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Medical Disease Classification by Machine Learning with Cloud Computing

Nindiya Mahajan[1], Gurjeet Kaur[2]

M.Tech. Student, Department of Computer Engineering, Sri Sai College of Engineering and Technology, Badhani, India [1]

Associate Professor, Department of Computer Engineering, Sri Sai College of Engineering and Technology, Badhani India [2]

ABSTRACT: Cloud computing and its convergence with technologies such as mobile computing, wireless networks, sensor technologies allows for creation and delivery of newer type of cloud services. In this paper, use cloud as machine learning algorithm for computation. In cloud make two classifier model first is naïve Bayes and second decision tree. In experiment analysis result on the basis of accuracy, precision and recall.

KEYWORDS: accuracy, precision, recall, cloud, diabetics.

I. INTRODUCTION

The rising cost of healthcare, the increase in elderly population, and the prevalence of chronic diseases around the world urgently demand the transformation of healthcare from a hospital-centered system to a person-centered environment, with a focus on citizens' disease management as well as their wellbeing. The development of personal mobile devices such as smart phones and tablets is helping establish a model of mobile health (m-Health) that can facilitate a continuum of person-centered care by relying on these mobile devices as a medium of sensing, interaction, and communication.

Wearable devices encompass a variety of functions including data collection from on-body sensors, preprocessing the data, momentary data storage, and data transfer to internet-connected immediate neighbors such as mobile phones or to a remote server. It is the characteristic of wear-ability that adds value to these devices and allows customizing the collection of body's physiological or motion data depending upon the end-user application. While wearable sensors offer significant advantages to healthcare by automating remote healthcare interventions that include diagnostic monitoring, treatments and interoperability between patients and physicians, they face barriers such as the requirement to work in close proximity to other computing devices to compensate for low computing power, short battery life, and short communication bandwidth.

In order to overcome this barriers and to respond to the patients'health monitoring requirements few systems have been proposed that provides an integrated platform to enable access to data gathered using wearable sensors via a web application but still many challenges need to be addressed . The system provides clinicians with a means to interact remotely with patients in the home setting, to configure the sensor nodes for the application at hand, and to record annotated data.

Cloud computing is broadly adopted by health care associations around the world. Amid the previous couple of years, health care enterprises have understood the capability of cloud computing and how it can enable them to give quality administrations to patients. The cloud innovation has quickened the way human services industry can utilize or share data over a system.

When you need to reach or oversee a large number of clients then you require an all the more effective framework to complete the work, and patient information additionally should be imparted safely to medicinal services suppliers.

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Most recent EMR frameworks have better control over social insurance information and it has turned into the principal need for healing facilities to receive these frameworks inside the business.

Healthcare regulations are pushing the industry to move towards better storage, collaboration and data sharing in the cloud. With electronic medical records (EMR systems), there are chances of data loss or other sensitive information loss. The only solution is to use cloud services with EMR systems to address the problem. This process will not only secure data but also makes data transfer faster between parties. The only responsibility of health care providers is to define the security responsibilities between cloud vendors and tenants.

Enter to the cloud World: Nowadays, most of the healthcare industries have effectively adopted cloud solutions and those who have not, are in a hurry to adopt the same keeping in view its benefits. We are living in a period where everything is overseen or managed by innovation. Things being what they are, in what manner would healthcare be able to part stay behind in this?

Cloud has become a vital tool in the healthcare field for better collaboration. It allows easy storage and remote access of healthcare data to professionals. Now better care can be delivered by healthcare experts around us without any delay. Further, there is a remote conferencing facility that updates a patient's condition within minutes and saves overall travelling time for doctors.

Excellent reach in tough times: In case of disaster, when this is not possible to visit any particular place then cloud technology represents doctors with necessary information they need at that particular time. Now on-duty doctors with little surgery experience can get real-time guidance through information transmission systems to make sure an excellent work is done by the team.

• **Information transformation for informed decisions**: In the medical field, you must have heard about big data storage. Hospitals have to store a massive amount of data daily and this is necessary to make data analysis carefully for more informed decisions. With cloud, data can be analyzed carefully for meaningful insights and there is always less room for errors during treatment.

Definition of Integrated Medical Clinical Reporting System: Medical field is the basically the only field in which the area of "Specialization" of each 'Modality' has been extensive and is still expanding. Each 'Field' in the medical has its own workflow for treating patients. These workflows are designed in such a manner that doctor-patient interaction become smooth and simplified. However, now the role of medical equipment or machine to machine interaction is also gaining significance. At the same time the Man-Machine interaction is also importance due to advent of technologies like cloud. Now, it is possible to extract, load and process data from different department machines.

