

Predicting stock dividend using neural network and decision tree and comparing them with voting technique

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ABSTRACT

Data mining is one of the developing sciences and it is very suitable for analyzing database. Data mining is used in many sciences, such as business intelligence, shopping basket analysis, and medicine. The main algorithms of data mining are 4 categories that 2 main categories are feature ranking and classification algorithms. In this study, we propose a method for predicting the dividend of market price using data mining technique. A new method has been provided for classifying the data, and then the accuracy of each method has been achieved by implementing the above approach on a database with 371 companies in different industries and obtaining the precision of each model according to the inputs. We used stock data to apply this research, and based on the approach, we predicted the rate of change in the companies' dividends in 2015 according to the data of companies. The results indicated the high accuracy and high speed of the proposed approach.

1. Introduction

Development and investment opportunities are one of the factors that investors consider along with other stock valuation criteria such as higher dividend, free cash flows and risk of stocks. The emergence of capital markets has been increased quickly in the country by the continued development of the economy of society. Today, investing in stocks forms an important part of the economy of society. That is why predicting stock price is so important for shareholders to get the highest return from their investment. The main goal of investors from investing in corporate stocks is to increase wealth, which is achieved through the stock return. Therefore, evaluating the stock returns of different companies is the most important issue that investors face in the capital market (Karbassi Najafabadi, Ali and Morteza Saberi Kamar Poshti, 2016).

Undoubtedly, investment in the stock exchange forms an important part of the whole economy of the country and undoubtedly, most of the capital is exchanged through stock markets around the world, and the national economy is severely affected by the performance of stock market. In recent years, world's financial markets have always faced significant volatility and uncertainty, in a way that uncertainty in relation to return on invested assets has concerned many investors and financial analysts (Aghdaie, 2014).

As investors state, uncertainty is the most important factor in pricing any financial asset. Many studies have been conducted about dividend in the stock exchange and the prediction of these dividends has a great importance for next years. Using profitability of the company in previous years is effective in predicting dividends but it is not very effective and regression methods cannot accurately determine the increase or decrease of profitability (Hosseini Bamakan, 2014).

In this research, stock data are classified using data mining algorithms and then, the results are evaluated using voting technique to obtain the most stock accuracy with the most profit.

1.1. Neural network

The neural network consists of a network of simple processing elements (neurons), which can show a determined overall complex behavior of the relationship between the processing elements and element parameters. The main source and inspiration for this technique is derived from testing the central nervous system and neurons (axons, multiple branches of the nerve cells, and contact sites of two nerves), which forms one of the most remarkable elements of the nervous system's information processing. In a neural network model, simple nodes (neurons) are connected to form a network of nodes that is why it is called neural networks. While a neural network should not be compatible by itself, its practical use is possible through algorithms designed to change the weight of communications in the network (to produce the considered signal).

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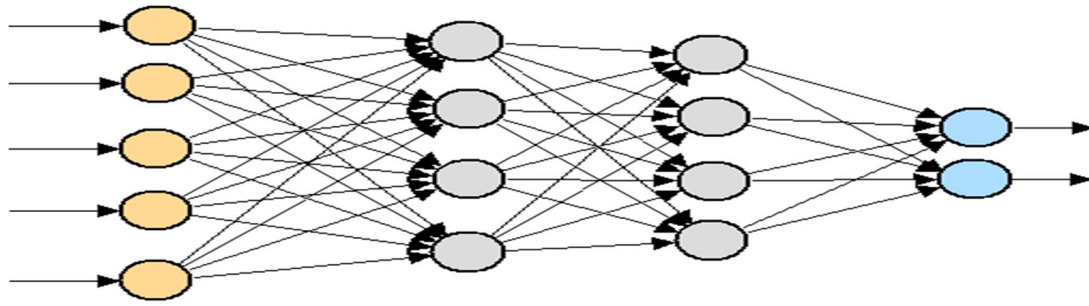


Figure 1. Deep neural network structure for predicting market dividends

Neural networks are widely used in recognizing patterns because they are capable of responding to unexpected inputs generally. During the making of neurons, they learn how to detect different specific patterns. If a pattern is accepted while the input is not related to the output during execution, the neuron chooses from a set of patterns that previously learned output that resembles the pattern and has the least difference with the input. This procedure is generally called (Yousefi Ramandi, Hadi, 2009).

