

Identifying and measuring information content of financial statements in audit reporting adjustment

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Abstract

Making economic decisions and allocating resources optimally without the presence of valid and reliable data is not possible. Capital flows towards superior economic activities when capitalist decisions rely on timely, relevant and reliable information. In this regard, auditing plays a vital role in determining the validity of information; in other words, given the accountability requiring the presence of valid and reliable data, it can be stated that auditing is one of the fundamental accountability processes. In the current research, an optimum prediction method for independent auditor's report types is selected and two approaches of the J48 algorithm and random forest are compared. This research has been conducted on 84 corporates during 2008-2017. In order to train, test and investigate the research variables, Weka software was used. The dependent variable is the auditor's report type. Results indicated that the accuracy of the J48 algorithm has been 72.61% and 60.42% in training and test sections, respectively and the accuracy of the random forest has been 94.57% and 63.09% in training and test sections, respectively; so, the random forest model is more effective.

Keywords: Auditor's report type, J48 algorithm, random forest
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1 Introduction

Accounting as a data system gives valuable financial information to capitalists, creditors and other users and it has always discussed what content the accounting information has for the users. Some changes in capital market theory were traced to the 1960s when the research on information content and the selection of appropriate accounting methods were considered. According to a view in accounting theory, the observance of market reaction to accounting variables, the guidance of accounting data content evaluation and the selection of a better criterion was given to the accounting theorists in order to predict the business events [4].

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2 Research Background

2.1 External background

A sample consisting of 530 English and Irish corporates was used and a model was developed to determine the conditional accounting comments, which was evaluated by a curve in relation to the operational properties of receivers and wrong classification costs. It was concluded that using the mental preferences of auditors are sufficient to evaluate the model performance based on performance criteria [10].

Efstathios et al. [5] applied three data mining methods including multilayer perceptron, decision tree and Bayesian network using a sample of 450 English and Irish corporates to classify the comments of auditors. Results indicated the higher performance of the Bayesian network as compared to the others.

In research, Gaganis et al. [6] addressed the potential of probable neural network method using a model of 881 English corporates during 1997-2004 in developing a model to predict the comments of auditors and results showed the power of the desired model by the means of probable neural network method. Also, findings indicated that the method is more appropriate than artificial neural networks and logistic regression.

In research, Gaganis et al. [7] investigated the efficiency of the nearest neighborhood to develop models for estimating the comments of auditors as compared to logistic and linear differentiation analysis. The sample consisted of 5276 observations. It was shown that the nearest neighborhood was more effective.

2.2 Internal background

Hasas Yegane et al. [8] compared the prediction of independent auditor's reports in Iran with two approaches of neural network and probable neural network. In this respect, data related to the corporates in Tehran Stock Exchange were used during 2003-2010. Results indicated that the accuracy of the probable neural network is more than the other one.

Bagherpor Valashani et al. [2] addressed the prediction of independent auditor's reports in Iran using data mining approaches including decision trees and artificial neural networks and data related to the corporates in the Tehran Stock Exchange in 2003-2009. Results indicated that the accuracy of the decision tree was more than the others.

Barkhordarian et al. [3] considered the prediction of conditional auditor comments using a multilayer neural perceptron network and decision tree. In this study, the power of two models in predicting the comments was addressed. With respect to the research purpose, three hypotheses have been presented. H_1 investigates the power of a multilayer neural perceptron network, H_2 regarded the power of the CART decision tree in predicting the comments of an auditor and finally, H_3 compared the results of two models. The statistical population involved financial statements of 898 corporates in the Tehran Stock Exchange in 2005-2009. Sampling was performed by a systematic removal method and financial ratios were considered as research variables. Finally, two mentioned models have been analyzed. Research findings indicated that the multilayer neural perceptron network is able to predict the comments of auditors with a validity of 70% showing the high capability of the model. Also, the CART decision tree could predict the comments with a precision of 70%. In two modes, results indicate the high power of models so that H_1 and H_2 are confirmed. This enables the beneficiaries to predict the comments using the models. Thus, there is no significant difference between the two models and H_3 is rejected.

