"Comparison the various Classification and Clustering Algorithms using WEKA Tool on data set"

JASWINDER KAUR, NAVEEN DHILLION

M.Tech Scholar in R.I.E.T, Phagwara
Principalat R.I.E.T, Phagwara

ABSTRACT

With the information technology advancement, huge amount of data is available around each corner. To extract meaningful information and hidden patterns from available data, data mining techniques can be applied. There are many techniques in data mining to find hidden patterns such as clustering, classification, and association rule mining and regression analysis. Data mining is the process is to extract information from a data set and transform it into an understandable structure. It is the computational process of discovering patterns in large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. Clustering is dividing data set into related groups such that all the groups do not have anything in common. Prediction, as the name suggests, predictions are made with available data set. It does not give surety of any kind, it may predict right or may predict wrong. Classification is classification of data sets into some predefined sets using various mathematical models. Association is discovering a correlation hidden in large amount of data, that is, in a given transaction based on the relationships between the items a pattern is discovered. In this research, we study one of the most widely used methods to handle big data, that is, data mining clustering algorithms and classification algorithms. Here we have studied and made a comparative analysis of classification and clustering algorithms. A comparison between proposed study and earlier method is performed in terms of certain parameters such as accuracy, error recognition rate and execution time.

Keywords: - *HAC, DBSCAN, K-means, WEKA.*

1. INTRODUCTION

Data mining is the extraction of intriguing patterns or information from huge stack of data. In other words, it is the exploration of links, associations and overall patterns that prevail in large databases but are hidden or unknown [1]. Data mining is used in classification, clustering, regression, association rule discovery, sequential pattern discovery, outlier detection, etc. [2]. Data mining is a multi-stage process [3], data is mined by going through various phases, as shown in Figure 1.

Data selection process of extracting valuable information and facts from data has become more an art than science. Even before the data is collected and processed, a preconception of the nature of the knowledge to be extracted from the data exists in the human mind, hence the human intuition remain irreplaceable. Various techniques were developed for the extraction of data, each of them customized for the specific set of information. Clustering is a technique of "natural" grouping of the un-labeled data objects in such a way that objects belonging to one cluster are not similar to the objects belonging to another cluster. It can be considered as the most essential and important unsupervised learning technique in Data Mining [1]. Clustering is the task of grouping a set of objects in such a way that objects in the cluster are more similar to each other than to those in other clusters[4]. Clustering techniques have numerous applications in various fields including, artificial intelligence, pattern recognition, bioinformatics, segmentation and machine learning.

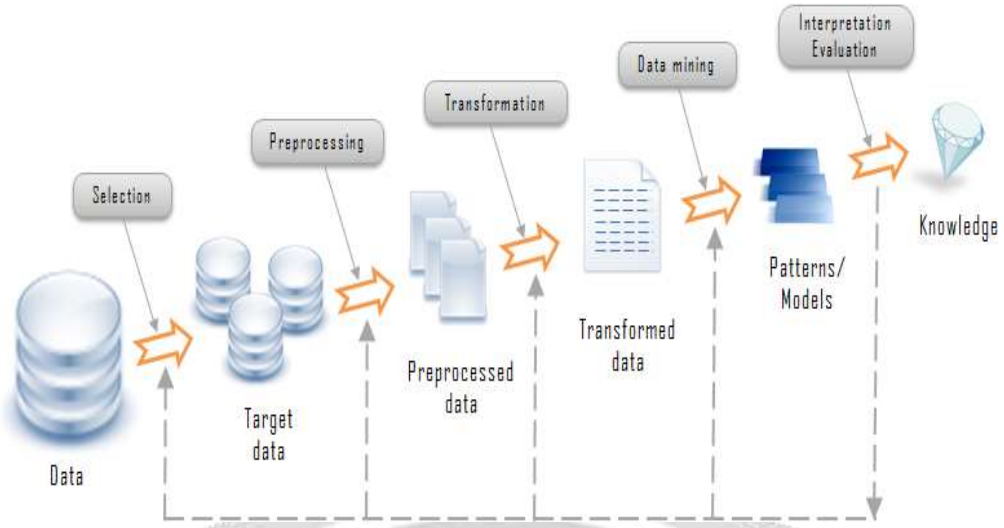

Figure 1: Phases of data mining

In this paper, firstly we have discussed the different clustering approaches and techniques used in data mining and then in the later part, we have compared and analyzed few algorithms in terms of accuracy and efficiently. The dataset used for clustering is on banking. Waikato Environment for Knowledge Analysis (WEKA) tool is used to execute the algorithms [12].