1.2. Decision tree

A decision tree is usually composed of four parts of the root, the branch, the node, and the leaf. The nodes are marked with a circle, and the branches represent the connection between the nodes. For drawing the decision tree to be done easier, it is usually drawn from left to right or from top to bottom, so that the root (first node) is placed above. The end of a chain is called the leaf. Each node is related to a certain attribute, and branches mean a range of values that provide different parts of the set of certain values of attributes to the user. The branching operation is performed by one of the predictor variables, the branching ranges are chosen to minimize the sum of the squared deviations from a tree model for M average of the data of each node. (Afsaneh Soroush, Mohammad Aghlaghi, 2017)

Decision trees are a way for showing a series of rules that lead to a class or value. For example, in the proposed method, we want to determine the profitability or loss of a company's stock through its properties. Figure (2) shows a decision tree that solves this problem and all the basic components of a decision tree are shown in it: decision node, branches, and leaves. In the proposed method, J48 algorithm is used to construct the decision tree. The most important part of the J48 algorithm is the process of creating an initial decision tree from a set of training examples (Niloufar Tavassoli, 2015).

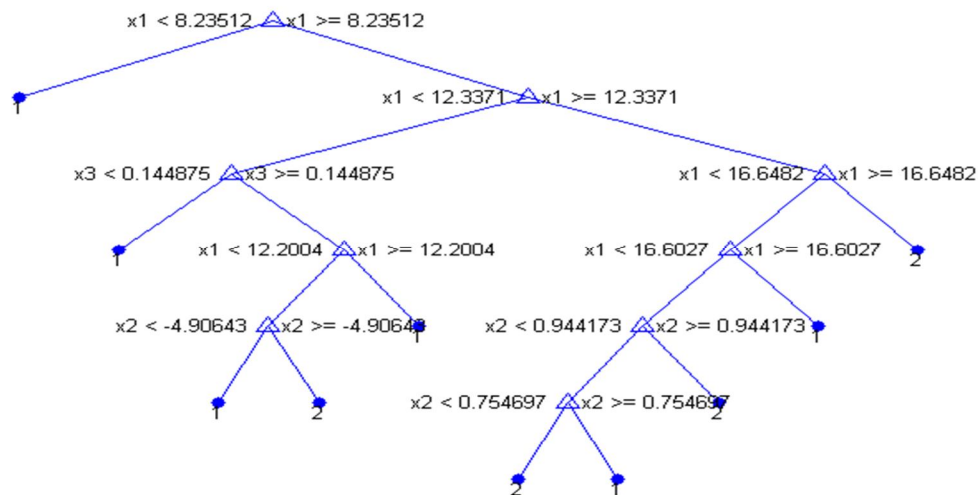


Figure 2. Decision tree created to detect profit and loss in the proposed method

1.3. Data analysis and implementation

The step of data preprocessing is the first step in the proposed method and is used to prepare the database for processing in next steps. This step contains a set of operations to normalize the features. Data normalization is performed using Formula 1 (Jandaghi, 2014):

$$\vec{N}_i = \frac{\vec{x} - \min(\vec{x})}{\max(\vec{x}) - \min(\vec{x})} \quad 1$$

In the above equation, X is the feature vector for different data samples and N is the normalized vector of features. Min and max are the search functions of minimum and maximum value in the input vector.

Two different algorithms are used to classify the features and predicting the profit and loss after the preprocessing operation. The proposed model has been implemented and tested in the MATLAB software environment. The database used to increase the accuracy of the test results repeats the tests 20 times. It should be noted that the selection of training and test samples is random and uniform. The Tehran Stock Exchange database has been used to evaluate the results from extracting feature by the proposed method. Figure 3 shows the graph of neural network convergence and Figure 4 shows the graph of neural network regression in 20 replicates of test.