Legacy Clinical Reporting Systems: These systems are basically working in isolation and are not connected with other departments of the hospitals. These systems rarely interact with medical hardware equipment machines. These systems are not available on demand. The diagnostic reports when required need to be collected physically from said departments. The degree of integration is low as these do not follow health standards or may be using competing health standards. They may share certain technical specification in terms of same 'brand' medical equipment or hardware, their integratibilty is low.

Body Sensor Network (BSN): A Wireless body sensor network (BSN) is a collection of wearable (programmable) sensor nodes communicating with a local personal device. The sensor nodes have computation, storage, and wireless transmission capabilities, a limited energy source (i.e., battery), and different sensing capabilities depending on the physical transducer(s) they are equipped with. Common physiological sensing dimensions include body motion, skin temperature, heart rate, skin conductivity, and brain activity.

The local personal device is typically a Smartphone or a PC, and allows for real-time monitoring, as well as long-term remote storage and off-line analysis. These sensor's data require interpretation of asynchronous events and periodic data in high level knowledge which medical person can understand, for this purpose, there is a need for integrated clinical reporting system. Furthermore, BSNs are great enablers for many other application domains such as e-Sport, e-Fitness, and e-Wellness, where the objective is not specifically related to disease detection and/or monitoring, but rather to help people maintain physical and mental wellness.

Diabetes is a leading health issue not only in industrial but advancing Countries as well and its incidence is inclining. It is a condition in which the body inadequate to generate or suitably use the hormone called insulin that ‘‘unlocks" the cells of the body and permits glucose to enter and fuel them. There are various factors which required to be investigated

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to diagnose the diabetic patient, and this makes the physician's job difficult. So we will carry out a profitable technique for categorization of patients for diabetes with the use of soft computing method. Our considerable establishment is to enhance the accuracy of diabetes dataset. Several methods have been investigated in the past to specify diabetic patients and anticipate the accuracy.

In this paper, there has been proposed a technique Bacterial Foraging Optimization and Artificial Neural Network for improving the accuracy of diabetes dataset. In First phase, we will apply Bacterial Foraging Optimization algorithm for feature selection. In second phase, artificial neural network is used to classify the patients for diabetes.

II. RELATED WORK

Brito et al. [2010]: To aggregate a number of heterogeneous, off-the-shelf, devices from which clinical measurements can be acquired. To provide access and integration with an 802.15.4 network of wearable sensors.Specialized layered approach in designing heterogeneous network. Service layer and middleware layers interact with each other using remote method function calls. Average response time in dispatch and processing used for evaluation. Service layer of this project can interact with mat lab 7.x (middleware) to demonstrating intera-portability. Average time used in dispatching ECG segment in xml based format and in simplified format using window PC is less while in Window mobile PDA is more.

Chen et al. [2011]: To design and implementation monitoring the system to minimize command latency, video latency, recovery latency and data uploading latency. Proposed arguments solutions for various types of involved in building and maintaining web-based system for health monitoring. Proposed a compression algorithm and validated using case study approach, which was conducted on particular platform of body sensors. Used three tier web based system to implement the average data latency and video latency. SHIMMER sensors are used to build the system. Use the video compression for uploading the video etc. Use the mobile devices as a gateway to collect the data. Display the results of analysis of the gathered data in the home settings.

Khorshed, MdTanzim et al.[2011]In this paper they first provide a brief overview on the importance of monitoring insiders' activities through a literature survey on cloud computing security. Then,they observe some of the real life insiders' activities that can be detected from the performance data in a hypervisor and its guest operating systems. Rule based learning is successfully used for identification of these activities in this research. We further observe that some of these insiders' activities can on occasions turn into a malicious insider's attack, and thus, need constant monitoring in the cloud environment.

Mehta et al. [2012]: To detecting the hyper functional (module) pattern of voice using mobile/smartphones platform sensors. Comparative analysis of temporal filtering method for detection of voice disorder with respect to spectral method.Proposed temporal algorithm for voice disorder item in mobile phone technology. Inverse filtering techniques yields comparable results with better accuracy from spectral methods as it is temporal in nature. Air flow measures maximum flow declination rate, speed quotient (sq), open quotient(oq) spectral slope measures shows that these measures validate the accuracy of proposed techniques.

Andreas et al.[2013]: To scale up and integrate newer technologies like social sharing of recording information ,platforms with the patient driven approach. To implement a prototype on mobile devices for feasibility and applicability of the presented work fine grain approach in security design. Attribute level security design using cipher text encryption algorithm. A study has been conducted on sixteen subjects with user acceptance evaluation good response to the concept in concept of patient sharing needs.

