Original Research Article

J. Computing & Int. Systems (2024) 395–401

Journal of Computing and Intelligent Systems

Journal homepage: www.shcpub.edu.in

ISSN: 2456-9496

DECISION TREE ALGORITHM-BASED ENTERPRISE FINANCIAL AFFAIR CRISIS EARLY WARNING MODELING AND IMPLEMENTATION

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Received on 26 NOV 2024, Accepted on 14 DEC 2024

Abstract — Numerous aspects of the business process, in addition to the managers' management expertise and business quality, can lead to a financial crisis for the company. Thus, identifying and accurately forecasting financial affairs crises as early as possible is crucial for lowering business risks, safeguarding creditors' and investors' interests, monitoring publicly traded companies, and averting financial affairs crises by government agencies. The decision tree algorithm is an effective classifier that produces straightforward and intelligible classification results. Nevertheless, for some features, the decision tree approach is very sensitive to conditional attributes. Decision trees' categorization accuracy and evaluation rules' conciseness are significantly impacted by the presence of these characteristics. The issue of incorrect root node selection cannot be essentially resolved by pruning, although it will significantly increase the amount of computation. The decision trees algorithm is suggested in this study as a paradigm for early warning of enterprise financial affairs crises. The prevention of financial affairs crises, the protection of creditors' and investors' interests, the oversight of listed companies by government agencies, and the reduction of enterprise operation risk all depend on the ability to identify and accurately predict financial affairs crises as soon as possible.

Keywords - Decision trees algorithm, enterprise financial affairs crisis, early warning modeling

I. Introduction

An enterprise's value and goal are to increase economic wealth and achieve the ongoing appreciation of its assets using its financial resources. But not every business can be fortunate all the time. The company may encounter a financial crisis due to a variety of business process elements, as well as the managers' management expertise and business quality.[1] Another name for financial affairs crisis is financial affairs hardship.

In general, a financial affairs crisis is when an organization's financial status deteriorates as a result of business or decision-making errors that prevent it from repaying its debts. Bankruptcy is the worst.[2]

The existence of financial matters, Crisis is a gradual evolution process, most of which are premonitory, rather than an accident. In order to lower enterprise operation risk, safeguard the interests of creditors and investors, oversee listed companies by government agencies, and avoid financial affairs crises, it is crucial to identify and accurately forecast financial affairs crises as soon as possible.

Relevant businesses and management departments can identify issues early and take appropriate action to protect the interests of all parties by using the financial affairs crisis early warning system. For all parties involved, early warning of a financial crisis is crucial. Thus, how to anticipate possible financial crisis situations in businesses and make necessary improvements in time to prevent more significant losses has emerged as the top concern for investors and business managers.[3-4].

Although decision trees are an effective classifier with easily comprehensible classification results, their method is especially sensitive to conditional attributes with certain features. The presence of these characteristics has a significant impact on decision trees' categorization accuracy and evaluation rules' ease of use. We have demonstrated through the preceding study that the financial affairs index data of listed firms is the object of this decision trees method.

Prior to creating the decision trees, it is suggested in this paper to rate the relevance of the attributes. Then, some of the most crucial attributes will be chosen to create the decision trees, while the remaining attributes will be used as alternative attribute sets.

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By choosing samples using two different techniques and creating models for comparison analysis, this work aims to make some audacious attempts in this area. The first method makes use of complete sample data for modeling. Data from paired samples forms the basis of the second model.

