

Hospital Management Software with Arthritis Prediction in Ayurveda

Rinsy R, Vrindha Vinoj, Kenas Jose

Student, Department of Computer Science,
Jyothi Engineering College, Thrissur, Kerala, India

ABSTRACT

The application of data mining is visible in fields like commerce, e-business, and trade. The medical fields are rich in information but the knowledge is still weak. Data wealth is high in the medical field. But there is a lack of analytic tools to analyze trends in data. Here we implement a hospital management software in order to computerize the front office workflow and it implements Predictive models for the diseases using machine learning algorithms. The front office management deals with the collection of patient information and diagnosis details etc. Traditionally all these works were done manually and using this software we can digitalize the entire operations. We are implementing this hospital management software and predictive models in Ayurveda. As the initial step, we are implementing a predictive model for Arthritis, by analyzing Rheumatoid Factor (RF), age and symptoms of the patient. There are five types of arthritis Gout, Rheumatoid arthritis, Osteoarthritis, Psoriatic arthritis, and Juvenile arthritis. The age, RF value, and age determine the type of arthritis the person possesses. Rheumatoid factor is an antibody that can be detected in the blood of a person who has arthritis. We use six machine learning algorithms here. They are SVM, CART, Linear Regression, KNN, Naïve Bayes, Linear Discriminant analysis.

KEYWORDS: SVM, CART, KNN, LDA, Naïve bayes, machine learning, arthritis prediction, rheumatoid factor

I. INTRODUCTION

In India, we have noticed that there are many cases of medical negligence. Nowadays, doctors are not careful regarding the diagnosis of the patients and the treatment provided by them. So by using our hospital management software and using predictive models in order to increase the accuracy of the diagnosis of disease. The Hospital management software improves visibility and enhances the transparency of the workflow in the hospital. This can provide streamline accurate reporting in the cases of managerial subjects. Quality control is highly improved. We can also provide unlimited user support. Here we provide easy access to the doctors and other staff of the hospital to access different modules in the hospital. The complex modules such as pharmacy can be viewed from the doctor's page itself. In the case of Ayurveda hospital, doctors need to know the availability of medicines in the hospital pharmacy. So the doctor could know whether a medicine is available or not in the hospital pharmacy section. The health care field has to make changes and upgradations with time. Nowadays there are many hospitals that have been accused of giving wrong treatment to the patients by the lack of accuracy in prediction.

As the initial stage of implementing predictive modeling in hospital management software, we are implementing an arthritis prediction model. By identifying the Rheumatoid factor in the blood and by analyzing the age and the symptoms the doctor could predict the level of risk condition

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of the patient. By predicting the disease at an early stage we can avoid unwanted casualties. Prediction and Prevention go hand-in-hand. The organizations can identify the people with elevated health risks and take wanted steps for their treatment at the early stages. The use of predictive models helps the hospitals to build their reputation. The creation of risk scores will help health care providers to give proper treatment at the right time.

II. PROBLEM DEFINITION

The information technology has metamorphosed the area of medicine. The hospital management system is an integrated software that regulates a distinct sector of clinical medicine. It is the linchpin for the victorious operation of the health care department. It also assists the hospital in their administration and monitor sections. As we all know ayurvedic medicine is one of the world's ancient healing weapons. It is the most amazing science of life which is advantageous to humans both in this world and the world beyond. In order to improve the efficiency of the modern ayurvedic clinics and hospitals, HOSPITAL MANAGEMENT SOFTWARE SHOULD BE INTRODUCED. This is ideally suited to meet the demands for running hospitals in this 21st century this system is invented to help hospitals for managing and maintaining the whole information regarding the patients, doctors, and staff in a systematic and methodical manner. It includes the biodata, history, previous treatment details and current status of indoor and outdoor patients.

