DEEP LEARNING IN SMART HEALTH PREDICTION SYSTEM

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ABSTRACT-We have developed an expert system called Smart Health Prediction system, which is used to overcome the drawback of existing system and simplify the task of doctors. The system checks a patient at initial level and suggests the possible diseases. It starts with asking about symptoms to the patient, if the system is able to identify the appropriate disease then it suggests a doctor available to the patient in the nearest possible area. If the system is not sure enough, it asks some queries to the patients, still if the system is not sure then it will display some tests to the patient. Based on available cumulative information, the system will display the result. Smart Health Prediction system makes use of deep learning (one of machine learning methods) and database management to get the most accurate illness that could be associated with patient's symptoms and based on the database of several patients' medical record. Deep learning is applied for mapping the symptoms with possible diseases with greater accuracy and speed. This system not only simplifies task of the doctors but also helps the patients by providing necessary help at an earliest stage possible.

Index Terms --Smart Health Prediction System, Data Mining, Clinical Predictions, and Predictive Analysis, Deep learning.

1. INTRODUCTION

Data Mining, the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help companies focus on the most important information in their data warehouses. Data mining is about processing data and identifying patterns and trends in that information so that you can decide or judge.

Data Mining used in the field of medical application can exploit the hidden patterns present in voluminous medical data which otherwise is left undiscovered in databases, or KDD for short, refers to the broad process of finding knowledge in data, and emphasizes the "high-level" application of particular data mining methods.

Doctors need speedy and accurate software to analyses the existing patients 'records in the databases and find the exact illness of the patient. Human error can be avoidedwith the help of computer assisted quality decision making. Patients need a software which will get the symptoms from them and ask relevant questions to find the exact disease they may have been affected with and guide them to a nearby doctor.

We have developed an expect system called Smart Health Prediction System, which is used to overcome these drawbacks, to simplify the task of doctors and to help patients. Thesystem checks a patient at initial level and suggests the possible diseases. It start with ask about systems to the patient, if the system is able to identify the appropriate disease then it suggests a doctor available to the patient in the nearest possible area. If the system is not enough, it asks some queries to the patients, still if the system is not sure then it will display some tests to the patient. Based on available cumulative information, the system will display the result.

Doctor will also get notification on how many people had accessed the system and what all are the disease predicated by the system.

Deep learning makes a computer program to think and find a solution like a human. It is one of the Machine Learning Methods. It has in recent years set an existing new trend in machine learning. Existing Data mining techniques like Association, Classification,Clustering,Prediction,Sequential patterns and decision trees etc. are useful in finding patterns and trends for business, marketing and sales. This in turn may cause human casualty.

But Deep Learning is fast, accurate and predicts the disease more effectively than these existing data mining techniques. Our SHPS makes use of deep learning and database management to get the most accurate illness that could be association with patient's symptoms and based on the database of several patients' medical records.

1.1 Existing System

Everyone is a patient at some time or another, and we all want good medical care. We assume that doctors are all medical experts and that there is good research behind all their decisions. However, that cannot always be the case. Nevertheless, they cannot possibly commit to memory all the knowledge they need for every situation, and they probably do not have it readily available.

They want a doctor who will talk to them, listen to what they say and give them advice about how to get better and protect their health in the future. In many cases, the wish for a prescription is secondary to the wish of being cared for

Demerits:

1) The patient has to visit the doctor in person and still does not get proper treatment, as the doctors are unable to predict the exact disease.
2) Human error can be avoided with the help of computer assisted quality decision making. It is poor when there are huge amounts of data to be classified.
3) In addition, efficiency and accuracy of decisions will decrease when humans are put into stress and immense work. Imagine a doctor who has to examine five patient records; he or she will go through them with ease.
4) However, if the number of records increases with a time constraint, it is almost certain that the accuracy with which the doctor delivers the results will not be as high as the ones obtained when he had only five Records to be analyzed.

1.2 Proposed System

We have developed an expert system called Smart Health Prediction system, which is used for simplifying the task of doctors. A system checks a patient at initial level and suggests the possible diseases. It starts with asking about symptoms to the patient, if the system is able to identify the appropriate disease then it suggests a doctor available to the patient in the nearest possible area. If the system is not sure enough, it asks some queries to the patients, still if the system is not sure then it will display some tests to the patient. Based on available cumulative information, the system will display the result.

