An Approach to Analyze Stock Market Using Clustering Technique

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Abstract*: In order to analyze the various sectors of the stocks in stock market field, need to use machine learning algorithms to determine the particular sectors of the stocks in intraday trade. In this paper, we compared different types of clustering algorithm with the help of data mining tool WEKA. This paper will demonstrate the strength and accuracy of each algorithm for clustering in terms of performance, efficiency and time complexity required*

Keyword*:* Machine Learning, Clustering, Weka tool, Multi database, Stock market data

1. Introduction

Machine learning has confirmed to be of good quality value in different kind of application domains. It is specifically useful in data mining problems where big databases may have valuable enclosed regularities that can be discovered automatically. Designing a machine learning approach contains no of design options like choosing the typing of training experience. Target function from training ex: various commonly used machine learning algorithms are Artificial neural network, decision tree, genetic algorithm, apriori algorithm, Rule induction etc..The application of machine learning approach to stock market data is a recent trend in research. The stock market daily trade result in stock market field has been still a source of great concern and research interest to process the analyzing stock market data and buyers to find the better stocks in different stock sectors. The discovery of this process can help the customer to take their own decision on daily basis trade where it can analyze the buying habit of the customers.

The literature is replete with various works in a machine learning area on stock market data. The focus of this work is on applying machine learning algorithms to stock market data for predictive and analyzing data purposes in stock market field.500 records of dataset has to be used the training data will be measured by clustering algorithm. The comparison of various algorithm will be produced the performance and efficiency of dataset.

2. Aim & Objective

The aim of this study is to use machine learning algorithms to determine the specific sector stocks in intraday trade of stock market, the general objectives is to demonstrate how machine learning algorithms can be applied to stock market data.
- To create database representing the specific sector of stock market
- To model the daily trade data based on dataset.
- To compare models generated from the machine learning algorithms (K-means, optics, EM, Cobweb) using the accuracy level and Time taken and identify which model is most appropriate for taking decision on daily trade data.
- To generate the model.
- To examine the sectors to see what can be learned from that
- To design a system framework based on efficiency of algorithm.

3. Literature Review

There has been significant progress in the field of machine learning bordering on its application to the areas of medicine, natural language processing, software development and inspection, financial investing, stock market applications and so on Edwin Lughofer et al, 2012 [3] uses cluster analysis to group related documents for browsing, to find genes and proteins that have similar functionality, and to provide a grouping of spatial locations prone to earthquakes. The ability to discover highly correlated regions of objects when their number becomes very large is highly desirable, as data sets grow and their properties and data interrelationships change.

Kevin Duh [4] has proposed a novel active learning strategy for data-driven classifiers, which is based on unsupervised criterion during off-line training phase, followed by a supervised certainty-based criterion during incremental on-line training. In this se, they call the new strategy hybrid active learning. Sample selection in the first phase is conducted from scratch (i.e.no initial labels/learners are needed) based on purely unsupervised criteria obtained from clusters: samples lying near cluster centres and near the borders of clusters are expected to represent the most informative ones regarding the distribution characteristics of the classes. In the second phase, the task is to update already trained classifiers during on-line mode with the most important samples in order to dynamically guide the classifier to more predictive power.

Both strategies are essential for reducing the annotation and supervision effort of operators in off-line and on-line classification systems, as operators only have to label an exquisite subset of the off-line training data representation

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give feedback only on specific occasions during on-line phase.

Xiaodong Yu *et al.* [5] have proposed a flexible transfer learning strategy based on sample selection. Source domain training samples are selected if the functional relationship between features and labels do not deviate much from that of the target domain. This is achieved through a novel application of recent advances from density ratio estimation. The approach is flexible, scalable, and modular. It allows many existing supervised rankers to be adapted to the transfer learning setting. R.J. Gil. [6] have proposed a novel updating algorithm based on iterative learning strategy for delayed coking unit (DCU), which contains both continuous and discrete characteristics. Daily DCU operations under different conditions are modelled by a belief rule-base (BRB), which is then, updated using iterative learning methodology, based on a novel statistical utility for every belief rule. Compared with the other learning algorithms, their methodology can lead to a more optimal compact final BRB. With the help of this expert system, a feed forward compensation strategy is introduced to eliminate the disturbance caused by the drum-switching operations.