Actually it is based on the carefully designed database model which successfully eradicates the repetition or superfluity of data. Electronic medical records can make the assemblage of and availability of patient data much easier compared with paper-based records it is really timesaving and effortless. Medical errors can be easily avoided if the health care practitioners are well equipped with a perfectly managed health information system especially in ayurvedic sector diagnosis of a particular disease is an important component of treatment. As a surplus feature prediction of clinically distinct variants of arthritis is introduced to support the doctor in diagnosis. It is a persisting and daunting task for a practitioner to differentiate between skeletal disorders due to poliomyelitis and juvenile arthritis. It is in this context that this project assumes a considerable significance. But with prompt diagnosis and initial medical care remission is possible. Rheumatoid factor which is serum immunoglobulin M, autoantibody that binds to self is the diagnostic criteria used. At last not the least it is only the early diagnosis treatment and assurance of public health is the side aim of this ambitious project.

III. RELATED WORK

In the literature survey, we elaborated on all the aspects and the products which are existing in the market. In the heart disease prediction system using case-based reasoning, the GRNN and RBF are used for the function of heart disease diagnosis and the medical data is prescribed. And we collected the ideas from Intelligent hospital management software. We also gathered the details of the RFID hospital management system.

Heart disease prediction system using case based system

Cardiovascular disease is a major challenge of today's medical field. It disease that involves the heart and related muscle tissues.[5].Data mining and artificial neural network are used for the diagnosis of heart disease and also to identify the medicine for this particular disease.GRNN and RBF techniques are used here to diagnose the disease.[6].The main goal of this system is to ensure the utilization of artificial neural networks. Here to increase the accuracy CBR ie the Case-Based Reasoning is used, as the back propagation technique of the ANN is good but to make it even better CBR is employed.

Intelligent hospital management software

The field of Hospital management software is developing day by day. Many developers and researchers are working in this field. Every time some new features are added to HMS. The registered patients have to answer a particular question aire. The visual component library (VCL) is used here to make the forms to register the medical complaints. [3] The System decides the patient's movement. The doctor to be consulted, visiting the lab, etc. This software is placed on the internet, then the patients can access the hospital management software for their lab reports, prescription, Timing of doctor, etc.

RFID in HMS

Wireless sensors are used here[2] that are installed at the front and exit entrances of labs, operation theatres, wards etc. A patient report management system are maintained online. So that the doctor and the patient could easily access it. Here, an architecture that is able of controlling multiple layers of a hospital management system is developed. This technique

can be applied to the infant and age caring sector, as RFID can be used to track down the patients. It also states the future of the system as collecting the patient details from other health care providers, that is the data is always on the internet, the people who are responsible for the data can access it through some kind of authentication methods.

Heart Disease Prediction System

The primary goal of this system is to predict whether a patient is having heart disease or not. Two attributes are basically given as input that is smoking and obesity, in order to get more accuracy. Decision trees, Naïve Bayes, Neural Network are used here in order to compare the accuracy, after the comparison, it becomes clear that neural networks have more accuracy when compared to decision trees and Naïve Bayes. This paper also gives the chance of expanding the system by increasing the number of input attributes other than smoking and obesity. Here, a large amount of unstructured data is used, so in order to mine that data, text mining is employed here[6].

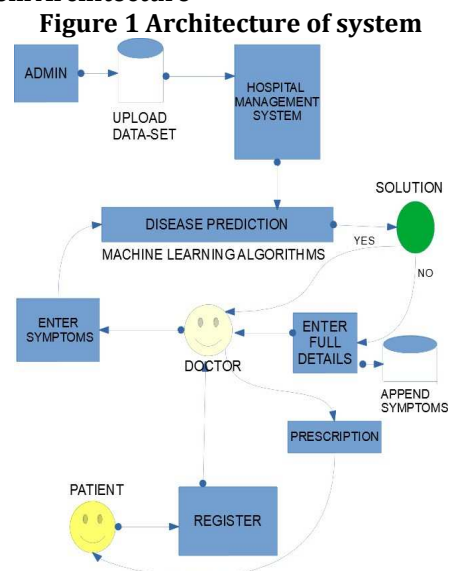
Prediction of Arthritis

A simple software tool WEKA is used here. WEKA[8] is used for analyzing the data which is given. CART, Classification and regression Tree algorithm is used here for the prediction. The historical data sets are used for analyzing the CART. Here a simple CART algorithm is implemented. An attribute "Age" is taken and analyzed and a corresponding decision tree is made. A confusion matrix is generated here. The accuracy of the different classes like the TP rate, FP rate, Precision, and Recall are calculated.

