A PERFORMANCE OF CLASSIFICATION ACCURACY IN MODIFIED J48 ALGORITHM USING PEARSON'S

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***Abstract* - We have been using the most popular algorithm J48 for classification of data. The J48 algorithm is used to classify different applications and perform accurate results of the classification. J48 algorithm is one of the best machine learning algorithms to examine the data categorically and continuously. When it is used for instance purpose, it occupies more memory space and depletes the performance and accuracy in classifying medical data. Our proposed method is to measure the improved performance and produce higher rate of accuracy. For this research, the dengue dataset was collected from various government hospitals in Krishnagiri District. To measure the entropy of information and to identify the dataset and to increase the accuracy of J48 algorithm, the entropy of J48 is modified with Pearson's Correlation Coefficient algorithm (PNJ48) to improve the accuracy of classification and performance Time taken to build model. Thus, it is modified as Pearson's New Correlation Coefficient J48 algorithm (PNJ48) for better performance.**

Key words* - *Data mining, Classification, Dengue, J48, Entropy, Pearson's Correlation J48 (PNJ48), WEKA

I. INTRODUCTION

A. Data Mining

Data Mining (DM) is a technique which is used to find, new hidden and useful patterns of knowledge from large databases. From statistics, artificial intelligence and data warehouses, it is very easy to design methods and procedures to classify the data for the use of real world applications. DM concept is actually split of the knowledge discovery process. DM has become a current technology in existing research and for medical field applications. The data mining applications are applied to find the final result of a disease and it is one of the most inspiring works and a difficult task (1).

B. Decision Tree

A decision tree be a flowchart-like tree structure, where each internal node represents a test happening an attribute, each branch represents an ending of the test, class label is represented by each leaf node or terminal node . Given each tuple the attribute value of the tuple are tested next to the decision tree. A path is traced beginning the root to a leaf node which holds the class prediction used for the tuple. It is simple to convert decision trees into classification rules. Decision tree learning uses a decision tree because a predictive model which maps observations on an item to conclusions about the item's object value. It is single of the predictive time taken in build model approaches utilize in statistics, data mining and machine learning. Tree models where the object variable can take a finite set of value are called classification trees, inside this tree structure, leaves correspond to class labels and branches represent conjunction of features that lead to individuals class labels. Decision tree can be constructed moderately quick compare to other methods of classification.

SQL statements can be constructing from tree to can be used to access databases accuracy. Decision tree classifiers obtain like or better Accuracy when compare with other classification methods. A amount of data mining techniques have already been done on learning data mining to improve the performance of students like Regression, Genetic algorithm, Bays classification, k-means clustering, associate rules, prediction etc. Data mining techniques can be there use in educational field to improve our understanding of learning process to focus on identify, extracting and evaluating variables linked to the learning process of students. Classification is one of the most regularly. The C4.5, ID3, CART, J48 decision tree are applied on the data of students to predict their performance (2).

C. Classification of Algorithms

Classification is one of the most essential data mining problems. The input is a dataset of training record, in which each record has got several attributes. Numerical attributes are attributes with numerical domains and categorical attributes are attributes with non-numerical domains. Besides, there is also a distinguished attribute called the Class label. This classification is intended at building a console model which can be utilized to predict the class label future, unlabeled records. There are many classification models are used and, I am using the technique called decision trees (3).

D. Organization of Paper

This paper is divided into seven sections. Section 1, deals with the overall concept of the topic. Section 2, Review of Literature, discusses the main objective with reference to the authors who have done research on this topic. Section 3, deals with the existing methods in the technical field. Section 4, focuses on the proposed method Pearson's Correlation Coefficient. Section 5, discusses about designing experiment, details of dataset and experimental outcomes. Section 6, analyses the results and the last section 7 conclusion about the research.