3 Case Study

Financial information is the main requirement for making economic decisions. On the other hand, accountability in government and private business units is discussed. Decisions are made in a variety of fields such as allocation of budget, and economic development. Therefore, it can be stated that without valid financial information, correct decisions are not possible. Financial units provide different reports and the most important one is a financial statement which is the common language for conveying financial information to the units outside. Thus, it is expected to meet their information needs. In terms of the users outside the corporate referring to those who have no statements for qualitative and quantitative aspects, there are some limitations. Then, they use the services supplied by independent auditors. So, auditors are an inevitable part of financial reporting and play an important role in judging and making decisions by validating the information of financial statements based on a coded systematic process. Since the auditors extract their reports based on auditing methods and standards not necessarily scientific models, the major problem is the determination of effective elements scientifically in exploratory research and its relation to the comment types, which is done by auditors based on the extracted problems but so far the elements considered in a range of studies were financial leverage, profitability and capital structure. In this respect, the following elements are first discussed:

a) Effective elements in auditor's report type

Financial leverage

Receiving a loan looks like a double-edged sword; if it is received and used timely, it will lead to increased sales. Otherwise, the corporate will face serious risk and financial leverage acts as a monitor of the corporate situation for paying back the loans basically, the auditing report cannot be accepted due to high leverage and inability to pay back the debts.

Profitability

Profitability criteria express the effects of liquidity, assets and debt management in a business unit. Totally, the outcome of all the business strategies is shown by profitability. As well, the continuity of activity is based on the probability of corporate assets; consequently, it is a suitable index to predict financial crisis and bankruptcy and perhaps, unacceptable auditing reports.

Capital structure

Considering the increase and development of markets followed by sale growth and expanding the business unit activities, new financial resources are required, not necessarily provided by shareholders or internal sources and they must be provided by external sources like loans and stocks. A low equity-to-asset ratio means so much reliance on debts to provide the required financial resources, which have advantages and risks; on one hand, it is of tax advantages and on the other hand, the increased financial risk leads to corporate bankruptcy. It directly affects the auditing report type.

Performance

Performance criteria indicate how to apply the assets in creating income and profit. Corporates with good performance have high-profit stability. It causes the improvement of financial reporting quality followed by the reduced probability of unacceptable reports. On the other hand, corporates with weak performance seek to conceal the performance results; which leads to the increased probability of unacceptable reports.

Liquidity

Liquidity criteria show the corporate ability in short-term commitments. In other words, liquidity is a relationship between cash given to the corporate for a short period and cash needed by the corporate [1].

Bankruptcy risk

Corporate bankruptcy leads to the loss of resources and investment opportunities. Corporates with financial crises followed by an increased probability of bankruptcy are more likely to receive unacceptable auditing reports as compared to others.

Corporate governance

Corporate governance is a set of mechanisms to control inside and outside the corporate and determines how and who manages the corporate. It encourages the efficient use of resources and plays an assistant role in managing the resources while keeping the social, economic, individual and collective goals balanced.

Profit management

Profit management occurs when the management inserts personal judgments in preparing the financial reports and tries to deceive the stockholders by mock transactions. Managers try to mislead the users of financial statements for some reason. For example, if the managers' rewards depend on their performance, management incentives to achieve more rewards will be stronger. More common methods used by managers are the change of accounting methods, assets sale, long-term investments, change of business operations and accrual accounts in order to manage the profit.

Corporate size

As the corporate is larger, the number of supervisory contracts and corporate governance increase. Thus, auditors are more accurate in presenting auditing reports.

Other elements related to auditor's report

It has been recognized that the financial ratios of corporates in an industry tend to be the average values due to competitive forces. It means that industry averages indicate optimum operational structures. Therefore, industry type as an effective factor in corporate performance can be used in predicting the report type. Corporates with more experience in preparing financial statements and those in the stock exchange have high-quality financial reporting due to the stock exchange regulations.

This research aims to gather the effective elements through a comprehensive study of articles at the national and international levels as well as the experts' comments and afterwards, determine the most effective ones and most suitable methods to predict the auditing report type.

4 Research Methodology

The researcher must select a suitable research method by specifying and regulating a research topic. The research method is data-driven with respect to data mining nature. In order to direct the data mining analysis systematically, a general process should be followed like CRISP-DM.

CRISP-DM: It is a standard industrial process involving 6 stages for a data mining study. This process is widely used in industries. 6 stages include 1) recognition of the business, 2) recognition of data, 3) preparation of data, 4) modelling, 5) model evaluation and 6) model development.

4.1 Research population

The population includes all the elements and people existing on a geographical scale with one or more common features. Population involves the corporates in Tehran Stock Exchange from 2008-2017.

4.2 Sampling method

A systematic removal method or screening has been used for sampling and regarding the limitations, the sample volume is 84 corporates (Table 1).

