International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

Classification of Blood Pressure Using Machine Learning

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Abstract- In this paper, we present an intelligent model to classify a patient's blood pressure level using Machine Learning Algorithms. The contribution of this work is related to the helping cardiologist in providing a good diagnosis and patient's treatment and we want to allow the corresponding diagnosis to analyze the patient's blood pressure, in order to prevent heart disease.

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***Key Words*:** Machine Learning, diagnosis, disease

1. INTRODUCTION

Blood pressure is one of the most vital physiological parameters measured from the body and showsone the important indicators of cardiovascular health. Blood pressure could be defined as the pressure applied via the blood circulation to the walls of the blood vessels. An estimate of a person's risk for cardiovascular disease is important for many aspects of health promotion and clinical medicine. Due to digital technologies are rapidly growing, healthcare centers store a huge amount of data in their database that is very complex and challenging to analyze. Data mining techniques and machine learning algorithms play vital roles in the analysis of different data in medical centers. The techniques and algorithms can be directly used on a dataset for creating some models or to draw vital conclusions, and inferences from the dataset.

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2. Proposed Algorithm

SUPPORT VECTOR MACHINES (SVM) Algorithm:

Support Vector Machine (SVM) is a supervised machine learning algorithm which can be used for both classification or regression challenges. However, it is mostly used in classification problems. In the SVM algorithm, we plot each data item as a point in n dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. Then,we perform classification by finding the hyper-plane that differentiates the two classes very well.

So, you're working on a text classification problem. You're refining your training data, and maybe you've even tried stuff out using Naive Bayes. But now you're feeling confident in your dataset, and want to take it one step further. Enter Support Vector Machines (SVM): a fast and dependable classification algorithm that performs very well with a limited amount of data to analyze.

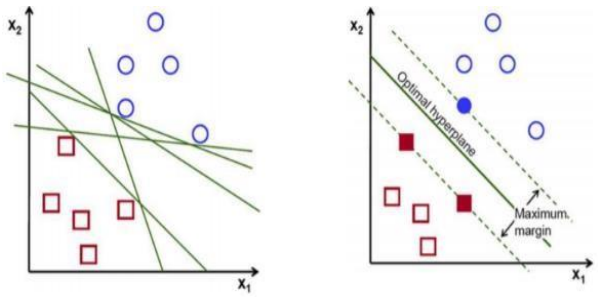

Fig 1. Introductory Graphs on Support Vector Machines

To separate the two classes of data points, there are many possible hyperplanes that could be chosen. Our objective is to find a plane that has the maximum margin, i.e. the maximum distance between data points of both classes. Maximizing the margin distance provides some reinforcement so that future data points can be classified with more confidence.

Hyperplanes are decision boundaries that help classify the data points. Data points falling on eitherside of the hyperplane can be attributed to different classes. Also, the dimension of the hyperplanedepends upon the number of features. If the number of input features is 2, then the hyperplane is just a line. If the number of input features is 3, then the hyperplane becomes a two-dimensional plane.

K-NEAREST NEIGHBOUR(KNN) Algorithm:

The k-nearest neighbors (KNN) algorithm is a simple, easy-to-implement supervised machine learning algorithm that can be used to solve both classification and regression problems.

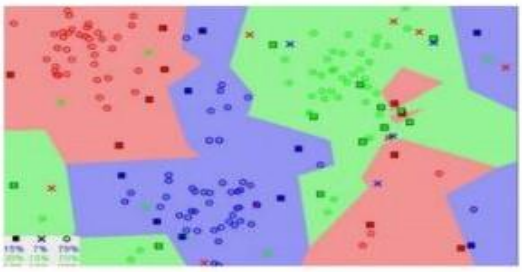

Fig 2. Introductory Figure on K-Nearest Neighbor

Notice in the image above that most of the time, similar data points are close to each other. The KNN algorithm hinges on this assumption being true enough for the algorithm to be useful. KNN captures the idea of similarity (sometimes called distance, proximity, or closeness) with some mathematics we might have learned in our childhood— calculating the distance between points ona graph.