II PRINCIPLE AND ALGORITHM OF DECISION TREES ALGORITHM

One of the most used inductive reasoning methods in data mining models is the decision tree. In empirical research, sample selection is crucial, and the validity of the research findings depends on how well the sample was chosen [7] The approach reduces the depth of the decision trees and speeds up classification by using the largest attribute as the branch selection attribute of each node. Consider the element e = 〈 V1, V2,..., VN > in e as an example, where VJ ∈ DJ, J = 1,2,..., N. Let e = (D1, D2,..., DN) be an N-dimensional space vector, where Dj is a finite collection of discrete symbols. Let e have two example sets, PE and NE, each of which is a positive example. ID3 is predicated on the following two assumptions, assuming that the sizes of the negative example set NE and the positive example set PE in vector space E are N and p, respectively:

The probability of positive and negative examples in vector space E is compatible with the classification probability of any example by a right decision tree; the expected information needed for a decision tree to correctly categorize an example is

$$I(p,n)=-\frac{p}{p+n}lb\left[\frac{p}{p+n}\right]-\frac{nn}{p+n}lb\left[\frac{n}{p+n}\right] \quad (1)$$

E is divided into V subsets if attribute A, which is considered the root of the decision trees, has V values. The expected information needed by subset Ei is I(pi,ni), assuming that there are pi positive and ni negative examples in Ei. The expected information needed by attribute A as the root is

$$I_E(A)=\sum_{i=1}\frac{p_i+n_i}{p+n}I(p_i,n_i) \quad (2)$$

Consequently, the knowledge gained with an as the root is

$$g(A)=I(p,n)-I_E(A) \quad (3)$$

The branch property is G (a), which is the largest attribute a. This technique provides a faster classification speed since it reduces the average depth of the decision trees that are produced. Practice, however, has shown that this criterion makes it simple to prioritize the qualities with higher values. Quinlan fixed this and suggested the information gain rate selection approach, which is described as

$$G(A)=g(A)/I_E(A) \quad (4)$$

The sample set is chosen from the decision trees based on the evaluation of each attribute value, hence reducing the degree of uncertainty. trees of decisions. The purpose of the decision tree algorithm is to extract rules or valuable information from vast amounts of data. The issues to be investigated should be foreseeable, even though we are unable to forecast the outcome of the decision tree method beforehand. Certain input column content kinds, predicted column content types, and modeling flags are supported by the decision trees algorithm. as shown in Table 1.

TABLE 1 TYPES AND TAGS OF DECISION TREES ALGORITHM

Enter the column Content type	Continuous, Cyclical、Discrete, Discretized,Key, Table and Ordered
Predictable column content type	Continuous, Cyclical、Discrete, Discretized, Table and Ordered
Modeling mark	MODEL EXISTENCE ONLY, NOT NULL and REGRESSOR

The financial affairs statement data of publicly traded corporations served as the study's data source. We may go on to the next phase of the data mining process, which is creating a data mining model, following the data preparation tasks mentioned above [8]. After decision trees are generated, pruning technology is frequently employed to address the over-fitting issue. After decision trees are generated, pruning technology is frequently employed to address the over-fitting issue.

Another significant factor that affects tree size, prediction accuracy, and computation quantity is pruning. It is in this application demand environment that Decision trees came into being and developed rapidly. Its presence offers a way to automatically and intelligently turn vast amounts of data into knowledge and information that is useful.

III EARLY WARNING MODEL AND METHOD OF ENTERPRISE FINANCIAL AFFAIRS CRISIS

There is currently no universally accepted definition of a financial affairs crisis, both domestically and internationally. The terms "financial affairs crisis," "financial affairs distress," "financial affairs failure," "bankruptcy," and so forth are used in existing international research on the notion of financial affairs crisis.

The notion of a financial affairs crisis can be studied by international researchers using two primary concepts. Businesses will experience different types of financial affairs crises during their development, but they are not always the result of financial affairs crises. The first is that businesses declare bankruptcy liquidation as a sign of a financial affairs crisis.

The majority of the studies that are now being conducted overseas are categorized based on whether or not the business is insolvent. The majority of them likewise employ the paired sampling technique when it comes to sample techniques. Because listed companies' financial concerns annual reports are readily available in China, Most studies use listed businesses as research samples because of the high degree of authenticity and accuracy of their annual report data [13].

