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# SVM based Classification of Recent Diseases using Machine Learning Algorithms

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**ABSTRACT:** In the field of medicine, techniques from the field of machine learning are used to improve patient outcomes by making use of the growing amount of available health data. These techniques are used by making use of the increasing amount of data that is available in the field of medicine. These strategies have a great deal of latent potential that has not yet been exploited. Because of the growing complexity and quantity of available data, machine learning, which is also abbreviated as ML, is expected to play an increasingly important role in the healthcare sector. AI is already being put to use in a number of different capacities by payers and providers of medical care, in addition to corporations operating in the life sciences industry. Making diagnoses and treatment recommendations, encouraging patient participation and adherence, and performing administrative duties are some of the most common types of applications. This article's primary purpose is to illustrate the SVM-based classifier model for disease management.

**KEYWORDS:** SVM; Machine learning; healthcare; Artificial intelligence.

## I. INTRODUCTION

Machine learning techniques have been used to solve many clinical problems over the past decade[1]. Every country on the planet has implemented these solutions. Innovative data features and nonlinear correlations, as well as situations where there are more predictor variables than observations[2], can be found using machine learning-based approaches[3]. When dealing with situations in which there are more predictor variables than observations, these methods may be especially useful. In particular, this is true if the methods are based on artificial neural networks (ANNs)[4]. This data and the application of machine learning are being put to various and unique uses. A wide range of uses has been found for these applications. Detecting liver disease in its early stages has been made easier by the use of computer vision and machine learning algorithms[5-7]. Patients now have more precise information about their prognosis as a result of this. The deep neural networks trained by data scientists can, for example, detect fatty liver disease, which is also known as hepatic steatosis, by analyzing ultrasound images[8]. A buildup of fat in the liver is the root cause of this condition. The accumulation of fat in the liver is the primary cause. Symptoms of hepatitis include the texture and echogenicity of the liver, two characteristics of the liver as an organ[9,10].