2. METHODOLOGY

The methodology describes all the steps according to which comparative analysis of clustering algorithms is performed.

Step1. Choose the clustering algorithms: To perform the comparative analysis, three clustering algorithms are chosen namely K-means, Hierarchical and Make Density.

Step2. **Choose the dataset:** The "Bank" data set has been chosen from specific location where it is stored. The file format is .CSV.

Step3. Load data on WEKA: Load data file for further analysis.

Step4. Normalize data: After loading of the dataset the next step is to normalize the dataset using the WEKA tool through filter tab. Select normalize filter and apply on the same data set. Save the result using save button.

Step5. Apply clustering algorithms: Apply the all clustering algorithms on unnormalize as well as normalize dataset.

Step6. Store the result: After running all algorithms, results are stored into the tabular forms and based on number of iteration, sum of squared error, time taken to build clusters, correctly clustered data, and comparative analysis is performed.

Step7. Plot the graph: Represent results in graphical format.

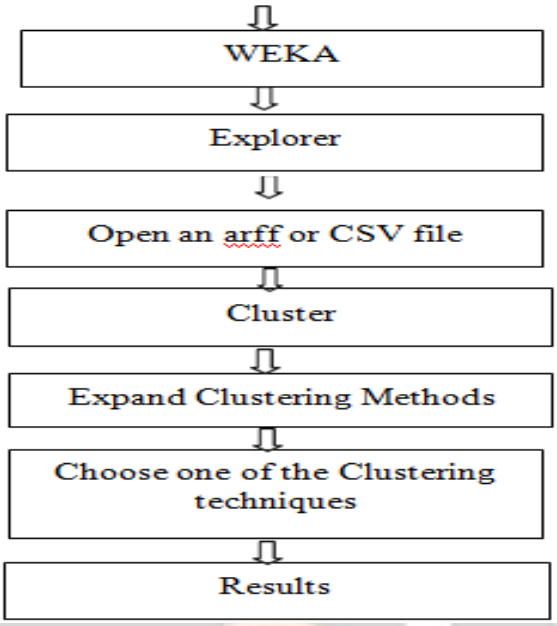

Figure 2: Clustering using WEKA

3. CLUSTERING ALGORITHMS

3.1K-Means clustering

Data clustering refers to an unsupervised learning technique, which offers refined and more abstract views to the inherent structure of a data set by partitioning it into a number of disjoint or overlapping (fuzzy) groups [5].Clustering refers to the natural grouping of the data objects in such a way that the objects in the same group are similar with respect to the objects present in the other groups. There are broadly three types of clustering, namely, Hierarchal clustering, Density based clustering, and Partition based clustering. It follows as: first randomly select K the objects as mean (center) of clusters. After that all objects are assigned to the K clusters which have minimum Euclidean distance between objects and cantroids. Mean is updated until all the objects are assigned as mean. This updation is continuing until the assignment is stable.

3.2HIERARCHICAL Clustering

Hierarchical Clustering method merged or splits the similar data objects by constructing hierarchy of clusters also known as dendogram[7]. Hierarchical Clustering method forms clusters progressively. Hierarchical Clustering classified into two forms: Agglomerative and Divisive algorithm.

Agglomerative hierarchical clustering is a bottom up method which starts with every single object in a single cluster. Then, in each successive iteration, it combines the closest pair of clusters by satisfying some similarity criteria, until all of the data is in one cluster or specify by the user [7].

3.3DENSITY BASED CLUSTERING

It is based on the concept of local cluster criterion. Clusters in the data space are considered as the regions with higher density as compared to the regions having low object density (noise). The major feature of this type of clustering is that it can discover cluster with arbitrary shapes and is good at handling noise. It requires two parameters for clustering, namely,

a. □- Maximum Neighborhood radius
b. Min points- Min number of points in the □ neighborhood of that point.

The density based approach uses the concepts of density reach ability and density connectivity [6].