Merits

1) This causes the disease to be predicted more effectively.
2) Moreover, this proposed system also consists of various suggestions such as doctor details and prescriptions.
3) There is a specialist appointed for each disease predicted. The details of each doctor along with their location for each disease will be given.
4) Doctor's consultation cost can be avoided at an initial stage prescribed medicines are displayed in detail.

The systemization records, allergies, radiology images, sensors multivariate time's series (such as EEG from intensive care units), laboratory, and test results.

- Data complexity owing to varying length, irregular sampling and lack of structured reporting and missing data. The quality of reporting varies considerably among institutions and persons.
- Multimodal datasets of several petabytes that includes medical images, sensors data, lab results, and unstructured text reports.
- Long-term time dependencies between clinical events and disease diagnosis and treatment that complicates learning. For example, long and varying delays oftenSeparate the onset of disease from the appearance of symptoms.
- Inability of traditional machine learning approaches to scale up to large and unstructured datasets.
- Lack of interpretability of results hinders adaptation of the methods in the clinical setting

In medical fields, the foreign scholars have solved some medical problems that are hard to be settled in classic statistics by using Bayesian classification. Naive Bayes is one of the most popular classification technique introduced by Reverend Thomas Bayes. Without any additional data, classification rules are generated by the training samples themselves.

It is the application of computing and communication technologies to optimize health information processing by collection, storage, effective retrieval (in due time and place).The proposed system is mainly used by the all the people where confidentiality and integrity of the data has utmost importance.

On the basis of selected symptoms the system will generate related disease. The system will show another form that contain some queries if the information for the disease is not enough.

On the basis of the information a query is generated and the data base responses to that query.

2. THE CONTRIBUTION

In the reference paper,[14] Health care industry contain large amount of data and hidden information Several tests are done in the detection of cardio vascular diseases in the patient; however with data mining these could be reduce .But there is a lack of analyzing tool to provided effective test result with the diagnosis of heart diseases patient. The aim of the few parameter and predicts heart diseases, there by suggests a heart diseases prediction system (HDPS) based on the data mining approaches.

This reference paper,[11] Decision Support in Heart Disease Prediction System is developed using both Naive Bayesian Classification and Jelinek-mercer smoothing technique.Jelinek-mercer smoothing technique is the more effective than naïve bayes to predict patient with heart disease and new significant rules can be generated using underlying Data Mining technique.

In the paper, [12] the delivery of health care services thus assumes greater proportion, and in this context the role played by information and communication technology has certainly a greater contribution for its effective delivery mechanism. The various available application techniques have been discussed and analyzed for the purpose of the paper.

The reference paper,[7] a web page classification based on support vector machine using a weighted vote schema for various feature. The system use both latent sematic analysis and web page feature selection training and recognition by the SVM model. The latent semantic analysis method project terms and a document. Based on the output of the SVM, voting schema is used to determine the category of the web page .Experimental result indicate our method is more effective than traditional methods.

In the reference paper,[9] Deeplearning allows computational model that are composed of multiple processing layers to learn representation of data with multiple level of abstraction. Deep learning discovery intricate structure in large data sets by using the back propagation algorithm to indicate how a machine should change its internal parameters that are used to compute the representation in each layer from the representation in the previous layer. Deep convolutional nets have brought about breakthroughs in processing images,video,speech and audio,whereas recurrent nets have shown light on sequential data such as text and speech.

As in reference paper, [4] It takes .csv files as input, and process the files for classification and then estimation accuracy.The web tool presented in the paper, gives an account of how the data can be classified and accuracy can be estimated using Naïve Bayes over web.

The reference paper, [8] the main contribution is a thorough evaluation of networks of increasing depth using architecture with very small (3x3) convolution filter. we have made our two best-performing convent models publicly available to facilitate further research on the use of deep visual representation in computer vision.

In the paper, [10] there has been much interest in unsupervised learning. Scaling such models to full-sized, high-dimensional imagers main a midcult problem. We present the convolutional deep belief network, hierarchical generative models. Theirexperiments show that algorithm learns useful high-level visual features, such as object part, from unable images of naturel scene. We demonstrate excellent performance on several visual recognition task full-sized images.

