IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 8, Issue 3, March 2019

An Intelligent Cloud Based Data Processing Model for Mobile Health

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Abstract: If you aren't aligned with the human need, you are just going to build a very powerful system to address a very small or perhaps nonexistent problem ". The vast amount of complex healthcare data yields many opportunities for us, and that can be achieved through effective analysis of data. More specifically, big data analytics has the potential to improve care, save lives, and lower costs by discovering associations and understanding patterns and trends within the data. Proposed system is an online consultation project in which symptoms of a disease are fed into the system, and it predicts the chances of having the disease by using machine learning. Thus, patients will get speedy diagnosis and quality of healthcare wills drastically improve.

Keywords: Healthcare, Machine Learning, Mobile Health, Cloud Computing

I. INTRODUCTION

It often happens that there is an urgent need to visit a doctor but the doctor is unavailable. Sometimes you want a primary diagnosis before you decide if the symptoms are serious enough to visit a doctor. Our proposed system is an end user support, an online consultation project. The application allows users to provide their symptoms. It then computes over all of them and predicts the illness associated. To achieve this we have used smart and intelligent machine learning algorithms such as Logistic regression, Naïve Bayes classifier, SVM Classifier, KNN Classifier Decision Tree Classifier, Random Forest Classifier. After correct prediction of the disease the application presents contact details of all relevant doctors in the vicinity who are experts of that particular disease. Appointments can be booked and medical history can be saved for future use.

The paper is organized in such a way that Section 2 deals with the existing work. Section 3 deals with data description. Proposed work is discussed in Section 4 followed by performance analysis in Section 5 . The paper is concluded with Section 6.

II. RELATED WORK

Big data for secure healthcare system: a conceptual design presented a broad overview of healthcare big data the need for its effective utilization [1]. Disease prediction by machine learning over big data from healthcare Communities proposed a new convolution neural network based multi-modal disease risk production (CNN- MDRP) algorithm using structured and unstructured data from hospitals [2]. Implementation of cloud based electronic health record (EHR) for Indian Healthcare needs is proposed in [3]. This paper proposes an EHR for India and provides many merits such as reduction in treatment costs , increased quality of healthcare among others. A secure EHR system based on hybrid clouds proposed an EHR sharing and integration system in healthcare clouds and various security and privacy issues in access and management of EHRs were analyzed [4].

III. DATA DESCRIPTION

The data set that we have created contains non-surgical data related with heart disease diagnosis, neuro disease symptoms, ortho related diseases and several other common diseases . It has been professionally calibrated under medical experts.

A. Data set Format

It contains different important parameters like cholesterol, chest pain, fasting sugar and many more. Hence, every disease is structured into different columns based on the symptoms found in each disease. This is then filled with many patient records which shows the numerical value up to which the intensity of each symptom lies using a scale from 0-100(very low to very high).

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B. Features and label Description

In the data set, last column is the label and holds binary values where '0' depicts 'NOT PRESENT' and '1' depicts 'DISEASE PRESENT', while the symptoms are the features. Fig 1.shows a sample of our data set

1	recurrent	chills	sweating	vomiting	pallor	headache	abdomen	fatigue	weight lo:	breathles:	oedema	malaria
2	65	0	75	20	23	10	35	0	0	0	0	1
3	70	0	56	0	14	0	35	0	10	10	20	1
4	45	46	23	0	0	0	0	36	0	0	0	0
5	0	13	14	0	14	0	0	0	0	10	35	0
6	10	12	10	10	13	0	0	0	15	13	15	0
7	43	0	55	35	67	23	67	0	0	0	0	1
8	63	0	77	0	32	0	45	0	33	0	0	1
9	48	13	68	11	14	14	34	0	0	0	32	1
10	0	45	12	0	32	0	73	0	0	0	0	0
11	46	0	34	57	30	60	55	0	0	0	0	1

Fig. 1. Sample Dataset

IV. PROPOSED WORK

The proposed system will have the following phases of implementation .

- User Profile Creation
- Registry of symptoms and their degree
- Prediction of disease using ML Algorithms
- Suggestion of doctor for the above diagnosis.

A. System Architecture

System architecture of the proposed work is shown below in Fig 2.