II. LITERATURE REVIEW

In general, all year after completion of rainy season a few epidemics are hitting to the people. Because the lack of living standards in slum areas nearly all of the people in those areas affected by epidemics. Fewer hygienist and poverty is the major classes of victims of epidemics used for these areas. The main factors for cause the epidemic are Poor hygienist, Rapid climate change, Drinking water contamination Unplanned sewage removal system etc. There are large amount water borne and mosquito borne disease such as Cholera, Dengue fever, Malaria, Typhoid, Diarrhea, Jaundice, brain fever etc. Every rainy reasons, Hundreds of people be admit in the hospital due to some transmittable disease and a few of them were even failure their life. More types of epidemics finishing in this season. The major reasons for causing these epidemics are pollution of drinking water, non consistent change in climatic whether condition, mosquitoes because of water stagnation payable to unexpected sewage disposal system. Poor health of population in the slums resulted by poor quality and old age, Living conditions like personal hygienist, hygienist of the humanity, lack of health awareness or unsatisfactory knowledge in observing hygienist, per capita income of the inhabitance etc are also some of the reasons behind this disaster.

Water borne disease is, purely, any illness resulting from eating of or contact with water. Like food borne diseases, water-ingestion illness is also infections or intoxications. Organisms dependable for infections are mainly bacteria. These organisms generally occur in water contaminated by sewage or by infected persons or animals. Intoxications may well be chemical in nature and generally occur as a result of metal leaching into water and during the accidental spillage or seepage of chemicals into water supply. They can to happen during toxins produced by blue-green algae eg, Anabaena, Microcystis or Oscillatoria. These organisms have cause even deaths in southern part of India during drinking pond water; Illnesses acquired through speak to with water are caused by bacteria.

The diabetes of the patients is calculated by use the decision tree within two phases: data pre-processing in which the attributes be identified and next be diabetes prediction model constructed with the help of using the decision tree method. Both the phases are implemented use WEKA data mining tool. The performance evaluation of Decision Tree Algorithms and Artificial Neural Network on health data was performed going on the base of parameter like kappa statistics, mean absolute error, relative squared error, time toward model and mean-squared error. On the basis of results it have been examine to Decision Tree Algorithms perform improved than the Artificial Neural Network. Hypertension parameter predicted using J48 and Naive Bayesian classifiers in WEKA. The comparison result of accuracy of J48 is greater than Naïve Bayesian. A slight development of ensemble five J48 classifier is see over clean Naive Bayesian and J48 in sensitivity, accuracy and F-measure. Rough set tools are able to decrease the ensemble of five members to three except there is substantial growth of sensitivity (4).

Classification accuracy is usually measured by determining the percentage of rows positioned in a proper class. This disregards the fact that there can be also a cost associated with an improper assignment to the incorrect class. This perhaps should also determine (5).There are so many classification algorithms including J48 and we compared it with each other. The worth mentioning improvement in the classification accuracy, while implementing J48 is identified for the cognitive behavior and cognitive load (6).Machine Learning Techniques (MLT) is applied to predict the medical datasets at an early stage to protect human life. Much of medical datasets are available in various data store that are used in the real world application. To group and predict symptoms in medical data, different data mining techniques had been used by various researchers in different time. In this system the popular predictive algorithms apply various algorithms including J48 to ensemble hybrid model by combining individual techniques/methods into one in order to increase the performance and accuracy (7).

It is compared that the performance of the datasets using the various classification techniques with evaluation principle as accuracy and implementation time. It's examined that performance of classification techniques differ with datasets. Factors which affect the classifier's performance are Dataset, Number of instances and attributes and Type of attributes. The updatable

J48 has come out with better results with other datasets utilized in the comparison (8).The decision trees produced by J48 can be utilized for classification. At every node of the tree, J48 chooses the attribute of the data that most effectively splits its arrangement of tests into subsets improved in one class or the other. The splitting criterion is the standardized information gain. The attribute with the highest worthy standardized information gain is making on the decision. The J48 algorithm at that point recurs on the smaller sub lists. Also using Generalized Sequential Pattern mining algorithm, we have used it for predicting medical dataset and to improve the performance (9).

The modified J48 classifier has been used to increase the accuracy rate of the data mining procedure. The data mining tool WEKA has been used as an API for generating the modified J48 classifiers. Experimental result using AST parameter of Dengue Data. Compare to existy J48 algorithm the modified J48 algorithm achieve improved classification accuracy. The modified J48 algorithm reaches 87.52% (10).

A. Objective

The objective of this research is to show the improved J48 classification algorithm by modifying the entropy and using Pearson's Correlation Coefficient as PNJ48 for developing accuracy and save the Time taken to build model to get the expected results in an accurate manner.

