13]. People are using machines to help with disease detection in the area of expertise. For example diagnostic imaging services utilize algorithms to detect anomalies in CT and X-ray data although doctors' assessment is required [10]. Machine learning is common in drug discovery. Machine learning accelerates routine processes for instance bench side streamlines relevant antibodies discovery through imaging bio-information's data and scientific oncologists. In the healthcare system these are the sample of machine learning applications and we are going to conclude the nature of this technology in one line when humans work slowly and make mistakes machines help them become more efficient.

IV. COMPARATIVE STUDY

Advanced analytical techniques are getting acceptance in the intricate solutions to classification decision problems in multitude areas. As well as healthcare and the pharmaceutical sector. Now a days, Using machine learning approaches it is easy to analysis various category of illnesses like cardiac Disease detection's, diabetic Diseases analysis, Machine Learning analysis in Breast cancer, Thyroid Disorder analysis etc. These techniques are based on some methods which we apply [34] [35] [36] [37] [38] [39] [40].

In this paper here discussed the relationship between machine learning and healthcare and its properties. Also discussed the suitable methodologies for machine learning in healthcare. The main objective was to highlight the systematic importance of healthcare analysis solution design Research from current composition. The results indicate that healthcare analysis is an emerging result in the field of design where DSR is enhanced and positioned to support design instruction specifically for healthcare analysis solutions.

Nowadays we can use many types of algorithms to make a better healthcare system analysis. For pattern related diseases and healthcare analysis by examining those healthcare records and newly admitted patient data that machine learning algorithms can identify. The help of ML algorithms rather than substituting doctors helps to develop transparency in matters related to medical obligation.

By Using this Machine learning algorithms like BFTree, Ridor, NBTree, IB1, MLP, SMO. Also we can use k-nearest neighbors, Fuzzy logic, CART, SVM(support vector machine) etc. This healthcare system is improving rapidly. We can see a huge change in our medical system by using this algorithm. Researchers yet have a lot of work to do to make unfailing, exact and also very sensorial algorithms that can be purposely unified into the patient responsibility case, but in examination process and leader are deliver merchant adjacent to daily clinical responsibility. With the development of this technology, lives and fix more diseases with the help of current and advanced medication and diagnoses will recover.

Also some other algorithms such as (DNN) that means Deep Neural Network, (KNN) means K-Nearest Neighbor also (SVM) that means Support Vector Machine. And these algorithms test this performance in heart diseases. The decision and efficiency of these algorithms are assessed in relation to the capabilities between them [41].

By using these algorithms of machine learning and also some ML techniques, that helps our medical system make it easier to predict diseases easily. That makes the healthcare system more efficient for doctors and patients also. Also using these algorithms and methods we can classify such type of machine learning applications in healthcare like, diseases predictions, manufacturing of drugs, modifications, records of health care analysis, trial in clinical analysis also also research purpose those makes our medical analysis system more preferable for both doctors and patient etc. Also in healthcare epidemiology machine learning is used for improvement of healthcare sector. After analyzing some paper it is clear that how can machine learning put its impact in infectious diseases [42]. Machine learning's major goal in healthcare is to ensure that it works for everyone. It's also worth noting if this healthcare method is beneficial or not, because after that's determined, the next step will be taken [43]. Following the review articles, it is obvious that various ethical considerations in the healthcare applications sectors employing machine learning have been highlighted. With the spread of ML-HCA, it is expected to bring difficult problems and unexamined ethical considerations [44].

V. CONCLUSION

In today's world machine learning has contributed a lot in almost every sectors. The system, healthcare is one of them. In healthcare analysis system machine learning plays a significant role for making it easier for doctor and patient also. We know that in this time Healthcare field has become much more expensive and it also faces many problems. By using some Machine Learning Algorithms we can see huge changes in clinical sides for identifying diseases. Mainly this papers indicates some machine learning techniques that's help to identify diseases in various purpose. This Technologies play a significant role for gaining the low cost for in this sectors and provide the treatment for better analysis in diseases predictions. Now every country is concern about it and every year they spend more money about its purpose for the development of healthcare system by using such techniques like big data and machine learning.

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