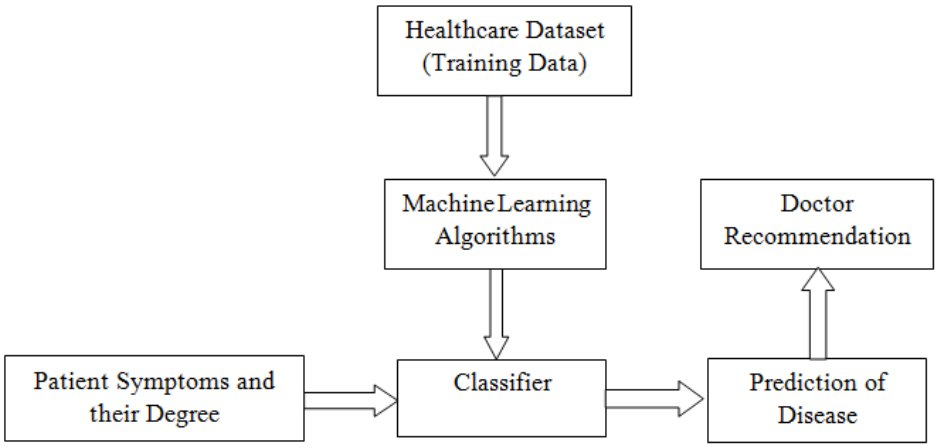

Fig. 2 System Architecture

B. Working

PHASE 1: User Profile Creation

a) Patient's End :

1) The patient creates his profile by entering his username and password and emergency medical information like blood group ,age , allergies, chronic medical condition
2) In case the patient has some medical history then he is required to upload it. The medical history is uploaded on the cloud for giving it immunity against damages.

b) Doctor's End:

1) The doctor registers into the system by specifying his username and password area of expertise.
2) A relevant medical license validated by the admin will lead to successful creation of the profile.

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PHASE 2: Registry of symptoms and their degree.

When the patient logs into the system he is asked to enter his symptoms for diagnosis. Based on the symptoms entered the system asks for the level or scale in which the patient feels these symptoms

PHASE 3: Prediction of diseases using six machines learning algorithms.

Logistic regression: The stages in this algorithm are as follows:

Step1: With the logistic response function or logit function, map the continuous predictors to a function (the logit) of the response variable, which is also continuous.
Step 2: Convert the logit into odds.
Step 3: Once we know the odds, we know the probability score.

Naïve Bayes classifier: The stages in this algorithm are as follows:

Step 1: Read the training data set.
Step 2: Calculate the mean and standard deviation of the predictor variables in each class.
Step 3:Calculate the probability of fi using the guass density equation in each class. Until the probability of all predictor variables has been calculated.
Step 4: Calculate the likelihood of each class.
Step 5: Get the greatest likelihood.

SVM Classifier: The stages in this algorithm are as follows:

Step 1: Prepare the pattern matrix
Step 2: Select the kernel function to use.
Step 3: Select the parameter of the kernel function and the value of C .You can use the values suggested by the svm software, or you can set apart a validation set to determine the values of the parameter.
Step 4: Execute the training algorithm and obtain alpha.
Step 5: Unseen data can be classified using the alphas and the support vectors.

KNN Classifier: The stages in this algorithm are as follows:

Step 1: Calculate “d(x, xi)” i =1, 2, n; where d denotes the Euclidean distance between the points.
Step 2: Arrange the calculated n Euclidean distances in non- decreasing order.
Step 3: Let k be a +ve integer, take the first k distances from this sorted list. Find those k-points corresponding to these k- distances.
Step 4: Let ki denote the number of points belonging to the ith class among k points i.e. k>0 If ki >kj

Decision Tree Classifier: The stages in this algorithm are as follows:

Step 1: Place the best attribute of the dataset at the root of the tree.
Step 2: Split the training set into subsets. Subsets should be made in such a way that each subset contains data with the same value for an attribute.
Step 3: Repeat step 1 and step 2 on each subset until you find leaf nodes in all the branches of the tree.

Random Forest Classifier: The stages in this algorithm are as follows:

Step 1: Randomly select “k” features from total “m” features. Where k << m Among the “k” features, calculate the node “d” using the best split point.
Step 2: Split the node into daughter nodes using the best split
Step 3: Repeat 1 to 3 steps until “l” number of nodes has been reached
Step 4: Build forest by repeating steps 1 to 4 for “n” number times to create “n” number of trees.