The contribution of the paper reference paper, [15] the propose to use deep convolutional neural network(CNNs) for is intense stage brain tissues using multi-modality MR images. The compared the performance of our approach with that of the commonly used segmented method on a set of manually segmented isointense stage brain image.in addition, their result indicated that integration of multi-modality image led to signification performance improvement.

The reference paper, [1] Clinical data management system typically provide care give teams with useful information, derived from large. Over `the last decade there has been a signification surge in interest in using these data source, from simply reusing the standard clinical databases for event prediction or decision support, to include including dynamic and patient-specific information into clinical monitoring and prediction problems. The three challenges in critical care are considered: compartmentalization, corruption, and complexity. A range of applications addressing these issues are covered, including the modernization of static acuity scoring; and incorporation of multimodal data sources such as genomic and free text data.

In the paper, [6] it's provides an overview of recent development in big data in the health informatics.it will benefit from an integrated approach of piecing together from a diverse range of data source, both structure and unstructured, coveringgenomics as well as imaging and long-term. The aim of discusses some of the existing activities and future opportunities related to big data for health, outlining some of the key underlining issues that need to be tackled.

This reference paper, [3] Deep architectures have demonstrated state of the art performance in the variety of setting. Deep learning algorithms are based on learning several level of representation of the inputs. Beyond test-set performance, there is a need for qualitative comparison of the solutions. The goal of our research is to improve tools for finding good qualitative interpretation of high level features learned by such models. They hope that such techniques will allow researchers in deep architecture

The contribution of the paper, [13] This aim of achieved by mining radiological report a ground truth for training and testing.it will be enrich the dataset and improving classification performance. They have deep learning can be used to trained. It will be very reliable and accurate and the computer –aided diagnosis.

The reference paper, [2] Deep learning is a one of the machine learning, the aim of to learn of hierarchy of the input data. Nowadays, deep learning algorithm for solving problem will be challenging. They are many areas are preformationin signal processing and speech recognition and natural languages processing. Deep learning to specify area are road crack detection, fault diagnoses and human activity detection.

3. RELATED WORKS

We have developed an expert system called Smart Health Prediction system, which is used for simplifying the task of doctors. A system checks a patient at initial level and suggests the possible diseases. It starts with asking about symptoms to the patient, if the system is able to identify the appropriate disease then it suggests a doctor available to the patient in the nearest possible area. If the system is not sure enough, it asks some queries to the patients, still if the system is not sure then it will display some tests to the patient. Based on available cumulative information, the system will display the result.

Here we use some intelligent data mining techniques to guess the most accurate illness that could be associated with patient's symptoms and based on the database of several patients medical record, Deep learning is applied for mapping the symptoms with possible diseases.This system not only simplifies task of the doctors but also helps the patients by providing necessary help at an earliest stage possible.

Deep learning approaches:

Deep learning approaches have been designed to scale up well with big and distributed datasets. The success of DNNs is largely due to their ability to learn novel features/patterns and understand data representation in both an unsupervised and Supervised hierarchical manners. DNNs have also proven to be efficient in handling multimodal information since they can Combine several DNN architectural components. Therefore, it is unsurprising that deep learning has quickly been adopted in medical informatics research.

Deep neural networks (DNN):

To extract the knowledge from huge and unstructured databases, we use Deep Learning which is one of the Machine Learning methods. Initially, we need to train the Deep Neural Network (DNN) model with the sample data sets from database. After the training with these sample data, DNN is able to find the similarities for new data sets we are going to give. This is how Deep Learning method will try to find the exact illness of the patient based on the symptoms he has given to the system. The more data sets during the training we feed in to the DNN, the more accurate results it will produce.

Deep learning in healthcare informatics:

Existing Data mining techniques are Association, Classification, Clustering, Prediction, Sequential patterns, Decision trees, Combinations and Long-term (memory) processing. These techniques are useful in finding patterns and trends for business, marketing and sales. These methods have probability to cause errors which in turn may cause human casualty.