Table 1: Selection of research statistical samples

Description	No.	Sum
Corporates accepted in Stock Exchange in late 2017	435	
Corporates left Stock Exchange.	122	
Corporates entered Stock Exchange.	103	
Corporates with no ending in 12/29 fiscal year.	32	
Corporates are classified as investors, banks and dealers.	48	
Corporates had changes in fiscal year.	12	
Corporates had stopped transactions.	9	
Corporates had no sufficient data to achieve research variables.	25	
Total of sample corporates	84	

4.3 Research variables

X1: Auditor's report (1 for acceptable and 0 for unacceptable)

X2: Size of the board of directors. A Board of directors with more managers cannot be useful for the corporate and is accompanied by lots of costs. It seems that a larger board of directors leads to improve supervisory and effectiveness but it may affect the quality of relationships in the corporate.

X3: Unemployed members. An unemployed manager is a part-time member of the board of directors and has no executive responsibilities. According to Article 1 in the Corporate Governance Regulations draft, most members should be unemployed in the stock corporates.

X4: Independence of board of directors. It refers to the number of employed and unemployed members on the board of directors.

X5: Auditor type (1 for government auditor and 0 for non-government auditor).

X6: Cash in banks. The cash to debts ratio indicates the corporate ability to pay back short-term debts with cash assets.

X7: Current debt; Debt to total assets ratio.

X8: Current assets; market assets to net earnings ratio.

X9: Net fixed assets.

X10: Sum of total assets.

X11: Profit and loss after tax deduction; profit after tax and interests to assets ratio.

X12: Sum of earnings.

X13: Incurrent debts.

X14: Equity; equity to assets ratio.

X15: Financial costs.

X16: Profit and loss before tax deduction; profit before interests and tax deduction to assets ratio.

X17: Operational profit and loss.

X18: Cash balance.

X19: Corporate size; natural logarithm of corporate assets.

5 Descriptive statistics

In this section, data have been analyzed through such indices as average, scattering, standard deviation and skewedness (Table 2).

Table 2: Descriptive statistics of research variables

Variables	Minimum	Maximum	Average	SD	Skewedness
Comment type	0	1	0.51	0.5	-0.02
Members of board of directors	3	5	4.20	0.001	0.14
Unemployed members	3	4	3.45	0.005	0.25
Independence of board of directors	0.6	0.8	0.65	0.23	-0.49
Auditor	0	1	0.26	0.44	1.08
Cash in bank	147	6783317	185400.51	619987.13	6.01
Sum of current debts	7978	150752864	320352686	1220396971	7.21
Sum of current assets	17026	116426401	2920766.01	116426401	7.33
Fixed net assets	3238	36378676	1087440.12	3559384.79	5.94
Sum of assets	36481	190731126	5187222.62	16890113.12	6.47
Profit and loss after tax	-7204976	15760512	457982.31	1747132.17	4.51
Sum of earnings	7330	257851151	4112204.97	16052440.24	9.40
Incurrent debts	0	23888735	347482.64	1649665.22	9.90
Sum of equity	-11623136	49326619	1636213.12	4855343.26	5.32
Financial cost	0	17194689	307021.11	1357512.79	7.54
Profit and loss before tax	-7204976	15760512	499152.91	1809831.85	4.43
Operational profit and loss	-5052189	16098952	617844.29	1931865.97	5.02
Cash remaining	222	5466988	160166.38	510862.37	5.67
Corporate size	10.10	18.45	13.82	1.38	0.70

6 Inferential statistics

6.1 J48 algorithm

One of the classification methods is the J48 algorithm which is a C4.5 decision tree written by Java. It is one of the generalizations of the ID3 algorithm which uses the gain ratio criterion to choose a specific property. It applies the post-pruning technique and accepts numerical data. It can be utilized for incomplete data with few changes. It selects a trait with maximum separation degree among classes and accordingly, it makes the decision tree. Creating a primary decision tree with a set of data is the most important part. Finally, the algorithm produces a classification in the form of a tree with two types of nodes. One node is a leaf specifying a class and one node is a decision testing a trait to produce a branch or sub-tree for an output. To make a similar tree, there is a regression to a subset from samples. This trend continues to include samples belonging to the same class. It stops when the number of samples is less than a specific limit [9].

Accuracy: It refers to the number of well-recognized samples to all the samples using the below equation:

$$TP + TN / (TP + TN + FP + FN).$$

The most important issue is to classify data correctly. When the percentage is more, the accuracy is more. Model accuracy is 72.61% and model error is 27.38%.