Duane et al. [2013]: To illustrate the new Health Level-7(HL7) standard Fast Healthcare InteroperatibiltyResource(FHIR) standard to achieve healthcare system interoperability. To explore the comparisons among HL7 existing standard with FHIR.Integration of social Layer with application using Restful API.Social layer integration evaluation using cost-benefit analysis in terms of communication cycle and energy. Existing HL7 standards v2 & v3 are not interoperateble themselves. HL7-v2 lack of formal ontogy while HL7-v3 offers semantic interoperatibilty but syntactically is complex. Restful architecture is a stateless protocol usingHTTP methods for transferring XML or JSON objects and arrays.

Ali et al.[2013]: To overcome the interoperable issues in e-prescriptions system. To evaluate the feasibility of the pharmer by conducting a usability evaluation. Implementation of interoperable cross reference resources using service

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based function calls design. User acceptability test conduct based on Linked scale model. Availibity of multiple cross referential pharmaceutical data. Possible potential of cross linking such data sets. The result values of system usability scale(SUS) show that system build and illustrated high score about seventy five ,which means the system has passed the user acceptance.

Chen et al. [2013]: To sharing human body sensor data continusoly 'beyond BAN communication' Improve the quality of service (QoS) performance of WBAN transmission significantly. Name data networking based entities and implementation of BSN objects with external network of mechanics Integration of zigbee protocol communication with TCP/IP using socket programming. Lifetime and energ consumption model used for evaluation of network system.

Video, medical context, reports can be shared and delivered beyond BSN, especially in the case of medical emergency handling. Integration of WBAN with long term evolution and NDN, Named Data Networking protocol is the solution as it assures good coverage and quality in wireless technology. The simulation show, this concept is tangible with effective enhancement in results,ifzigbee protocol is used with integration with TCP/IP.

Wang et al [2013]: To define the format for HL7 messages standard. To perform mapping and transfer of dynamic images using HL7 standard. User based evaluation – Participants answered to a set of six questions using the site under a three -minute time constraint for each question. User interaction with the site has been recorded, and the participants were asked to elaborate on the decisions they made during a playback of the testing session. Several methods have been deployed to assess the data for three characteristics: user performance, user perceptions, and user strategies. Timestamp values along with the subsequent data recovery are permitted in HL7 message. Differentiation between the local time GMT, OTC ,NTP is now managed, where this was not available in sensors. This concept is implemented with the help of zigbee protocol.

III. PROPOSED ALGORITHM

Naïve Bayes: The Bayesian Classification represents a supervised learning method as well as a statistical method for classification. Naïve bayes is completely based on the Bayesian theorem. This classification method analyses the relationship between each attribute and class for each case to derive a conditional probability for the relationships between the attribute values and the class. Naïve Bayesian classifiers must approximate the probabilities of a feature having a certain feature value. Naïve Bayes have also provides high accuracy and speed when applied to large databases. Naive Bayes classifiers often work much enhanced in many complex real-world situations than one might expect.

To demonstrate the concept of Naïve Bayes Classification, consider the knowledge of statistics. Let Y be the classification attribute and X{x1,x2,...,xk} be the vector valued array of input attributes, the classification problem simplifies to estimating the conditional probability P(Y | X)from a set of training patterns. P(Y | X) is the posterior probability, and P(Y) is the prior probability. Suppose that there are m classes, Y1, Y2... Ym. Given a tuple X, the classifier will predict that X belongs to the class having the highest posterior probability. The Naïve Bayes classifier predicts that tuple X belongs to the class Yi if and only if

$$PYi|X \geq PYj|X \quad \text{...}(1)$$

The Bayes rule state that this probability can be expressed as the formulation

$$P(Yi|X) = \frac{P(X|Yi)P(Yi)}{P(X)} \quad \text{...} (2)$$

As P(X) is constant for all classes, only P(X | Yi)

p(Yi) needs be maximized. The prior probabilities are estimated by the probability of Yi in the training set. In order to reduce computation in evaluating P(X|Yi), the Naïve Bayes assumption of class conditional self-rule is made. So the equation can be written into the form of

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$P(X|Yi) = \prod_{k=1}^{n} P(Xk|Yi)$..... (3)

And we easily estimate the probabilities P(X1 | Yi), P(X2 |Yi),...., P(Xk| Yi), from the training tuples. The predicted class label is the class Yi for which P(X | Yi) p(Yi) is the maximum.