R.J. Gil *et al.* [6] have proposed a novel model of an Ontology-Learning Knowledge Support System (OLeKSS) is proposed to keep these KSSs updated. The proposal applies concepts and methodologies of system modelling as well as a wide selection of OL processes from heterogeneous knowledge sources (ontology texts, and databases), in order to improve KSS's semantic product through a process of periodic knowledge updating. An application of a Systemic Methodology for OL (SMOL) in an academic Case Study illustrates the enhancement of the associated ontology through process of population and enrichment.

Md Nasir *et al.* have proposed a variant of single-objective PSO called Dynamic Neighbourhood Learning Particle Swarm Optimizer (DNLPSO), which uses learning strategy whereby all other particles' historical best information is used to update a particle's velocity as in Comprehensive Learning Particle Swarm Optimizer (CLPSO). But in contrast to CLPSO, in DNLPSO, the exemplar particle is selected from a neighbourhood. This strategy enables the learner particle to learn from the historical information of its neighbourhood or sometimes from that of its own.

4. Methodology

In this research, we focused on comparing the performance of machine learning algorithms that are trained with data relating to intraday trade with the aim of obtaining good stocks sectors for taking decision by their own of customers that will provide the proper alignment of daily basis trading data. For collection data to train the machine learning algorithms, quantitative approach will be used. A tool will be built based on database that interfaces with weka for training the algorithm for finding the optimization of analyzing model of stock market data will make a comparative research on the machine learning algorithms using cross validation and non clustering errors benchmarks. For training 40% date will be used while the remaining 60%

will be used to validate. During data collection, the relevant data will be gathered. Once the data has been collected, its quality will be verified. Incomplete data will be eliminated and the data will be cleaned by filling in missing values, smoothing noisy data, identifying or removing outliers and resolving in consistencies. At last, the Noisy data will be stored in different tables and later joined in a single table to remove errors.

a. Various Techniques
There are several clustering algorithm available in weka. But cobweb, DB scan, EM, Optics and K-Means will be used in this study. Attribute importance analysis will be carried out to rank the attributes by significance using information gain. Consistency subset selection and feature subset selection filter algorithm will be used to rank and select the attributes that are mostly used. The COBWEB algorithm was developed by machine learning researchers in the 1980s for clustering objects in a object-attribute data set. The COBWEB algorithm yields a clustering dendrogram called classification tree that characterizes each cluster with a probabilistic Description. Cobweb generates hierarchical clustering, where clusters are described probabilistically. COBWEB uses a heuristic evaluation measure called category utility to guide construction of the tree. It incrementally incorporates objects into a classification tree in order to get the highest category utility.

b. B. Experimental Results
The data set is with COBWEB algorithm with evaluation on training set of WEKA tools. The number of merges found was 76, and number of splits are 71. Total time taken to build model on full training data was 27.88 seconds. Numbers of clusters were 107. See figure 1.
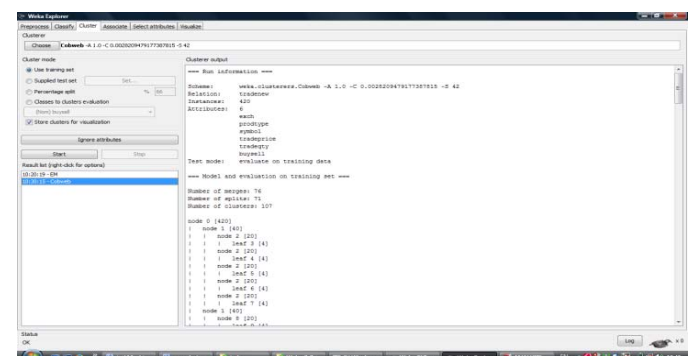

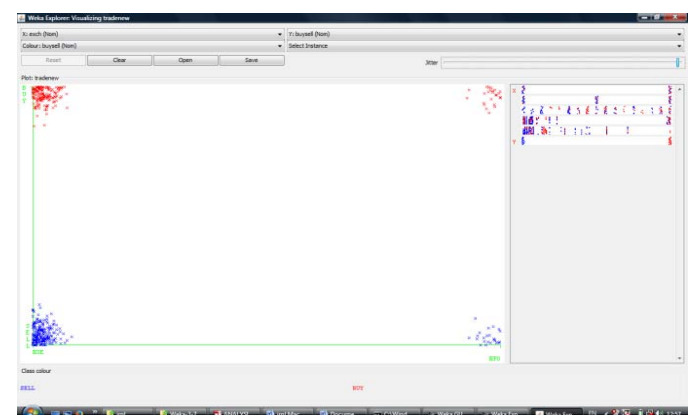**Figure 1:** Result of cobweb clustering algorithm