Another important aspect to take into account when deep learning tools are employed is that for many applications the raw data cannot be directly used as input for the DNN. Thus, preprocessing, normalization or change of input domain is often required before the training. Moreover, the setup of many hyper parameters that control the architecture of a DNN, such as the size and the number of filter in a CNN, or its depth, is still a blind exploration process that usually requires accurate validation. Finding the correct preprocessing of the data and the optimal set of hyper parameters can be challenging, since it makes the training process even

longer, requiring significant training resources and human expertise, without which is not possible to obtain an effective classification model.

Training of DNN Models

The training data is extracted from existing medical records. The records should not have any missing information. The extracted data have symptoms and the correct diseases. Then we would train the Deep Neural Network with symptoms and the associated diseases. The input data can be divided in to mini-batches.

Later, we need to verify with random inputs (which are some symptoms) whether the DNN is capable of identifying the disease. If the DNN is not ready, then we should keep on training it with more inputs from the database.

4. NAIVE BAYES ALGORITHM:

The proposed system uses data mining technique "Naïve Bayes classifier" for the construction of the prediction system. This system involves higher number of data sets and attributes which are directly collected from doctor's information for accurate prediction of the disease.

Apriori

Apriori enjoys success as the most well-known example of a frequent pattern mining algorithm. Given the above treatment of market basket analysis and item representation, Apriori datasets tend to be large, sparse matrices, with items (attributes) along the horizontal axis, and transactions (instances) along the vertical axis.

From an initial dataset of *n* attributes, Apriori computes a list of candidate itemsets, generally ranging from size 2 to *n*-1, or some other specified bounds. The number of possible itemsets of size *n*-(*n*+1) to *n*-1 that can be constructed from a dataset of size *n* can be determined as follows, using combinations:

C(n,n-(n+2))+C(n,n-(n+3))+…+c(n,n

```
INPUT:S,supportwhereS=dataset,min_support=real
OUTPUT:Set of Frequent Itemsets
Require:S=/0,0<=min_support<=1
1:procedureGETFREQUENTITEMSETS
2:   freqSets[]<-null
3:    for allItemsets I in S do
4:       if support>=min-support then
5 :         freqsets[]<-i
6:       end if
7:    end for
8: end procedure
```

1. **Apriori Candidate Itemset Generation Algorithm**A support value is provided to the algorithm.

First, the algorithm generates a list of candidate itemsets, which includes all of the itemsets appearing within the dataset. Of the candidate itemsets generated, an itemset can be determined to be frequent if the number of transactions that it appears in is greater than the support value.

```
INPUT:S,support where S=dataset
OUTPUT:Set of Candidate Itemsets
Require:S=/0
1:procedureGENERATECANDIDATES
2:          i<-2
3: Num,-NumAttributies(S)
4:       Candidates[],-null
5 :       while i<num do
6:  Candidate[],-all sets of size i,support
7: i,-i+1
8:      end while
9: end procedure
```

2. **Apriori Frequency Itemset Selection Algorithm**

Explicit association rules can then trivially be generated by traversing the frequent itemsets, and computing associated confidence levels. Confidence is the proportion of the transactions containing item which also contains item B, and is calculated as The manner in which Apriori works is quite simple; it computes all of the rules that meet minimum support and confidence values. The number of possible potential rules increases exponentially with the number of items in the itemset. Since the computation of new rules does not rely on previously computed rules, the Apriorialgorithm provides an opportunity for parallelism to offset computation time.

Bayesians and Frequentists

In essence, Bayesian means probabilistic. The specific term exists because there are two approaches to probability. Bayesians think of it as a measure of belief, so that probability is subjective and refers to the future.

Frequentists have a different view: they use probability to refer to past events - in this way it's objective and doesn't depend on one's beliefs. The name comes from the method - for example: we tossed a coin 100 times, it came up heads 53 times, so the frequency/probability of heads is 0.53.

- **Priors, updates, and posteriors**

As Bayesians, we start with a belief, called a prior. Then we obtain some data and use it to update our belief. The outcome is called a posterior. Should we obtain even more data, the old posterior becomes a new prior and the cycle repeats.
This process employs the **Bayes rule**:

P(A | B) = P(B | A) * P(A) / P(B)
P(A | B), read as “probability of A given B”, indicates a conditional probability: how likely is A if B happens.

- **Inferring model parameters from data**

In Bayesian machine learning we use the Bayes rule to infer model parameters (theta) from data (D):P(theta | D) = P(D | theta) * P(theta) / P(data)
All components of this are probability distributions.