III. EXISTING METHOD

A. J48 Algorithm

Quinlan's C4.5 algorithm actualizes J48 to create a trimmed C4.5 decision tree. The every aspect of the information is to split into minor subsets to base on a decision. J48 look at the standardized data gain that really the results the split the information by choosing an attribute. To summarize, the attribute extreme standardized data gained is utilized. The minor subsets are returned by the algorithm. The split strategies stop if a subset has a place with a similar class in all the instances. J48 develops a decision node utilizing the expected estimations of the class. J48 decision tree can deal with particular characteristics, lost or missing attribute estimations of the data and varying attribute costs. Here accuracy can be expanded by pruning (1).

The Algorithm:

Stage 1: The leaf is labeled with a similar class if the instances belong to similar class.

Stage 2: For each attribute, the potential data will be figured and the gain in the data will be taken from the test on the attribute.

Stage 3: Finally the best attribute will be chosen depending upon the current selection parameter.

B. Limitations of J48 Algorithm

Despite the fact that J48 one of the well known algorithms, there are a few shortcomings of this algorithm. A few limitations of J48 are discussed below.

1) Empty Branches

Constructing tree with significant value is one of the important steps for rule generation by J48 algorithm. In our research, we have come out with many nodes with zero values or very close to that. But, these values don't contribute to create or help to create any class for classification task. Instead it makes the tree wider and still complicating (11).

2) Insignificant Branches

Number of chosen distinct attributes produces the same number of potential division to build a decision tree. But the fact is, not all of them are significant for classification task. These least important branches not only decrease the usability of decision trees but also bring on the problem of over fitting (12).

C. Over Fitting

Over fitting happens when algorithm display gets information with exceptional attributes. This causes many fragmentations in the process distribution. Statistically unimportant nodes with least examples are known as fragmentations. Usually J48 algorithm builds trees and grows its branches 'just deep enough to perfectly classify the training examples'. This approach performs better with noise free data. But most of the time this strategy over fits the training examples with noisy data. At present there are two strategies which are widely used to bypass this over fitting in decision tree learning (13) those are:

- If tree grows taller, stop it from growing before it reaches the maximum point of accurate classification of the training data.
- Let the tree to over-fit the training data then post-prune tree.

Yet, nothing of those is perfect solution of this problem. So we have proposed two tools to minimize the input space of data in this research. The first tool is Entropy of Information Theory and the second is Correlation Coefficient. In this experimentation, we have examined dengue medical data. The particulars of the datasets explanation are provided Java based machine learning tool WEKA which is used to perform the research.

IV. PROPOSED METHOD

The primary focus of our research is to reduce the input space of data file, turn back the processing time and increase the percentage of classification accuracy. From doing so, we propose widely used measurement of Information Theory the Entropy. Entropy looks for the average uncertainty of collection of information. We have applied it to come out with the central point of the data file. After obtaining the central point, the Correlation Coefficient is used to select significant attributes in the data files. After that we have implemented J48 algorithm with Pearson's Correlation coefficient method. There are brief discussions on the Entropy with Pearson's Correlation Coefficient and new PNJ48 algorithm. Figure 1 is the structure of the proposed methodology.