Figure 2: Result of cobweb cluster in form of graph

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c. Db scan Clustering Algorithm
DBSCAN (for density-based spatial clustering of applications with noise) is a data clustering Algorithm proposed by Martin Ester, Hans-Peter Kriegel, Jorge Sander and Xiaowei Xu in 1996. It is a density-based clustering algorithm because it finds a number of clusters starting from the estimated density distribution of corresponding nodes. DBSCAN is one of the most common clustering algorithms and also most cited in scientific literature. OPTICS can be seen as a generalization of DBSCAN to multiple ranges, effectively replacing the parameter with a maximum search radius.

d. Experimental Results
The NSE data set is applied with COBWEB algorithm for evaluation on training set with Epsilon: 0.9, min Points: 6. Distance-type of clusters for DBSCAN Data Objects is Euclidian Data Object. The Number of generated clusters are 4 and elapsed time is 1.14 seconds.

e. Hierarchical Clustering
In hierarchical clustering the data are not partitioned into a particular cluster in a single step. Instead, a series of partitions takes place, which may run from a single cluster containing all objects to n clusters each containing a single object. Hierarchical Clustering is subdivided into agglomerative methods, which proceed by series of fusions of the n objects into groups, and divisive methods, which separate n objects successively into finer groupings. Hierarchical clustering may be represented by a two dimensional diagram known as dendrogram which illustrates the fusions or divisions made at each successive stage of analysis.

f. Experimental Results
The NSE data set is applied with hierarchical clustering algorithm for evaluation on training set with four clusters. The elapsed time is 1.88 seconds. The tree Visualizer can also be analyzed

g. The K Means Clustering
The k-means algorithm is one of a group of algorithms called partitioning methods. The k –means algorithm is very simple and can be easily implemented in solving many practical problems. The k-means algorithm is the best-known squared error-based clustering algorithm.

1. Selection of the initial k means for k clusters
2. Calculation of the dissimilarity between an object and the mean of a cluster
3. Allocation of an object to the cluster whose mean is nearest to the object
4. Re-calculation of the mean of a cluster from the objects allocated to it so that the intra Cluster dissimilarity is minimized. Except for the first operation, the other three operations are repeatedly performed in the algorithm until the algorithm converges. The essence of the algorithm is to minimize the cost function where n is the number of objects in a data set X, Xi $\in$

X, Ql is the mean of cluster l, and Yi l is an element of a partition matrix Yn x l as in (Hand 1981). d is a dissimilarity measure usually defined by the squared Euclidean distance.

There exist a few variants of the k-means algorithm which differ in selection of the initial k means, dissimilarity calculations and strategies to calculate cluster means. The sophisticated variants of the k-means algorithm include the well-known ISODATA algorithm and the fuzzy k-means algorithms.

h. Experimental Results
The NSE data set is applied with k-means algorithm for evaluation on training set. Distance-type of Clusters for k-means Data Objects is Euclidian Distance. The number of iterations is 17, within cluster sum of squared errors: 127.02034887051619. Missing values globally replaced with mean/mode The Number of generated clusters are 4 and elapsed time is 0.16 seconds. See fig 7.

i. Comparisons of various algorithms
Cobweb:
No of instances: 420
No of attributes: 6
No of merges: 76
No of splits: 71
No of clusters: 107
EM
No of clusters elected by cross validation:4
Cluster Instances: 4
Log likelihood: 14.01445
DBSCAN
Clustering data objects: 420
No of generated clusters: 21
Elapsed time: 3.97
Un clustered instances: 40
K-Means:
No of iterations: 4
Within cluster sum of squared errors: 539.34
Clustered instances: 0 372 89%
 1 48 11%

5. Conclusion

The main aim of this paper is to provide a detailed introduction of weka clustering algorithms.. It is the simplest tool for classify the data of various types. It is the first model to provide the graphical user interface of the user in order to performing the clusterization with the help of NSE data. It provides some features to analyze the NSE dataset for intraday trading with different clustering algorithms. Comparatively k-Means is the best because of simplicity and fastest than other algorithms that why k-means clustering algorithm is more suitable for stock market data mining applications. This paper shows only the clustering operations in the weka, further research can be performed using other data mining algorithms on Stock market data. In future, we can use various data mining algorithms like classification, association to produce good result by more records.

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