P (data) is something we generally cannot compute, but since it’s just a normalizing constant, it doesn’t matter that much. When comparing models, we’re mainly interested in expressions containing theta, because P(data) stays the same for each model.

P (theta) is a prior, or our belief of what the model parameters might be. Most often our opinion in this matter is rather vague and if we have enough data, we simply don’t care. Inference should converge to probable theta as long as it’s not zero in the prior. One specifies a prior in terms of a parameterized .P(D | theta) is called likelihood of data given model parameters. The formula for likelihood is model-specific. People often use likelihood for evaluation of models: a model that gives higher likelihood to real data is better.

Finally, P (theta | D), a posterior, is what we’re after. It’s a probability distribution over model parameters obtained from prior beliefs and data.

5. DEEP NEURAL NETWORKS (DNN) ARCHITECTURE

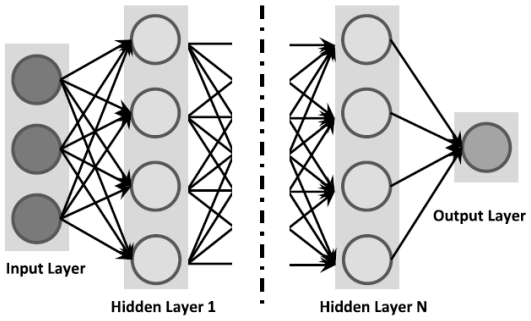

Fig1 Deep Neural Network Architecture

Deep-learning makes a computer program to think and find a solution like a human. It is one of the machines learningmethod. It has in recent year set exiting new trends in machine learning.

Traditional machine learning are one input and one output layer and hidden layer are perform and combined the input and outputs layer. The deep Neural Network are performs on three layer including input and output.so deep learning is a strictly defined .It will Perform on more than one hidden layer.

In deep-learning networks, are train the node on the pervious layer output. The further your neural are more complex and more difficult node can recognize. They aggregate and recombine features from the previous layer.

Smart Health Prediction system Architecture

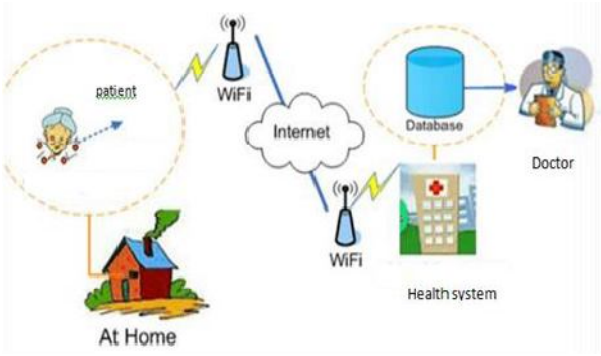

Fig.2 Smart Health Prediction system Architecture

We have developed an expert system called Smart Health Prediction system, which is used for simplifying the task of doctors. A system checks a patient at initial level and suggests the possible diseases. It starts with asking about symptoms to the patient, if the system is able to identify the appropriate disease then it suggests a doctor available to the patient in the nearest possible area. If the system is not sure enough, it asks some queries to the patients, still if the system is not sure then it will display some tests to the patient. Based on available cumulative information, the system will display the result.

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This system not only simplifies task of the doctors but also helps the patients by providing necessary help at an earliest stage possible.

6. CONCLUSION

Data mining can be beneficial in the field of medical domain .However privacy, security and unable to log into the account are the big problems if they are not addressed and resolved properly. Even if they did have access to the massive amounts of data needed to compare treatment outcomes for all the diseases they encounter, they would still need time .They want a doctor who will talk to them, listen to what they say and give them advice about how to get better and protect their health in the future.

. In our paper, we have developed an expert system called Smart Health Prediction system, which is used to overcome these drawbacks, to simplify the task of doctors and to help patients.

The system checks a patient at initial level and suggests the possible diseases. It starts with asking about symptoms to the patient, if the system is able to identify the appropriate disease then it suggests a doctor available to the patient in the nearest possible area. If the system is not sure enough, it asks some queries to the patients, still if the system is not sure then it will display some tests to the patient. Based on available cumulative information, the system will display the result.

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