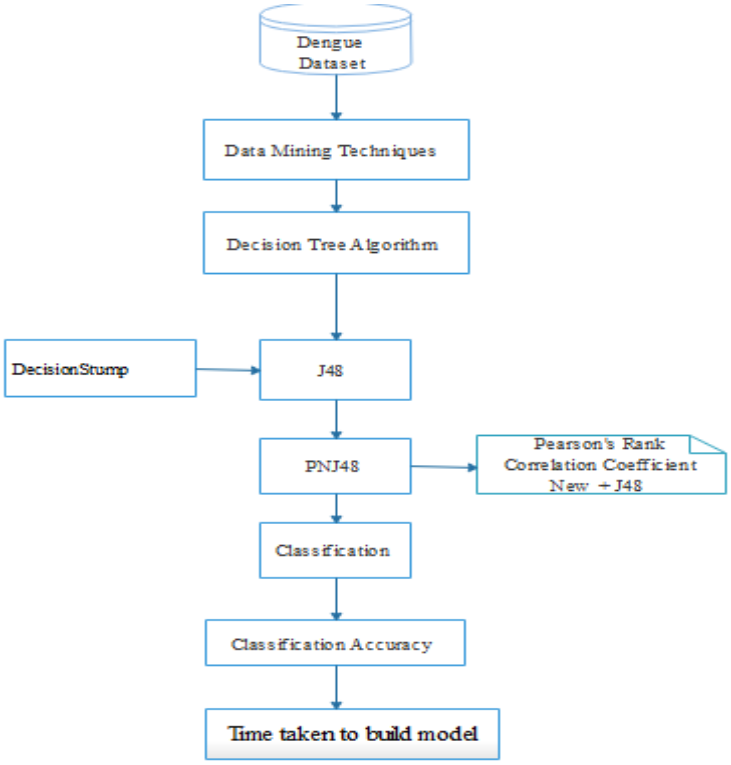

Figure 1 methodology

A. Entropy

Information theory is a popularly used theme for computer scientists, cognitive scientists, data miners, statisticians, biologists and engineers. In information theory, entropy measures the uncertainty among unstoppable variables in a dataset. The idea of entropy of random variables has already been developed. Also the beginnings of information theory and of the modern age of Ergodic theory have also been introduced. Entropy and information pertaining to that offers the long term behavior of random processes that are beneficial to analysis data. The behavior of random process is also an important factor for implementing the coding for information theory. Entropy is a measurement of moderate uncertainty of collection of information when we are not aware of the result of a data source. It means that it's a measurement of how much data we lack. This also points out the average amount of data we will obtain from the result of a data source (14). The equation 1 stands for measuring information theory of entropy.

Let X is an attribute, p is each element and j is position of each element of X then algorithm for entropy is

$$H(X) = \sum_{j=1}^{k} P_j \log_2 \frac{1}{p_j}$$
$$= -\sum_{j=1}^{k} P_j \log_2 p_j \quad (1)$$

Larger value H(X) indicates that attribute X is more random. On the other hand, attribute with smaller H(X) value implies less random i.e. this attribute is more significant for the data mining. The value of the entropy attains its minimum 0, when all other pj's are 0. The value reaches its maximum log2 k, when all pj's are equal to 1/k.

B. Correlation Coefficient

Correlation coefficient is one of the chief statistical tools to examine sets of variables and find out their relationship. So that user would be able to come out with decisions on the basis of available information by correlation coefficients. Hence, it secures millions even billions of dollars for businessman, saves much for researchers and scale down exertion for many other professional in various fields. Researchers have toiled on this tool to develop its efficiency by introducing various ways of calculation. Out of various correlation coefficients, we have selected the most popular one which is Pearson's Correlation Coefficients. In the following sections we have discussed briefly about it (15)

1) Pearson's Correlation Coefficients:

Pearson's Correlation Coefficients: Pearson's correlation coefficient is developed by Karl Pearson (16). It measures the linear relationship between two variables by comparing their strength and direction. Relationship between two variables is expressed by -1 to +1. If the variables are perfectly linear related by an increasing relationship, the Correlation Coefficient gains the maximum value i.e. +1. On the other hand, if the variables are perfectly linear related by a decreasing relationship, the correlation value gains -1. And a value of 0 expresses that the variables are not linear related by each other. In general, if the correlation coefficient is greater than 0.8, it expresses strong correlation between variables. Let X and Y are interval or ratio variables. They are normal distribution and their joint distribution is bivariate normal. So the formula of Pearson's Correlation Coefficient is:.

$$r_{xy} = \frac{\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}}{\sqrt{\left[(\Sigma x^2 - \frac{(\Sigma x^2)}{n_x})(\Sigma y^2 - \frac{(\Sigma y^2)}{n_y})\right]}} \quad (2)$$

Where

ΣX is sum of all the X scores. ΣY is sum of all the Y scores. ΣX2 is square of each X score and then sum of them.ΣY2 is square of each Y score and then sum of them. ΣXY is multiply of each X score by its associated Y score and then add of the resulting products together. This is also called cross product. n refers to the number of "pairs" of data

V. EXPERIMENTAL DESIGN

Performance of our experiment design; we have computed entropy with MODIFIED WEKA programming tools. We select the attribute with least entropy value. We propose that attribute as the central attribute of the database. Then we find out Pearson's Correlation Coefficient depending upon the central attribute using MODIFIED WEKA. Finally, we have applied J48 algorithm with MODIFIED WEKA. MODIFIED WEKA presents different types of test options to classify data files such as user training set, supplied test set, cross-validation and percentage split. We choose 10 fold cross-validation data.