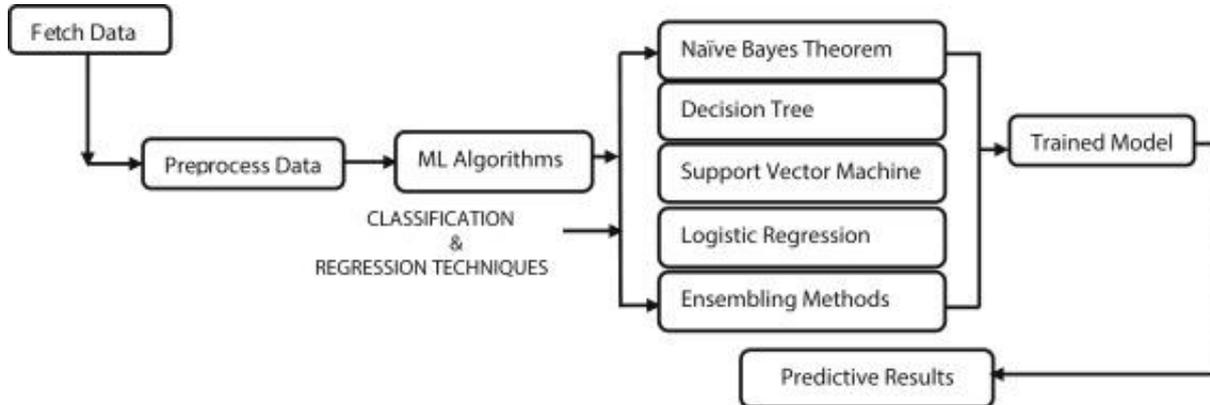


Fig. 1. Classification and Regression technique

## II. LITERATURE SURVEY

If machine learning is utilised in a wide variety of research applications, it will be difficult to carry out newly delegated responsibilities successfully[11]. Cancer research is the most important aspect of the medical field, and machine learning is required to analyse the data being collected for this research[12,13]. Given the current state of clinical knowledge, it is impossible to determine whether a patient is at risk of developing cancer, even if they have been receiving consistent treatment[14] for their condition. Even if the patient has been diagnosed with cancer, this is the case[15]. To determine which treatment would be most beneficial for an individual patient or which treatment would be most effective in prolonging the patient's life, an expert system is required[16]. Both of these questions can be answered by identifying the most effective treatment. The medical community is becoming increasingly interested in how machine learning principles can be applied to medical practice[17]. Patients diagnosed with Parkinson's disease have an increased risk of developing Lewy bodies, which are protein deposits in nerve cells[18-20]. These deposits have a distinctive appearance resembling a tangle. The gradual loss of dopamine-producing neurons in the substantia nigra region of the brain is caused primarily by protein aggregates composed primarily of improperly folded alpha-synuclein protein[21]. The cause of this loss is Parkinson's disease. This loss occurs in a systematic progression as catastrophe unfolds over a considerable number of years[22]. The motor symptoms associated with Parkinson's disease are caused by the underlying dysfunction of a system in the brain that is responsible for movement control[23]. The substantia nigra houses this system. Drugs designed to prevent the accumulation of alpha-synuclein aggregates did not prove effective in clinical trials, despite the growing body of evidence to the contrary. Even though these drugs were intended to prevent the accumulation of alpha-synuclein aggregates, this was the case[24].

### 1. ML Algorithms:

#### a) Naïve Bayes Theorem:

Typical applications of the Naive Bayes technique include classification endeavours such as text categorization, medical diagnosis, and other classification endeavours. The Naive Bayes technique is comprised of a series of classification algorithms that are both straightforward and powerful[25]. In spite of the fact that it functions based on the fundamental assumption that features are independent of one another, Nave Bayes classifiers frequently perform very well even when this assumption is violated. This is because of the way that Nave Bayes classifiers are designed. The fact that this technique needs only a limited amount of training data in order to estimate model parameters represents a significant benefit that sets it apart from other approaches[26].

In the realm of machine learning, the term "classification" refers to a type of supervised learning in which a model assigns a category to a new observation by referring to a training data set that contains examples whose categories are already known. In other words, the model is learning from examples whose categories are already known[27]. The Naive Bayes Classifier is a method of classification that makes use of Bayes' Theorem in addition to a presumption of the independence of the indicators that are being taken into consideration. This is done in order to



classify data. When dealing with enormous amounts of data, the Naive Bayes model is easy to construct and of great assistance [28-30].

According to the NB categorization approach, the following is a description of the concept of independence and the relatedness of all qualities: The status of one feature within a class does not affect the status of any other features that belong to the same class[31]. Because it is founded on conditional probability, this classification method is considered to be one of the most successful methods available. It performs very well in the context of dealing with data that contains imbalance concerns and missing value concerns[32]:

$$P(A | B)=P(B | A)P(A) / P(B) - 1$$

Where, P(A|B): Given the input characteristics, the conditional probability that the response variable will have a specific value. The posterior probability is also used to describe this.

P(A): This variable is indicating the a priori probability of the response variable.

P(B): This variable is indicating the probability that the data or evidence used for training is correct.

P(B|A): This variable is probability training data is what it's called.

**b) Decision Tree**

Decision trees are the machine learning algorithm that is utilized the most frequently in the field of healthcare for solving classification and regression problems. These are exceptionally complex algorithms that are able to accommodate a wide variety of data. These methods form the foundation for the ensemble algorithms used in machine learning[33].

The term "machine learning," or "ML," as it relates to the process of making decisions in the medical industry may be defined as "a set of techniques for resolving diagnostic issues." In machine learning and the analysis of decision making, decision trees are one of the most prevalent, reliable, effective, powerful, and popular classifications and prediction tools[34].

In order to construct such a model, one must first complete the steps of identifying options and detailing the sequence and connection of events. These steps are required, but they also help simplify difficult decision-making processes[35].