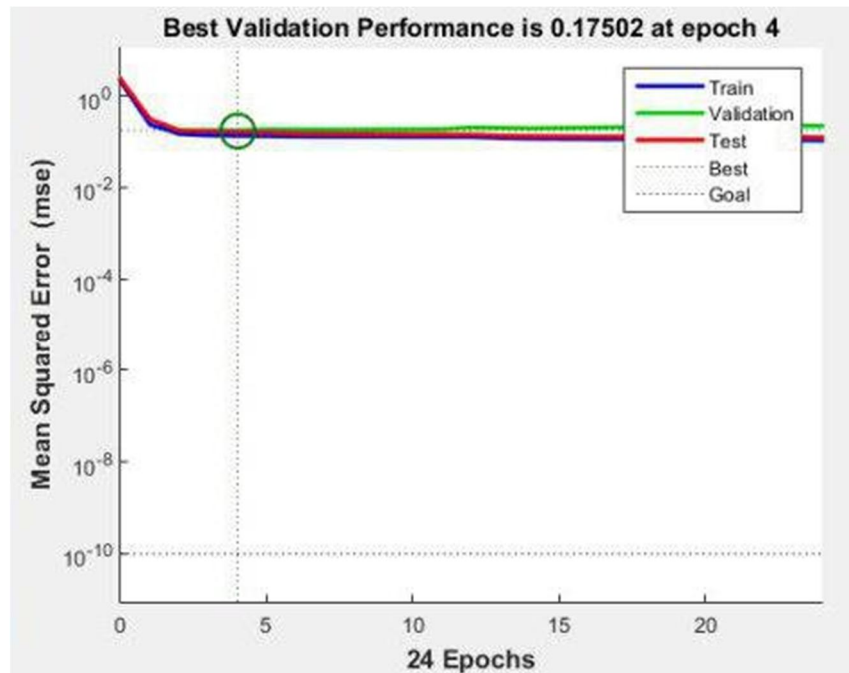


Figure 3. Graph of neural network convergence

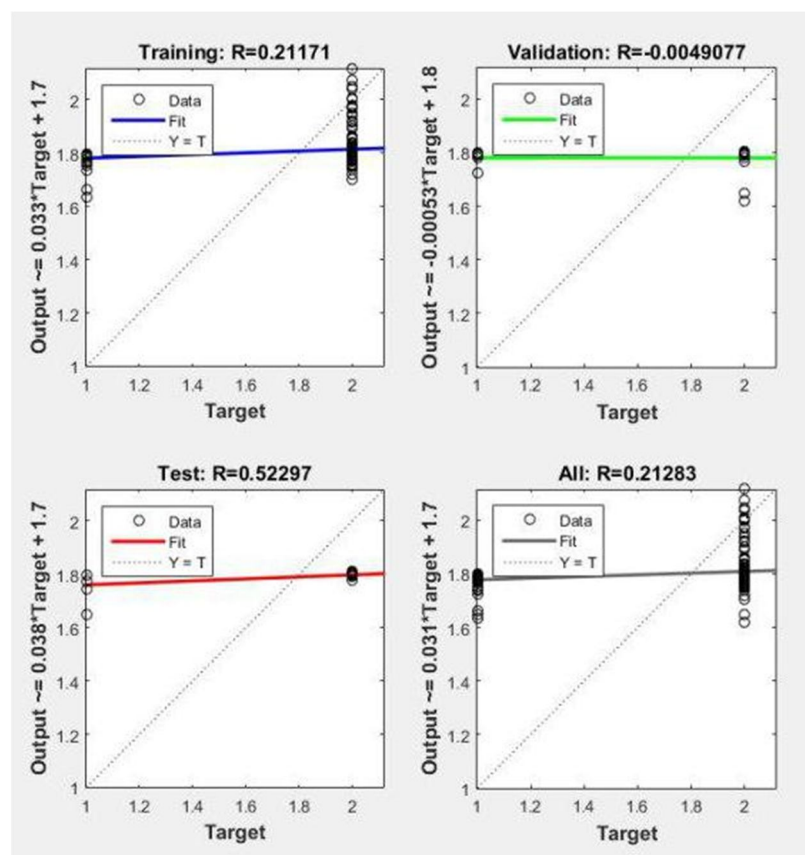


Figure 4. graph of neural network regression

The results of predicting each of the algorithms used in the proposed model are presented in Tables 1 and 2.

Table 1. Summary of the results of predicting each of the algorithms used in the proposed model

SD	Maximum accuracy	Minimum accuracy	Average accuracy	Title
1.153	100	96.63	98.88	neural network
0.7025	100	97.75	99.39	Tree decision
0.5292	100	97.75	99.44	Proposed model of voting

Table 2. Comparison of the results of each algorithm used in the proposed model

Accuracy	sensitivity	specificity	Title
98.87%	0.9700	0.9926	neural network
99.39%	0.9986	0.9899	Tree decision
99.43%	0.9966	0.9939	Proposed model of voting

The results shown in Table 1 and Table 2 show that the proposed method has a more limited change range in addition to higher average accuracy over different replicates.

2. Conclusion

MATLAB software has been used for implementing the proposed method and the limitation of the range of accuracy changes of an algorithm in its different replicates is considered an advantage. By limiting the range of accuracy changes in an algorithm, its reliability will also increase. This rate of changes and the average accuracy has been used for the algorithms in 20 replicates of test. The results of these tests show that the proposed method has better accuracy in predicting profit and loss compared to the algorithms discussed in this research using the voting technique.

It is suggested that the performance of the proposed system to be examined using other similar databases. In future studies, it can improve the accuracy of the proposed method in predicting profit and loss by testing other classification algorithms. Suggested solution can be used for other applications such as diagnosis of diseases based on medical information. It is suggested to use clustering algorithms such as differential clustering or hierarchical clustering for the development of current research.

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