A. Data Set Description

1) Dataset

Dataset: In this research work, fifteen attributes are used namely pid, pname, sex, age, tname, bgroup, neutrophil, wbc, rbc, platlet, ast, alt, hb, sodium and urban. The data are collected from 512 dengue affected patients at various Government Hospitals in Krishnagiri District

2) Data Preparation

Table 1 is dengue patients' data collected from various Government hospitals in Krishnagiri Distirct.

Table: 1 represents the attributes, description and the possible values

Attributes	Description	Possible Values
p_id	Patient ID	1-512
p_name	Patient Name	Patient Name
Sex	Patient Sex	Male , Female
Age	Age of Patient	Patient Age
t_name	Patient Taluk Name	Bargur, denkanikottai, Hosur, thally Krishnagiri, Pochampalli, Shoolagiri,
b_group	Patient Bloood Group	A+,A-,B+,B-,AB+,AB-,O+,O-
neutrophil	Low(0-1.5), Normal(1.5-8), High(8-above)	Normal, Low, High
Wbc	Low(0-3.8), Average(3.8-10.58), High (10.58-above)	Low,Average,Hight,
Rbc	Poor(0-4.23), Average(4.23-5.59), Good(5.59-above)	Poor,Average,Good
Platlet	Low(0-141), Average(141-316), High(316-above)	Low, Average, High
Ast	Worst(0-blow), Average(0-40), High(40-above)	Worst, Average, High,
Alt	Worst(0-blow), Average(0-40), Normal(40-above)	Worst, Average, Normal
Hb	Low(0-11), Average(11-16), Normal (16-above)	Low, Average, Normal
Sodium	Bad(0-135), Average(135-145), Good(145-above)	Bad, Average, Good
Urban	Urban	Yes, No

B. Experimental Outcome

Table 2 has the analysis of Neutrophil based classification from DecisionStump, J48, and PNJ48 algorithm. Correctly classified on DecisionStump, J48 and PNJ48 algorithm and the values are 91.4063%, 91.7969%, 91.9922% respectively. The PNJ48 algorithm is an efficient classification of accuracy than the original J48 and DecisionStump algorithm on dengue dataset. The figure 2 describes Neutrophil Based Classification.

Table 2 Neutrophil Based on Classification

Algorithm	Correctly Classified	Incorrectly Classified
DecisionStump	91.4063	8.5937
J48	91.7969	8.2031
PNJ48	91.9922	8.0078

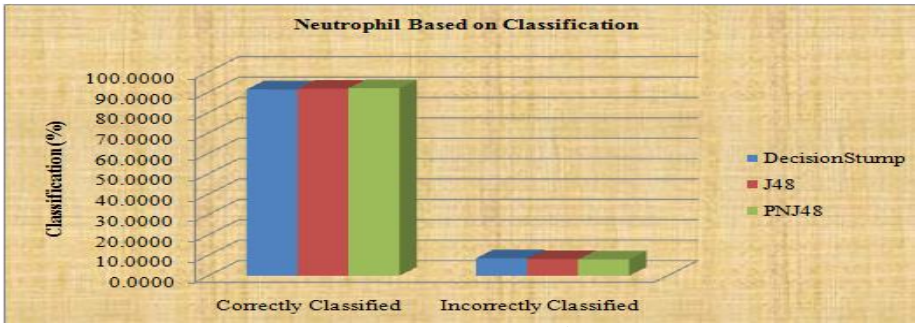

Figure 2 Neutrophil Based on Classification

Table 3 has the analysis of AST based classification from DecisionStump, J48, and PNJ48 algorithm. Correctly classified on DecisionStump, J48 and PNJ48 algorithm and the values are 88.8672%, 89.0625% 89.2578% respectively. The PNJ48 algorithm is an efficient classification of accuracy and the consumption of time is lower than the original J48 and DecisionStump algorithm on dengue dataset. The figure 3 is the description of AST Based Classification.