- I. The first step in developing a decision tree, or any other decision model, is to formulate the decision problem that needs to be solved.
- II. There ought to be a minimum of two options and one conclusion included in the decision problem to make a recommendation.

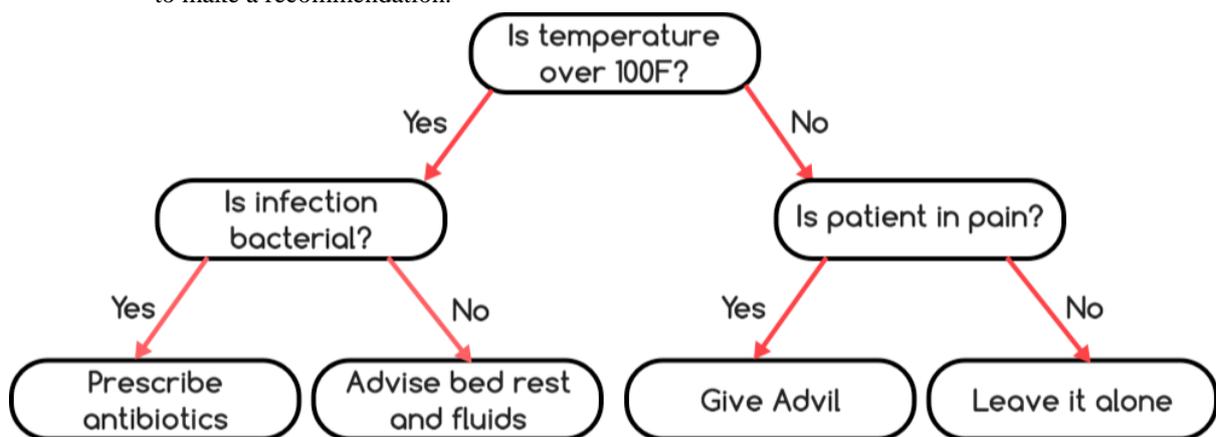


Fig. 2. Flow diagram – machine learning based model

ML is created whenever a decision tree like this one is entered into a computer. After the user inputs the necessary information into the computer in order for it to answer the questions, the computer will then automatically administer the treatment. Provide the ML with the information listed below, for instance, The patient's temperature is 102 degrees Fahrenheit. The patient is in pain. Bacteria are the cause of the infection. In addition to this, the algorithm for machine learning will automatically provide the patient with a prescription for antibiotics[36],[37]. As medical

sensors become more interconnected, we will be able to automatically feed machine learning with additional data to assist it in making decisions.

### **c. SVM (Support Vector Machine)**

Support Vector Machine (SVM) classifiers use a linear decision boundary known as the hyperplane to differentiate between the two groups of data. It has been ensured that the distance between the hyperplane and the instances is as great as possible by the positioning of the hyperplane[38].

Support Vector machines are the type of machine learning algorithm that are utilised in the healthcare industry the majority of the time. A supervised learning model is utilised by it for the purposes of classification, regression, and the identification of outlines. In recent years, the algorithm has been used to predict how heart patients adhere to their medication regimens. As a result, millions of people have been able to avoid adverse consequences such as readmission to the hospital or even death. Applications include, but are not limited to, protein categorization, the separation of pictures, and text classification[39].

#### *Use of SVM in cancer diagnosis*

SVM (support vector machine) is a dependable algorithm used to diagnose and forecast a wide variety of cancers. Both the testing (independent) datasets and the training datasets are initially executed on the pre-processed database. The information is used to develop SVM classifiers with the highest possible classification accuracy. On the basis of the categorization, an analysis of the error rate, as well as the predictivity, specificity, and sensitivity, is carried out. Classifiers based on SVMs, for instance, are utilized in the process of diagnosing breast cancer. [40] SVM is able to provide accurate breast cancer classifications using data obtained from mammography images[40]. It is more likely that predictability will be evaluated in datasets that are close to the hyperplane.