The KNN Algorithm:

Step-1: Select the number K of the neighbors

Step-2: Calculate the Euclidean distance of K number of neighbors

Step-3: Take the K nearest neighbors as per the calculated Euclidean distance.

Step-4: Among these k neighbors, count the number of the data points in each category.

Step-5: Assign the new data points to that category for which the number of the neighbor is maximum.

Step-6: Our model is ready.

DECISION TREE:

A decision tree is a flowchart -like structure in which each internal node represents a "test" on an attribute (e.g. whether a coin flip comes up heads or tails), each branch represents the outcome of the test, and each leaf node represents a class label (decision taken after computing all attributes). The paths from root to leaf represent classification rules.

In decision analysis, a decision tree and the closely related influence diagram are used as a visual and analytical decision support tool, where the expected values of competing alternatives are calculated.

A decision tree consists of three types of nodes:

1.Decision nodes – typically represented by squares
2.Chance nodes – typically represented by circles
3.End nodes – typically represented by triangles

Decision trees are commonly used in operation research and operations management. If, in practice, decisions have to be taken online with no recall under incomplete knowledge, a decision tree shouldbe paralleled by a probability model as a best choice model or online selection model algorithm. Another use of decision trees is as a descriptive means for calculating conditional probabilities.

Decision trees, influence diagrams, utility functions, and other decision analysis tools and methods are taught to undergraduate students in schools of business, health economics, and public health, and are examples of operations research or management science methods.

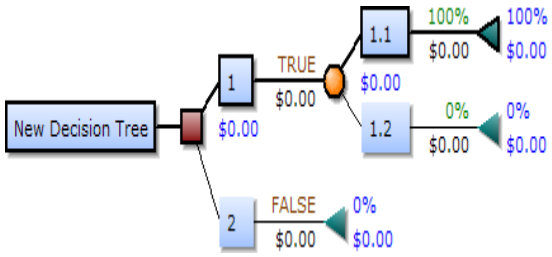

Fig 3. Introductory of Decision tree

3. Experiments & Results

We use Jupiter notebook to perform this experiment. The PC for experiment is equipped with an intel ®Core™ i3 and above personal laptop with 4GB RAM.

The comparisons of all these considered model based on various performance metrics are shown in Table 1. The proposed ensemble based methods are compared with some other competitive research in the literature. The Table-1 depicts the performance comparison of some of competent research on classification of blood pressure**.** From the table it may be conferred that, the proposed system is able to detect the anomalies with higher accuracy as compared to other methods.

The confusion metric of proposed KNN

Prediction Models	Precision	recall	F1-Score	Support	Accuracy (%)
SVM	0.75	0.87	0.80	54	88.57
KNN	0.90	0.79	0.84	78	89.04
Decision Tree	1.00	1.00	1.00	78	81.90

Table-1. Performance Analysis

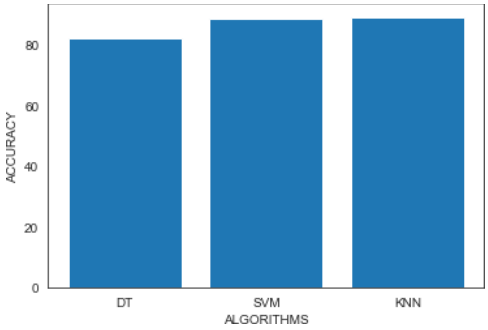

Fig 4. Comparison of accuracy

4. Conclusion

Thus as we get maximum accuracy in K-Nearest Neighbour (KNN). So we choose KNN as our final algorithm to find possibilities of cardiovascular, hypotension diseases. If for same problemstatement higher accuracies are required then following things can be done.

We need more data to train our model in multitude to train cases. With the given data we can get only above accuracies.

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