Table 3 AST Based on Classification

Algorithm	Correctly Classified	Incorrectly Classified
DecisionStump	88.8672	11.1328
J48	89.0625	10.9375
PNJ48	89.2578	10.7422

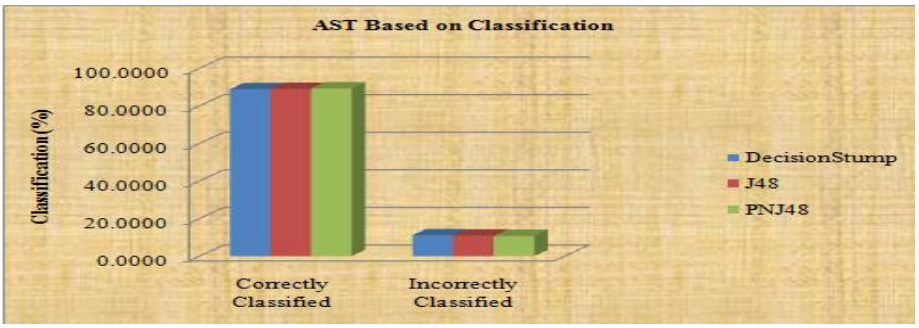

Figure 3 AST Based on Classification

Table 4 has the analysis of ALT based classification from DecisionStump, J48, and PNJ48 algorithm. Correctly classified on DecisionStump, J48 and PNJ48 algorithm and the values are 77.3438%, 78.3203% 78.9063% respectively. The PNJ48 algorithm is an efficient classification of accuracy and the consumption of time is lower than the original J48 and DecisionStump algorithm on dengue dataset. The figure 4 is the description of ALT Based Classification.

Table: 4 ALT Based on Classification

Algorithm	Correctly Classified	Incorrectly Classified
DecisionStump	77.3438	22.6562
J48	78.3203	21.6797
PNJ48	78.9063	21.1350

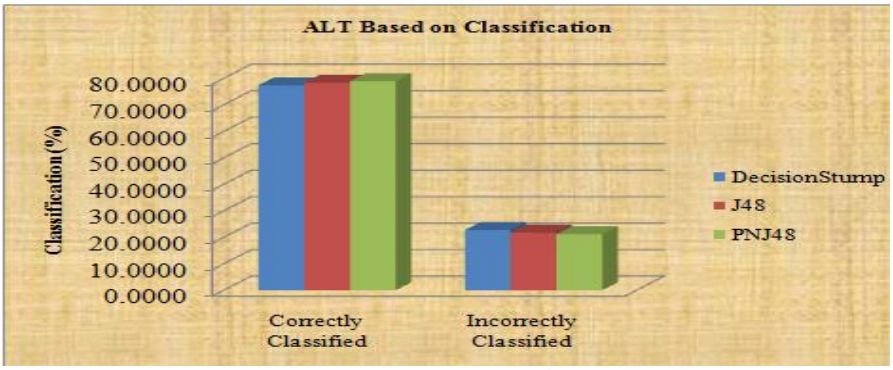

Figure 4 ALT Based on Classification

Table 5 has the analysis of WBC based classification from DecisionStump, J48, and PNJ48 algorithm. Correctly classified on DecisionStump, J48 and PNJ48 algorithm and the values are 74.6094%, 74.8047% 75.0921% respectively. The PNJ48 algorithm is an efficient classification of accuracy and the consumption of time is lower than the original J48 and DecisionStump algorithm on dengue dataset. The figure 5 is the description of WBC Based Classification.

Table: 5 WBC Based on Classification

Algorithm	Correctly Classified	Incorrectly Classified
DecisionStump	74.6094	25.3906
J48	74.8047	21.1953
PNJ48	75.0921	24.9079