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4. DATASET AND TOOL

4.1 DATA SET

For performing the comparison analysis 'Bank' dataset has been used.

Qualified for rebate
Rate of interest
Interest compound for period
With drawl restrictions
Interest on tax
Loan/advance against deposit
Payment of return
Nomination facility
Premature closer
Payment rule
Transferability
Minimal deposit
Banking services

Table1: Attributes of the Data Set

It is real world data. The dataset is described by the types of attributes, the number of instances stored within the dataset. Banking data are related to customer information and consists of 13 attributes and 5264 instances. In the paper "Bank data" is used in .csv file format. The attributes and their description are given in Table 1.

4.2 Tool

WEKA is a software tool that was developed at the University of Waikato in New Zealand and written on Java [11]. WEKA is platform-independent, open source and user friendly with a graphical interface that allows for quick set up and operation, WEKA is a collection of machine learning algorithms for data mining tasks and its main window is shown in Figure 2. The algorithms can either be applied directly to the dataset or called from your own Java code. WEKA contains tools for data preprocessing, classification, regression, clustering, association rules, and visualization.

WEKA tool contains Attribute-relationship file format (.arff) and .csv file of the data set. Data set consists of attribute names, types, values and the data. In WEKA, the data objects are called as instances and features of data are considered as attributes [12].

5. EXPERIMENT RESULT

Having introduced the clustering algorithms, now turn to the discussion of these algorithms on the basis of a practical study. This section presents the experimental result of each of the four clustering algorithms using bank data.

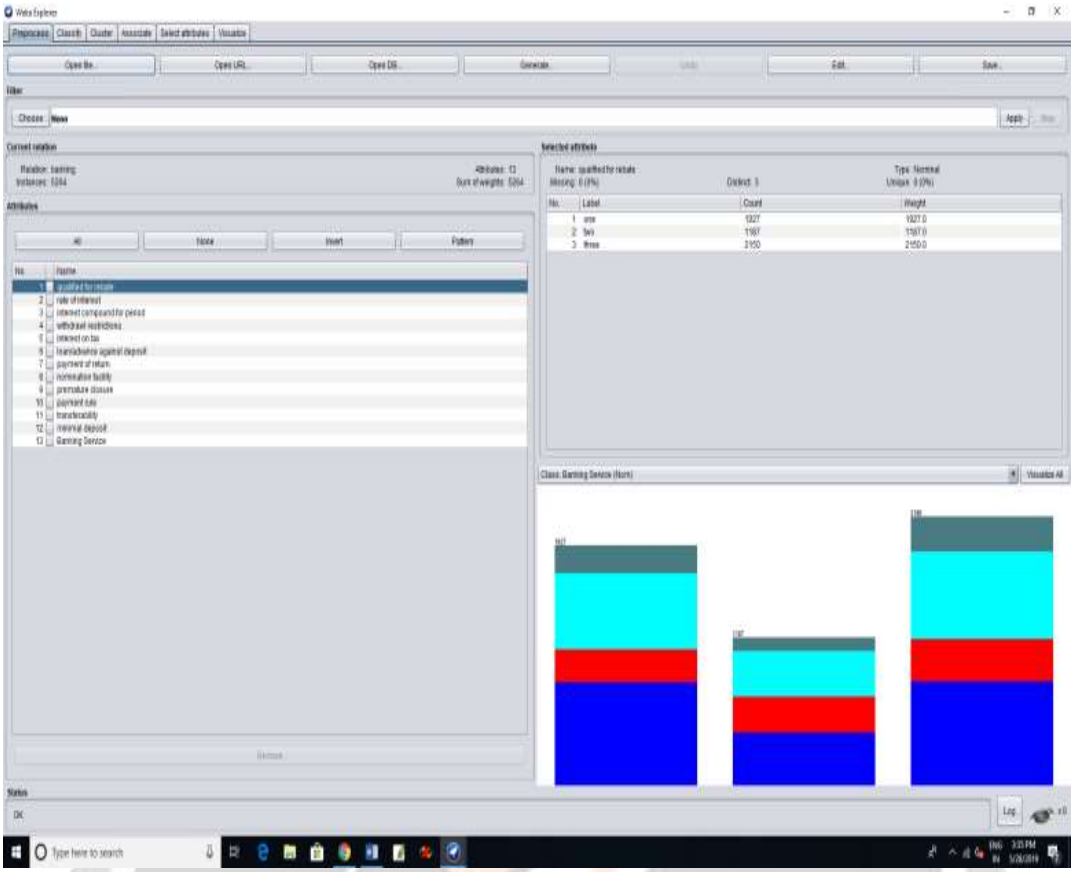

Figure 3: Banking instances

Figure shows the number of banking instances under each type in the dataset is shown in numerically.