#### *SVM on diabetes assessment*

In order to properly diagnose diabetes, an SVM model is an absolute necessity. When using SVM to diagnose diabetes, the three most important characteristics to consider are the patient's age, body mass index, and blood glucose concentration[41]. The output is segmented into the three categories as mentioned above using SVM. One can categorise people into one of three groups: those who already have diabetes, those who are at risk for developing diabetes, and those who do not have diabetes[42]. A regression analysis of the relationships between the characteristics reveals how the characteristics influence HGC levels. SVM algorithms have a high level of accuracy in the prediction of diabetes thanks to their use of classification and regression[43].

#### *The use of the SVM in the assessment of hypertension and blood pressure*

In addition, classification and regression analysis, both of which are used in the hypertension diagnostic process, rely heavily on support vector machines[44]. Following the completion of the data classification procedure with an N-dimensional hyperplane, the SVM splits the dataset into two distinct categories. Predictive analysis based on support vector regression is carried out according to the category to determine whether or not the parameters have an effect on the health condition. SVM has been shown to be quite accurate compared to other important algorithms, both in terms of prognosis and blood pressure diagnosis.

## **2. Logistic Regression**

This method of machine learning makes predictions regarding the current state of the category dependent variable by making use of predictor variables. It is frequently used to categorise and estimate the likelihood of an occurrence, such as in the case of illness risk management, which assists clinicians in making crucial decisions regarding patient care. In addition to this, it provides assistance to medical institutions in the process of identifying patients who are at a higher risk and developing behavioral health strategies to assist these patients in improving the everyday health behaviors that they engage in[45].



### 3. Methods Using Ensembles:

An approach to machine learning known as "ensemble learning" combines a number of different learning algorithms in order to achieve better predicted performance than is possible with any one of those individual machine learning algorithms. Ensemble methods can achieve a higher level of accuracy than the individual classifiers that comprise the method[46]. The idea that many weak learners can be combined to form a single strong learner is the driving force behind the ensemble learning model. This is due to the fact that the accuracy of the combined results of many weak learners is greater than the accuracy of any single weak learner working alone. This type of learning is also known as committee-based learning due to the fact that multiple classifiers learn to solve the same problem[47]. An ensemble is a collection of individual hypotheses or learners that have typically been derived from training data by applying one of the fundamental learning strategies. It is common knowledge that ensemble methods can assist students with difficulty in their studies.

Boosting and bagging are two distinct approaches to ensemble learning that are used in conjunction with the foundation learners[48]. Boosting is when a learner is given a boost, and bagging is when a learner is given a When compared to a single base classifier, the outputs of these ensemble learning approaches are used to achieve a higher level of accuracy in the predictions they make. Ensemble Learning is a subfield of machine learning that is both practical and scalable when applied to a wide variety of problems that occur in the real world. Numerous studies have demonstrated this. By combining the benefits of several different learning algorithms into a single model, the objective of ensemble learning is to produce a single solution that is superior in performance to any one of the individual learning methods.

### III. CONCLUSION

Machine Learning (ML) is a subfield of computational science that focuses on understanding and interpreting patterns and structures in data to enable learning, reasoning, and decision-making without the involvement of human beings. This is accomplished by teaching computers to learn without the assistance of humans. This is achieved by teaching computers how to learn on their own, without the intervention of humans. It enables the user to transmit a massive amount of data to a computer algorithm, which then analyses the data and bases its decisions, suggestions, and other outputs on the data it has been given. Additionally, it provides the user with the ability to do so. If any alterations are discovered, the algorithm will be able to apply this newly acquired knowledge to improve its decision-making capabilities in the future. One of the many new areas of research in machine learning is the field of healthcare, and one of the many roles that machine learning plays in the healthcare industry is extremely important in terms of detection, diagnosis, and decision making.

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