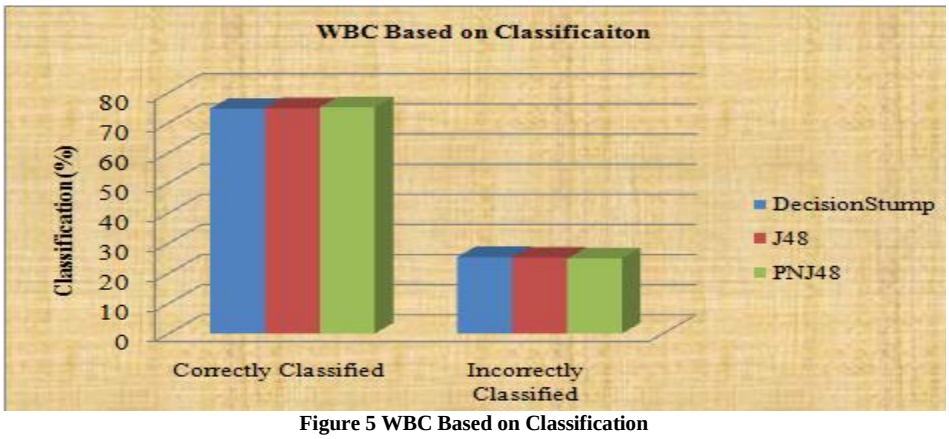

Figure 5 WBC Based on Classification

Table 6 has the analysis of RBC based classification from DecisionStump, J48, and PNJ48 algorithm. Correctly classified on DecisionStump, J48 and PNJ48 algorithm and the values are 71.6797%, 71.8750% 72.2656% respectively. The PNJ48 algorithm is an efficient classification of accuracy and the consumption of time is lower than the original J48 and DecisionStump algorithm on dengue dataset. The figure 6 is the description of RBC Based Classification.

Table: 6 RBC Based on Classification

Algorithm	Correctly Classified	Incorrectly Classified
DecisionStump	71.6797	28.3203
J48	71.8750	28.1250
PNJ48	72.2656	27.7344

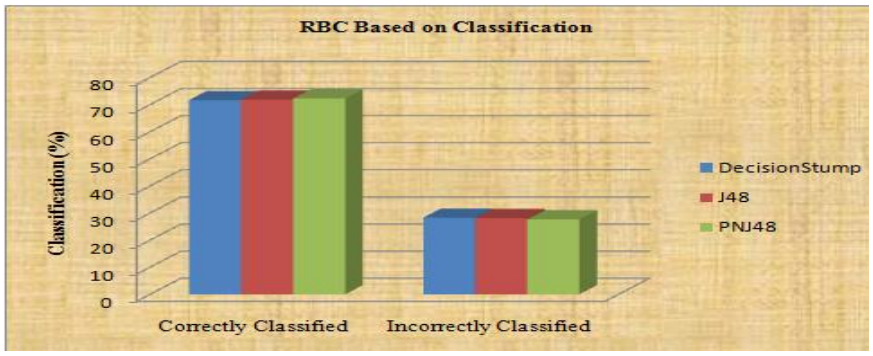

Figure 6 RBC Based on Classification

VI. RESULT ANALYSIS

Table 7 is comparison of original J48 and Modified Pearson's New J48 algorithm. The original J48 algorithm first classified on the WEKA tool and then changed the entropy on the J48 algorithm using MODIFIED WEKA on entropy Pearsons's Correlation Coefficient and we get PNJ48. PNJ48 is Pearson's new modified J48 algorithm and we used this new algorithm with dengue data set. The performance evaluation PNJ48 using Neutrophil. The performance result using of above parameter such as 91.4063%, 91.7969%, 91.9922%. The PNJ48 algorithm is an efficient classification method for dengue dataset and performs good accuracy rate and working for lower time compare to other algorithm J48 and DecisionStump algorithm. Figure 7 is comparison of Classifiers Accuracy and Figure 8 is Comparison of Time taken to build model.

Table: 7 Comparison of original J48 and Modified Pearson's New J48

Data Field	Accuracy (%)			Time taken to build model		
	DecisionStump	J48	PNJ48 (Pearson's New)	DecisionStump	J48	PNJ48 (Pearson's New)
Neutrophil	91.4063	91.7969	91.9922	0.02	0.02	0.01
AST	88.8672	89.0625	89.2572	0.03	0.01	0.01
ALT	77.3438	78.3203	78.9063	0.03	0.02	0.01
WBC	74.6094	74.8047	75.0921	0.05	0.03	0.01
RBC	71.6797	71.8750	72.2656	0.05	0.02	0.01