IV. Using the Decision Trees Algorithm to Model the Early Warning of the Enterprise Financial Affairs Crisis

A. Enterprise Financial Affairs Early Warning Index System Selection Principle:

The suitability of the financial affairs early warning sign selection is crucial for creating a scientific and successful early warning model. The following are examples of early warning indications for financial affairs:

The following are the fundamental steps involved in creating a decision tree:

① At first, every record is regarded as a single node. ② Examine every segmentation technique for every variable to determine the optimal segmentation point. ③ divided into two nodes T1 and T2 ④ Steps 2-3 should be repeated for T1 and T2, respectively, until each node is sufficiently "pure". The optimal division measure is: Let denote the percentage of class I in a specific node T.

Occasionally, we represent the proportion using ki instead of node T. The decision trees provide each branch's predicted classification at the leaf node.

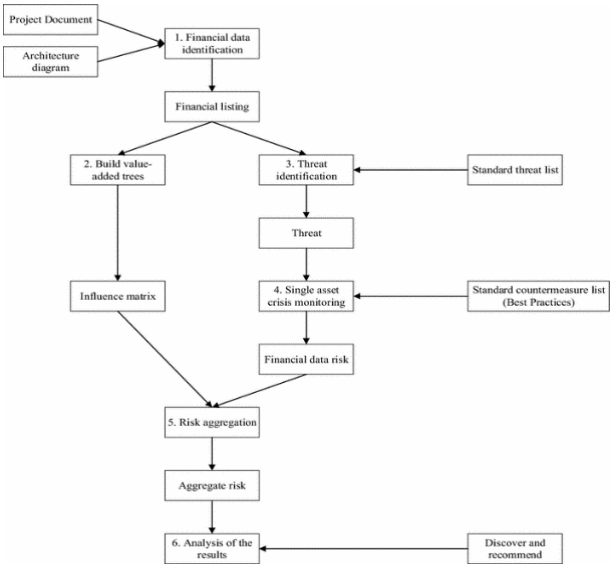

Fig.1 Decision trees prediction results

Any node's class distribution in the two types of issues can be expressed as (ko,k1), where k1 = 1k0. The degree of impure child nodes following a partition is typically used to determine the optimal partition. The class distribution is more slanted the lower the degree of impurity. Among the indicators of impureness are:

$$Entropy(t) = -\sum_{i=0}^{n-1} k(i|t) \log_2 k(i|t) \quad (5)$$

$$Gini(t) = 1 - \left[k(i|t)\right]^2 \quad (6)$$

$$Classification\ error\ t = 1 - \max_i \left[k\ i|t\right] \quad (7)$$

The accuracy of the final classification is not significantly affected by formulas. The entropy formula is typically used in shopping malls.

The enterprise financial affairs early warning indicator system is made up of a number of early warning indicators of different enterprise finance elements and their intricate and wide-ranging relationships. The financial affairs early warning index system is an organic synthesis of the many indices rather than a mere aggregation of them. When choosing the practicality principle. The job of early warning must be fulfilled by the current early warning system.

The principle of advance. In other words, the chosen indicators should change before the real financial affairs condition, which is the main focus of financial affairs early warning, fluctuates.
There is an important principle. We should understand the primary inconsistencies and facets of managing enterprise financial affairs, be mindful of cost-effectiveness criteria, and avoid having too many early warning signs.
The principle of sensitivity. In other words, the primary goal of enterprise financial affairs early warning is to sensitively portray the key elements of enterprise financial affairs state, which is what the chosen indicators can do [14]. early warning indications for financial affairs, the following guidelines should be adhered to.

B. Create an enterprise financial affairs crisis early warning model.

The selection of system independent variables and the determination of system samples are the foundation and premise of developing a financial affairs early-warning model, and they must be resolved before we can create an enterprise financial affairs early-warning model and conduct empirical analysis. Since there are numerous varieties of financial affairs indicators, choosing different financial affairs indicators might lead to subjectivity and relevance issues in financial affairs analysis and research. These are the ratios of non-performing assets, interest-bearing obligations, contingent liabilities, and technology inputs, in that order. Table 2 displays the remaining financial affairs indicators.