IV. PROPOSED SYSTEM

Here we implement a hospital management software along with predictive models in Ayurveda. A hospital management system which is capable of maintaining the workflow of the system is designed here. The doctors and the staff working there are given particular logins. The front office management is maintained by the receptionist there. There is an extra feature other than ordinary hospital management software and that is called the Prediction part. When a new patient takes an appointment in the registration the doctor will get the medical file of that patient and his old medical history. There is a special module for the doctor in order to do the prediction.

A. System Architecture



The administrator uploads the data to the hospital management system. The disease prediction is done using machine learning algorithms. The doctor enters the symptoms, the value of the RF factor and the age of the patient to the system. Prediction is done with the help of machine learning algorithms. In arthritis prediction, the patients are classified into three normal people, the placebo effect and the drug stage.

B. Data Preprocessing

- Step1: Dataset loading.
- Step2: Finding the dimension of the dataset.
- Step3: Finding the missing value.
- Step4: Replacing the missing value with mean value.
- Step5: Data visualization.

The data set is loaded into the system as a .csv file. The dimensions of the file are calculated. The missing values are replaced here with a mean value. Algorithm models are imported to the system and their accuracy is calculated.

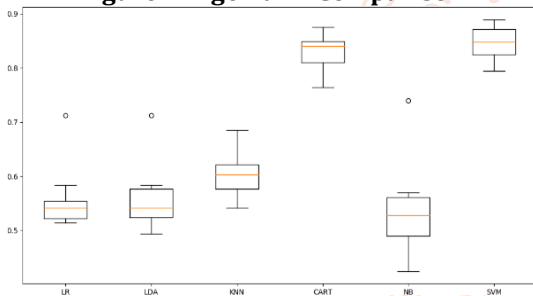
C. Data visualization

To show the accuracy of the algorithms we use,

1. Box plot graph
2. Scatter plot matrix
3. Histogram

Box plot graph

Figure 2 Algorithm Comparison



Scatter plot matrix

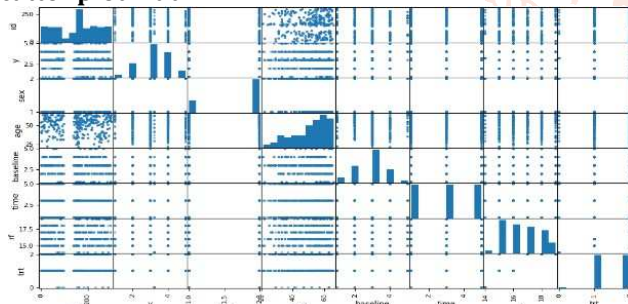


Figure 3 Relationship between entities

Histogram

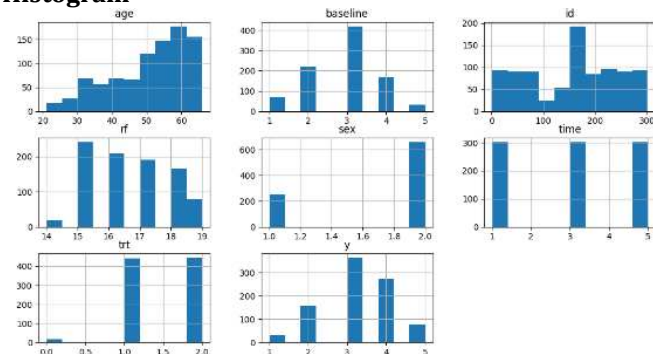


Figure 4 Analysis of algorithm

D. Accuracy

CART and SVM algorithms had more accuracy.