IV. PSEUDO CODE

Step1: We take a medical data set for the research.
Step2: The next thing we have to complete after the data set collection is to label them.
Step3: After the labeling of data feature preprocessing is done.
Step4: Send the preprocessed data to the Naïve Bayes classifier model.
Step5: After the classification then output goes to Test model.
Step6: Test model check the three parameters that are Precision, Recall, Accuracy.

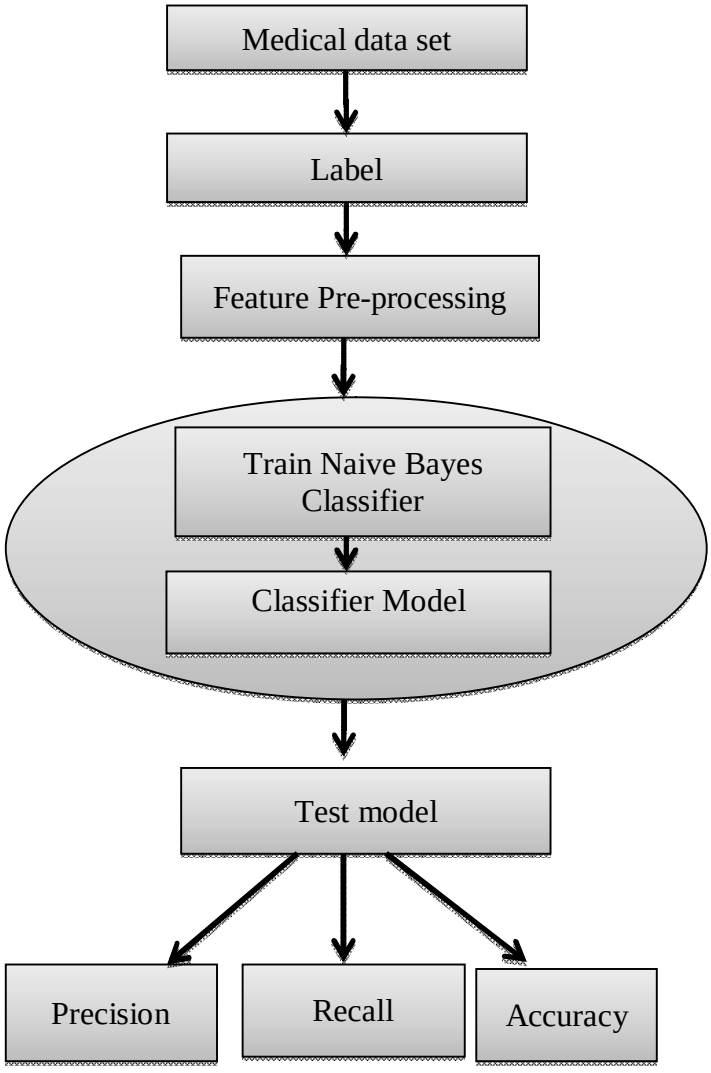

Figure4.1. Flow Chart of Proposed Methodology

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V. RESULTS

	Decision Tree	Naïve Bayes
Accuracy	62.068	76.954
Precision	64.285	80.952
Recall	60	73.333

Table 5.1 Comparison of Decision tree and Naïve Bayes:

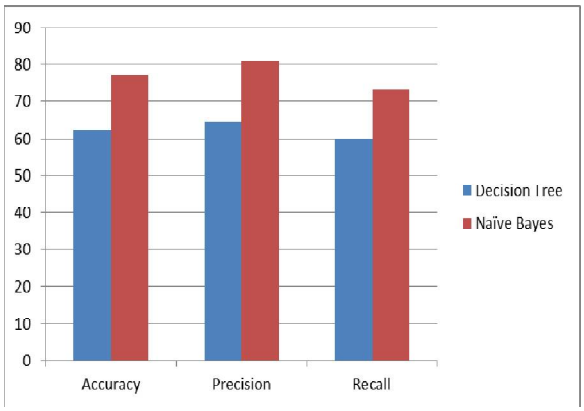

Figure 5.1 Comparison of Decision tree and Naïve Bayes:

VI. CONCLUSION AND FUTURE WORK

It applies Principal Component Analysis for attribute selection and decision tree and Naïve Bayes for user health status classification. In our work, we classified the user as diabetic and Non-diabetic. Naïve bayes achieves better classification accuracy and greater sensitivity and specificity measures indicating that it has better potential for disease identification in real-life scenarios. Apart from that, we utilized standard statistical prediction techniques that derive the resource usage patterns for CBIHCS and propose simple heuristics to perform dynamic infrastructure elasticity. Experimental results conducted on cloudsim clearly demonstrate the effectiveness of our approach in ensuring a stable level of application performance.

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