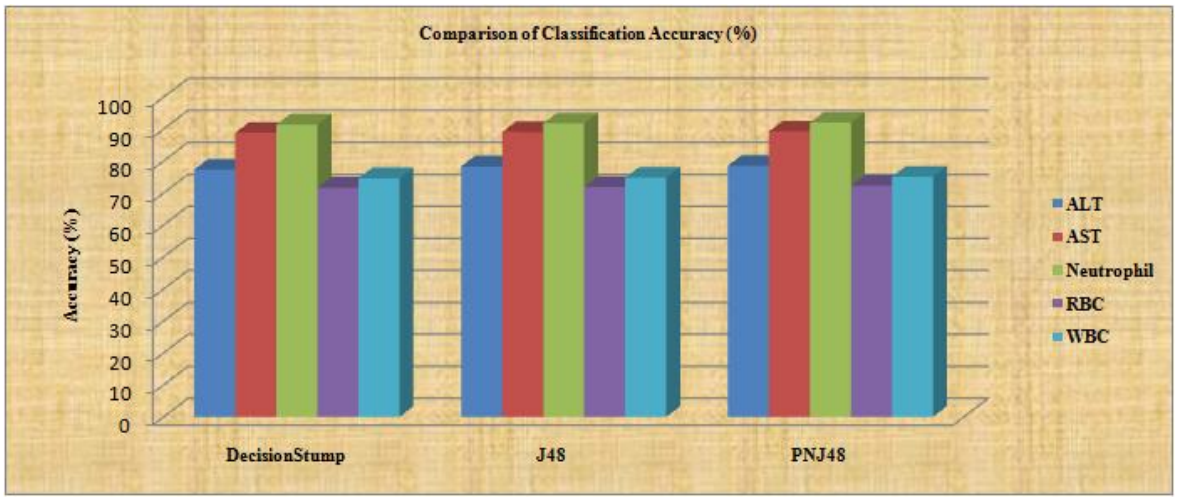

Figure 7 Comparison of Classifiers Accuracy

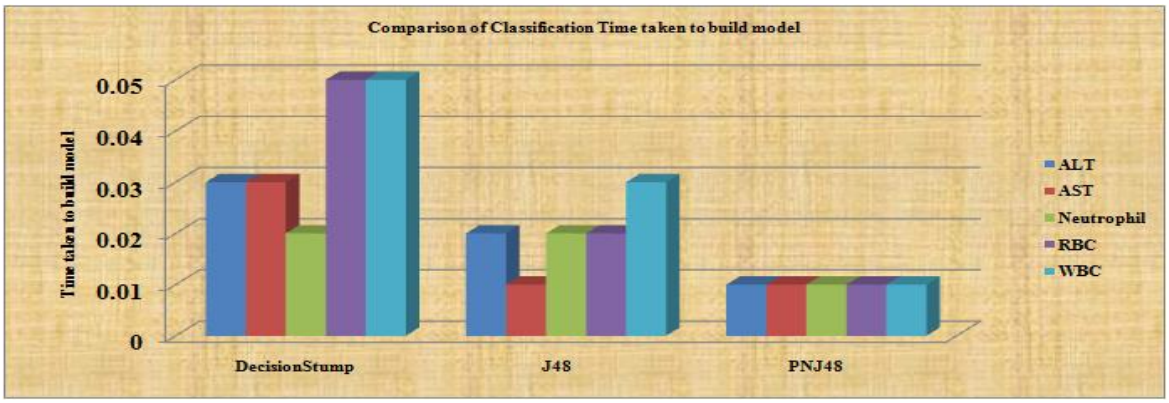

Figure 8 Comparison of Classifiers Time taken build model

VII. CONCLUSION

Data mining gives a grouping of techniques to extract hidden pattern beginning the healthcare industry. This proposed study given an overview of data mining techniques similar to classification algorithms and tools like WEKA tool. This research work proposed to the improved J48 classification algorithm which means developing accuracy and to save the Time taken to build model to get the expected results in an accurate manner. As it was already discussed regarding the modified J48 to become PNJ48 and its higher performance, this shows greater performance on the dengue dataset are using parameter as Neutrophil, AST, ALT, WBC and RBC the highest classification accuracy rate is 91.9922% on Neutrophil. The improved J48 provides better classifications than the original J48. The performance of PNJ48 is faster than J48 and in future it can be used to find accurate classifications of different medical datasets.

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