A series of evaluation criteria can be used to predict the error and evaluate the performance and algorithm when the variable is continuous. To enhance prediction accuracy, it is essential to have small values of criteria. Because the variable is nominal and the project is a classifying one, the error of predictors can be ignored.

TP Rate: It stands for true positive indicating the correct classification of data.

FT Rate: It stands for false positive indicating the wrong classification of samples.

Accuracy: It refers to the true ratio of samples in a class (the number of positive data) divided by the number of true positive samples + number of false positive samples: $TP / (TP + FP)$

Precision: It is based on prediction precision and indicates how much the classification can be relied on.

Recall: It is the number of true positive samples divided by true positive and false negative ones: $TP / (TP + FN)$

F-Measure: It is a combination of recall and precision criteria when the trait importance cannot be distinguished for both of them:

$$2 \times Precision \times Recall / (Precision + Recall).$$

Matthews's correlation coefficient (MCC): it is used in machine learning and was introduced as a quality criterion in 1975 (1= complete prediction):

$$mcc = TP \times TN - FP \times FN / \sqrt{(TP + FP)(TP + FN)(TN + FP)(TN + FN)}.$$

Receiver operating characteristic (ROC) graph: it is a way to review the efficiency of classes. With a larger number of classifications, the final efficiency of classification is assessed as more appropriate. ROC curves are two-dimensional; the true positive rate and false positive rate are drawn on the Y and X axes, respectively.

Confusion matrix: It shows the performance of classification algorithms with regard to a set of inputs in order to separate the types of classes. TN, FP, FN and TP concepts are as follows:

TN: It shows the number of records with negative true classes and their classification algorithm has been correctly recognized as negative.

FP: It shows the number of records with negative true classes and their classification algorithm has been wrongly recognized as positive.

FN: It shows the number of records with positive true classes and their classification algorithm has been wrongly recognized as negative.

TP: It shows the number of records with positive true classes and their classification algorithm has been correctly recognized as positive.

Data classification varies in different classes.

Class A: 314 samples have been classified correctly and 59 samples have been classified wrongly.

Class B: 235 samples have been classified correctly and 148 samples have been classified wrongly.

7 Evaluation criteria in training section

Table 3 has presented the evaluation criteria in the training section.

7.1 Graphic output of J48 algorithm

Fig. 1 has shown the graphic output of J48 algorithm.

In Fig. 1, the most important fields are X5, X14, X6, X9 and X8.

Table 3: Evaluation criteria in training section

classes	0	1
Accuracy	72.61	72.61
Precision	0.680	0.799
Recall	0.842	0.614
F-Measure	0.752	0.694
MCC	0.467	0.467
ROC	0.801	0.801