Table 1 Accuracy and Error rate of algorithms

ALGORITHM	ACCURACY	ERROR
SVM	0.845358	0.029811
CART	0.839764	0.026516
LINEAR DISCRIMINANT ANALYSIS	0.557972	0.58102
LINEAR REGRESSION	0.556526	0.055446
KNN	0.604947	0.043852
NAÏVE BAYES	0.534494	0.080606

Steps to find out the accuracy

- Step1: Importing python packages.
- Step2: Importing dataset.
- Step3: Organizing data into training and test sets.
- Step4: Model evaluation.
- Step5: Finding accuracy.

V. ALGORITHMS USED

A. Linear Regression

Linear Regression endeavors to demonstrate the connection between two factors by fitting a direct condition to observed information. A Linear Regression line has a condition of the structure $Y = a + bX$, where X is an explanatory variable and Y is a dependent variable. The incline of the line is b, and an is the block (the estimation of y when $x = 0$).

B. Linear Discriminant Analysis

It is used to reduce the dimensionality of the given dataset. It reduces the number of variables in a dataset without losing much data. If we have to reduce the number of variables we have to project the whole set of variables in to a X axis, but this will cause in loss of important data. But, if we are using LDA we can keep useful information and also reduce the dimensionality.

C. K- Nearest Neighbor

This is a non-parametric method that is used for classification and for regression. There will be an input that consists of the k closest training examples in a space. It is an instance-based learning or it is also called lazy learning. Weights are assigned to the neighbors. It classifies the objects on the basis of similarity.

D. CART

It refers to two types of decision trees. Classification and Regression Trees. In a classification tree algorithm, the target variable is constant that is it is fixed. The regression trees predict its value. In this algorithm there will be a sequence of questions, the answers to these questions decide which question is to be asked next.

E. NAÏVE BAYES

These are a collection of classifier algorithms on the basis of the Bayes algorithm. This classifier is a group of algorithms no a single one. The dataset is divided into two. The first one is the feature matrix and the other one is the response vector. The result of the training stage is a model used as an input for the testing/classifying stage. The model contains information (knowledge) for mapping a new input sample into a category[1].

F. SVM

The Support Vector Machine(SVM) finds a hyperplane.in a space of N-dimension.And this hyperplane classifies the data

points. Many hyperplanes will be found at first, but at last we have to find a hyperplane that is appropriate to classify the data provided in the dataset.

VI. SIGNIFICANCE IN AYURVEDA

A. This software mainly focuses on the Ayurvedic sector. Ayurveda is a growing field so that digitalizing the sector is really important. Many foreigners are coming to India to practice different types of Ayurvedic treatments such as kizhi, nasyam, etc and also to practice yoga. Usually, the Ayurvedic doctors use the technique called "Tridhosa Samhitha" in order to detect the patient's disease. Through this Tridhosa Samhitha, the doctor could identify the variations in Kabha, Pitha, and Vata. This type of treatment is depicted in the 20th chapter of the Charaka Samhitha. The imbalance of any of these three factors can cause the disease. Therefore if the doctor identifies any variation in these three factors, he can make the patients do a blood test and by analyzing the RF factor in the blood and also by adding the symptoms.

VII. CONCLUSION AND FUTURE WORK

This predictive model system has an accuracy of 86 percent. Now we have only implemented the predictive model for arthritis prediction, but in the future, we can implement predictive models for every disease which is difficult to diagnose. This software mainly focuses on providing the hospital with a tool to build their reputation. This tool can increase the accuracy of the doctor's prediction. Nowadays many problems could occur due to the mistakes of the doctor, by adding this predictive model module to the hospital management software we can reduce this problem. Prediction and Prevention should go hand in hand. It can reduce the risk score of the patients, The health organizations can give the patient a better treatment before the rise of risk factors.

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