Each of the algorithm gives a binary output stating the presence of the disease .

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PHASE 4: Suggestion of doctor for the above diagnosis:

Based on the predicted illness, a relevant doctor is recommended and an appointment can be immediately booked.

C. Accuracy Quotient Factor

As stated before we have used six machine learning models, to give a prediction . Each model gives results at varying accuracy levels .Taking the model predictions as M1,M2,M3,M4,M5,M6 and weight of each model as AQ1 , AQ2,AQ3,AQ4,AQ5,A6 we have calculated accuracy quotient . [(M1 AQ1) + (M2 AQ2) + (M3 AQ3) + (M4 AQ4) + (M5 AQ5) + (M6 AQ6) /6]100= % Probability o f having a disease .

V. PERFORMANCE ANALYSIS

We have used visual elements to provide an accessible way to see and understand the performance of our algorithms with respect to each disease .This makes it easier to analyze massive amounts of information and make data driven decisions.

A. Case 1

1) Input: The following test case was applied

Table I: Input For Case1

Symptoms	**Values**
Fever	60
Chills	65
Sweating	23
Vomiting	10
Pallor	0
Headache	5
Abdomen pain	0
Fatigue	36
Weight Loss	0
Breathlessness	1
Oedema	11

2) Output: Below shows the analysis of each algorithm vs presence of disease.

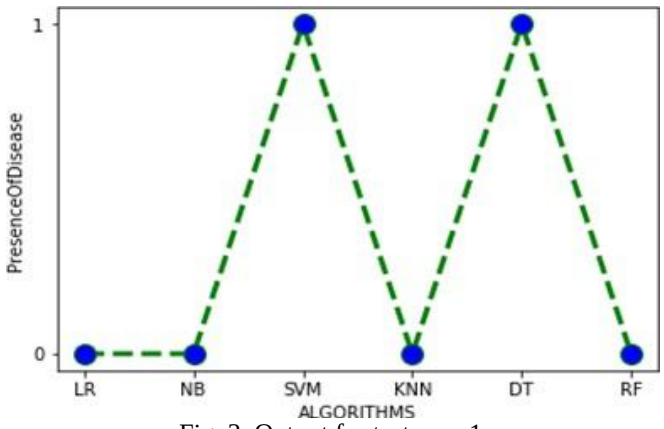

Fig. 3. Output for test case 1

3) Conclusion : On taking the weighted average of the algorithms, the probability of the occurrence of disease is 33.33% as 2 algorithms predicted the presence of malaria , while the other four reported negative for malaria

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B. Case 2

1) Input : The following test case was applied

Table II: Input For Case 2

Symptoms	**Values**
Fever	70
Chills	0
Sweating	56
Vomiting	0
Pallor	14
Headache	0
Abdomen pain	35
Fatigue	0
Weight Loss	10
Breathlessness	10
Oedema	20

2) Output: Below shows the analysis of each algorithm vs presence of disease.

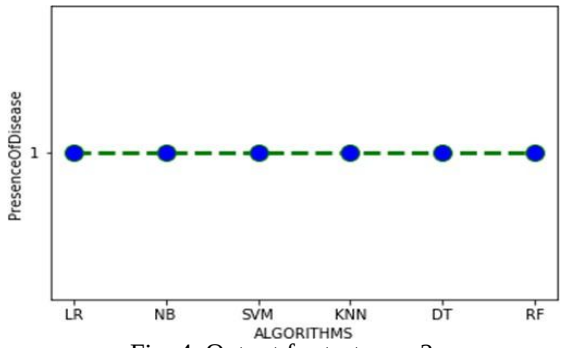

Fig. 4. Output for test case 2

3) Conclusion: On taking the weighted average of the algorithms, the probability of the occurrence of disease is 100% as all algorithms predicted the presence of malaria.

VI. CONCLUSION

This paper proposed an end user support, online consultation project. It is an approach which will change the way hospitals keep their databases, bringing an era of digitization in the field of healthcare. Patient's medical data is now seen as a useful information that can enable healthcare practitioners to make effective clinical decisions which could enhance the quality and accuracy of decision-making. It will reduce the time and effort of the patient as well as the doctor by pre diagnosis. It strongly promotes the idea of healthcare at your doorstep.

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