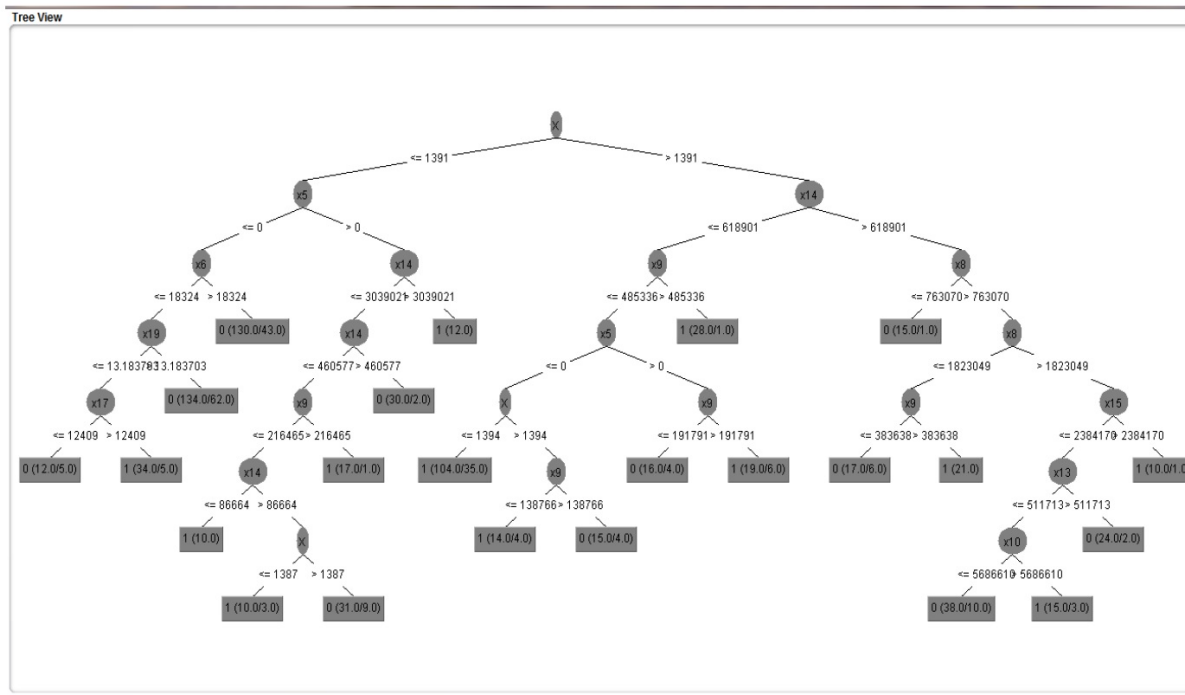


Figure 1: Graphic output of J48 algorithm

7.2 Analysis of decision tree

If X5 is equal to or smaller than 0 and X6 is larger than 18324, they are put in class 0 with 130 samples.

If X5 is equal to or smaller than 0, X6 is equal to or smaller than 18324 and X19 is larger than 13183703, they are put in class 0 with 134 samples.

If X5 is equal to or smaller than 0, X6 is equal to or smaller than 18324, X19 is equal to or smaller than 13183703 and X17 is larger than 12409, they are put in class 1 with 34 samples.

7.3 Evaluation of classification algorithms

7.3.1 Cross-validation method

$$K = 0$$

Assume that a data set is divided into two equal parts. Now, one of them is considered a training data set and a model is developed based on this set. Afterwards, the other set is used to evaluate the developed model. Now, the position of the two sets is changed. Thus, the first data set used for training and the second set used for evaluation is applied to train and develop a model, respectively. This method is called 2-fold cross-validation. If the operation is done k times instead of 2 times, k-fold cross-validation will be achieved. k is larger, more accurate and more comprehensive knowledge. Table 4 has indicated that out of 756 samples, 457 samples have been correctly classified and 299 samples have been wrongly classified. The model accuracy is 60.445 and the error is 39.55%. Other evaluation criteria were examined in this section.

Table 4: Evaluation criteria in test section

classes	0	1
Accuracy	60.44	60.44
Precision	0.587	0.627
Recall	0.670	0.540
F-Measure	0.626	0.581
MCC	0.212	0.212
ROC	0.618	0.618

7.3.2 Random forest algorithm

A random forest algorithm is a group algorithm with a set of decision trees. Classification accuracy of the random forest was considerable while developing a set of trees and voting among them to achieve a category with the most votes. The model involves several single-tree models. In Table 5, the model accuracy and error are 94.57 and 5.42%, respectively. Also, it presents other criteria in the training section.

Table 5: Evaluation criteria in training section

classes	0	1
Accuracy	94.57	94.57
Precision	0.944	0.948
Recall	0.946	0.945
F-Measure	0.945	0.946
MCC	0.892	0.892
ROC	0.988	0.988

7.4 Evaluation of classification algorithms

7.4.1 Cross-validation method

$$K = 10$$

Evaluation criteria in the test section have been presented in Table 6 and the model accuracy and error are 63.09 and 36.90%, respectively.

Table 6: Evaluation criteria in test section

classes	0	1
Accuracy	63.09	63.09
Precision	0.623	0.639
Recall	0.638	0.624
F-Measure	0.630	0.631
MCC	0.262	0.262
ROC	0.668	0.668

8 Conclusion

To develop and test the model in this paper, Weka software has been utilized and it was tried to achieve an efficient and effective model of auditor comment type determination by developing and comparing the resultant models of two data mining methods. The model performance has been assessed based on the observations of training and test samples. Results indicated that the accuracy of the J48 algorithm is 72.61% and 60.42% in training and test sections, respectively and the accuracy of the random forest algorithm is 94.57% and 63.09% in training and test sections, respectively so the random forest algorithm is more efficient. Research findings can be used by independent auditors, dependent auditors, investors, creditors, financial analysts, tax authorities, etc. Future researchers are recommended to use other data mining methods in order to predict the auditors' comments and apply the economic and nonfinancial variables in addition to financial ones.

8.1 Research limitations

1. Lack of easy and quick access to accurate classified information which can be converted into the required formats.
2. The data extracted from the corporate's financial statements have not been adjusted due to inflation. With the adjusted data, results may vary.
3. Not controlling some effective elements like political conditions, regulations, industry type, Barjam, etc. and the relations may be affected.

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