The purpose of the decision tree algorithm is to extract rules or valuable information from vast amounts of data. The problems foresee the outcomes of the decision trees method beforehand. It is evident from the earlier research that the financial affairs index data of listed businesses is the target of this decision trees algorithm.

Index type	Variable	Name
Profitability	X1	Rate of Return on Common Stockholders' Equity
	X2	Rate of return on total assets
	X3	Operating profit rate
	X4	Cash guarantee multiple
Asset quality	X5	Turnover of total assets
	X6	Receivable turnover ratio
	X7	Current assets turnover
	X8	Cash recovery rate
Debt risk	X9	Asset-liability ratio
	X10	Earned interest multiple
	X11	Quick ratio
	X12	Cash current liability ratio
Operating additional books	X13	Sales growth rate
	X14	Capital preservation and appreciation rate
	X15	Sales profit growth rate
	X16	Total assets growth rate

In empirical research, sample selection is crucial, and the validity of the research findings is determined by how well the sample was chosen. When choosing matching samples for the financial affairs crisis prediction element, Chinese researchers typically refer to international practices, i.e., choosing matching samples based on the asset magnitude of the organization. The financial affairs statement data of publicly traded corporations served as the study's data source. The following three factors provide the original data for listed firms' financial affairs indicators. ① Securities Star ② Database for Research ③ The aforementioned three platforms provide access to the annual reports of listed companies from the previous year.

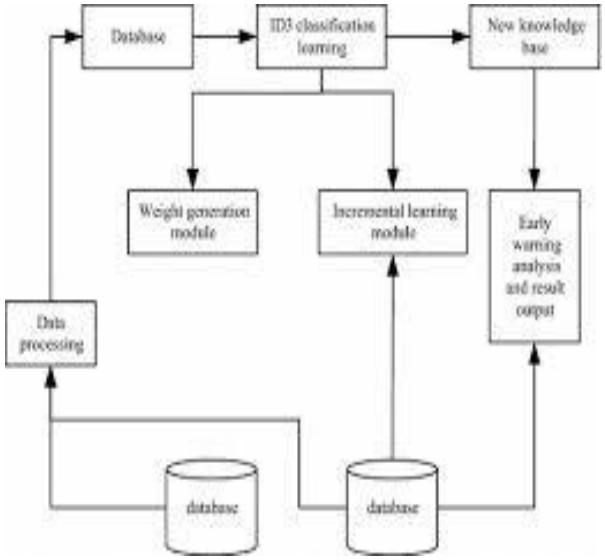

Fig.2 Structure diagram of enterprise financial affairs early warning model based on Decision trees algorithm.

The mining accuracy chart in the information column is chosen by the decision trees algorithm employed in this work. The accuracy of the early warning model can be tested using 60 groups of test sample data, yielding the classification matrix of results displayed in Table 3.

TABLE 3: PREDICTION RESULTS CLASSIFICATION MATRIX

Reality	**financial affairs crisis enterprise**	**financial affairs crisis enterprise**	**financial affairsly unstable enterprises**	**financial affairsly stable enterprise**
financial affairs crisis enterprise	15	0	2	1
financial affairs crisis enterprise	0	10	0	0
financial affairsly unstable enterprises	2	5	8	2
financial affairsly stable enterprise	0	2	5	8
Afinancial affairs crisis enterprisecc uracy rate	93%	61.8%	61.2%	84.9%

Based on the predicted outcomes, this study classifies the financial affairs crisis using the F score model in conjunction with ST classification. The early warning model is trained and generated using a data mining algorithm, resulting in multi-classified early warning results.