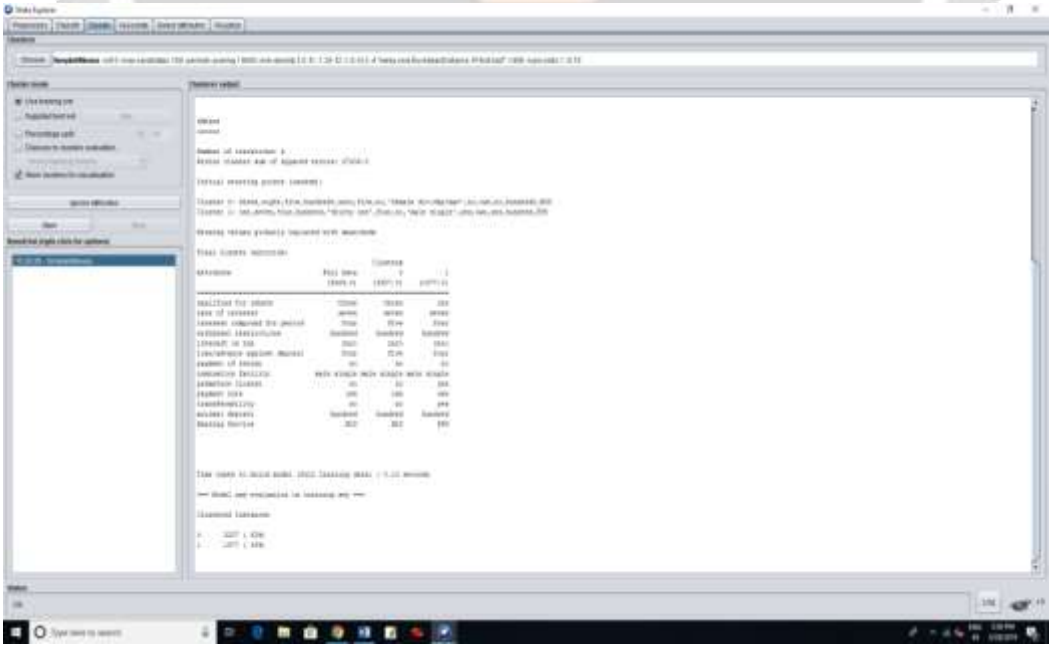

Figure 4: implementation of K-means

Figure shows the implementation of K-means: number of iteration, error rate and number of cluster**.**

RESULT

After implementation of these algorithms on data set, the following results obtained.

Parameters	Density	HAC	K-means
Number of Cluster	2	2	2
Number of Iteration	4	4	4
Computational time (seconds)	0.27	0.29	0.13
Accuracy (%)	50.83	54.16	55.20

TABLE 2: Comparative result of three Algorithms

For performing comparative analysis, this paper principally focus on the time taken to form clusters, accuracy and number of iterations. Result shows that K-Means algorithm takes lowest time i.e. 0.13 seconds and more accuracy i.e. 55.20%. Distribution of cluster instance is more properly done in Density based algorithm but it takes more time i.e. 0.27 seconds as compare to K-Means. So in terms of efficiency and accuracy K-Means clustering algorithm produce better result as compared to other algorithms.

6. CONCLUSION

In this paper, comparative study has been performed on the K- means, Hierarchical, and Density based clustering algorithms. Comparison is performed on Bank dataset using WEKA tool and the comparative results are presented in the form of table. The comparative study is performed on the basis of accuracy and efficiency parameters. Hierarchical clustering takes more time to form clusters and less accuracy. Density based clustering form clusters with less accuracy as K-means clustering. Simple K-means clustering algorithms forms clusters with less time and more accuracy than other algorithms. In terms of time and accuracy K-means produces better results as compared to other algorithms.

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