V. CONCLUSIONS

Businesses now face more financial affairs risks as global economic integration continues to grow. Businesses will experience different types of financial affairs crises during their development, but they are not always the result of financial affairs crises. The first is that businesses declare bankruptcy liquidation as a sign of a financial affairs crisis. Although it provides a tool for financial crisis prediction, the financial affairs crisis early warning model is not entirely reliable. We must also thoroughly examine the internal and external aspects of the business's operations and production in order to accurately determine whether the company is experiencing a financial crisis. Additionally, we must thoroughly examine the external and internal aspects of the business's operations and production. The early warning model for financial affairs crises is unable to predict many of the factors that led to the company's financial problem. Using a few financial affairs indicators and the decision trees method described in this paper, we may rapidly assess a company's financial health. A corporation that is deemed to be in a bad financial affairs scenario following a decision does not necessarily warrant further investigation and analysis, which is why the Decision Trees early warning model is important. The majority of studies in China employ listed companies as research samples because it is simple to access the financial affairs annual reports of these companies and because the data in these reports is very accurate and legitimate.

REFERENCES

[1] Zhao Zhifan, Wang Shimin, Cao Qian. Research on Multi- classification Early Warning of financial affairs Crisis Based on Data Mining. China Management Information Technology, vol. 000, no. 11, pp. 6-7, 2016.

[2] Yang Yunyi, Sun Zhonghe, Lu Jing. Research on financial affairs risk early warning model based on Z-Score index Decision trees. Modern Management, vol. 7, no. 5, pp. 9-10, 2017.

[3] Song Yu, Li Hongxi. Research on financial affairs Early Warning of Bond Issuing Enterprises Based on Decision trees Integration. Finance and Accounting Monthly, vol.

000, no. 6, pp. 6-9, 2020.

[4] Zhang Zhimin. Research on financial affairs Crisis Early Warning of Listed Companies. Cooperative Economy and Technology, vol. 000, no. 20, pp. 4-12, 2020.

[5] Song Yu, Li Hongxi. Research on financial affairs Early Warning of Bond Issuing Enterprises Based on Decision trees Integration. vol. 000, no. 6, pp. 45-50, 2021.

[6] Liu Yishuang, Chen Yiyun. Management Tone and Credit Risk Warning of Listed Companies——A Research Based on the Analysis of the Text Content of Company Annual Reports. Research in financial affairs Economics, vol. 33, no. 4, pp. 9-10, 2018.

[7] Ajay. P, Nagaraj. B, Ruihang Huang, "Deep Learning Techniques for Peer-to-Peer Physical Systems Based on Communication Networks", Journal of Control Science and Engineering, vol. 2022, Article ID 8013640, 12 pages, 2022. https://doi.org/10.1155/2022/8013640.

[8] Lin Sen, Guo Guizhen, Liu Beibei. Southern flood disaster assessment model of house damage based on gradient boosting Decision trees no. GBDT) algorithm. Catastrophe Science, vol. 35, no. 1, pp. 5-6, 2020.

[9] Peng Xidan, Luo Huaqing, Yuan Hongbo, et al. Research on Agreement Inventory Procurement Strategy Based on Decision trees Algorithm. Jiangxi Electric Power, vol. 042, no. 007, pp. 47-50, 2018.

[10] Peng San. Construction and Comparison of financial affairs Early Warning Models for Listed Manufacturing Companies——Based on ROC Curve Analysis. vol. 000, no. 5, pp. 95-98, 2021.

[11] Peng San. Construction and Comparison of financial affairs Early Warning Models for Listed Manufacturing Companies——Based on ROC Curve Analysis. Northern Economics and Trade, vol. 000,, no. 5pp. 5-6, 2019.

[12] P. Ajay, Ruihang Huang, "Wearable Sensor Data for Classification and Analysis of Functional Fitness Exercises Using Unsupervised Deep Learning Methodologies", Security and Communication Networks, vol. 2022, Article ID 8706784, 9 pages, 2022. https://doi.org/10.1155/2022/8706784.

[13] Li Xingchen, Wang Qinglong, Lin Guoqing. Comparative Study on financial affairs Early Warning Models of Listed Companies Based on Machine Learning Methods. Market Modernization, vol. 000, no. 7, pp. 3-4, 2020.

[14] Huang, R., Yang, X. and Ajay, P., 2023. Consensus mechanism for software-defined blockchain in internet of things. Internet of Things and Cyber-Physical Systems, 3, pp.52-60..