

# Data Mining of Enterprise Financial Management Based on AHP

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**Abstract.** With the rapid development of information technology, enterprises are increasingly dependent on information technology in the development process. In the process of production and operation, enterprises usually accumulate massive data, including internal cost data, investment data, financing data and asset allocation data, as well as external customer and supplier data. These two kinds of data are directly related to the financial management status and marketing planning means of enterprises. Taking data mining algorithm as an example, this paper introduces the categories of data mining algorithm. Then the application of data mining algorithm in enterprise financial management and marketing planning is described. Analytic hierarchy process (AHP) is a multi criteria decision-making method which combines qualitative and quantitative methods. It can express and deal with subjective judgment in quantitative form. In this paper, the analytic hierarchy process (AHP) is used to improve the data mining technology, and further broaden the types of data mining algorithm model. This method improves the efficiency and effectiveness of enterprise financial management, and provides corresponding reference for the development of enterprises.

**Keywords:** Analytic hierarchy process (AHP), Data Mining, Multi Criteria Decision, Enterprise Financial Management

## 1. Introduction

Economic development cannot be separated from the promotion of information technology, especially the development of enterprises. Many enterprises in our country (especially large-scale enterprises) have accumulated a lot of data in the process of long-term development. If these data are only stored in the database and not used, they will lose the significance of existence [1-2]. The emergence of data mining algorithms can dig out valuable and beneficial information from the massive data of enterprises [3]. Data mining algorithm is based on big data, through the establishment of mathematical model to analyze, classify and predict the data. The data processed by the algorithm can provide reference for the decision-making of enterprise management.

## 2. Main Data Mining Algorithms

The main functions of data mining algorithms include concept description, association rule analysis,



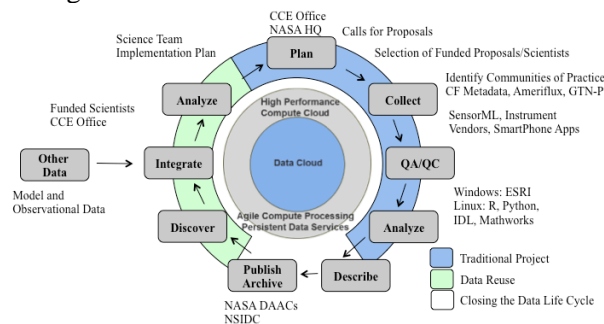
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classification and prediction, clustering analysis, anomaly analysis and trend analysis, evolution analysis, etc. Among them, classification and prediction are to classify similar data and predict some trends according to the characteristics of different types of data. Cluster analysis and classification have similarities, but they are different in essence [4-6]. Cluster analysis is to aggregate data of the same category, and this category is usually known. Anomaly analysis is mainly used in intrusion detection, abnormal data discovery and so on. It is mainly used in trend mining and trend analysis. The main data mining algorithms are as follows:

### 2.1 Clustering Algorithm

As the saying goes, "birds of a feather flock together, a group of people". Clustering is to classify the samples with similar characteristics into one group, while the samples without the same characteristics into another. We can think of clustering as a "measure of similarity", that is, the more similar things are, the more likely they are to be grouped into one group. The method of cluster analysis plays an important role in the development of enterprises. Usually, it can cluster the behavior characteristics of customers, cluster the customers with similar behavior, analyze their characteristics and carry out personalized marketing [7]. Data association diagram between financial management system and other external systems is shown in Figure 1.



**Figure 1** Data association diagram between financial management system and other external systems

### 2.2 Decision Tree Algorithm

Decision tree algorithm is a classification algorithm, it is a tree structure, it is mainly composed of four parts, namely root node and leaf node, non leaf node and branch. Each non leaf node represents a test on a characteristic attribute, and each branch represents the output of the characteristic attribute on a certain value domain, and each leaf node stores a category. The decision tree represents a kind of mapping between the object attribute and the object value. Each node of the tree represents the judgment condition of the object attribute, the branch represents the object meeting the node condition, and the leaf node represents the prediction result to which the object belongs. Thus, decision tree is an algorithm to classify objects according to conditions.

### 2.3 Association Rule Method

The so-called association reflects the knowledge of dependency and association between one event and other events. The most classic case of association rule algorithm is "beer and diaper". It tells us that American women will let their husbands buy diapers for their children after work. When they buy diapers, they usually buy some beer. A supermarket found this rule and put beer and diapers next to each other. Finally, the sales of beer and diapers have been greatly improved. It can be seen that the so-called association rule is a way to find the relationship between foods.

### 2.4 Genetic Algorithm

Genetic algorithm is a relatively complex data mining algorithm. According to the principle of "natural selection, survival of the fittest", genetic algorithm can be understood as a process of seeking the optimal solution. Each chromosome in the genetic algorithm corresponds to a solution in the

genetic algorithm. Generally, the applicability function is used to measure the merits and demerits of the solution. Therefore, a mapping is formed from the fitness of a genome to its solution.

To sum up, there are many kinds of data mining algorithms, many of which are more complex, but different algorithms have their own advantages and limitations, the more types of algorithms, the more ideas and methods to solve the problem.

### 3. The Principle and Steps of Analytic Hierarchy Process

#### 3.1 The Principle of Analytic Hierarchy Process

Analytic hierarchy process (AHP) is a qualitative and quantitative method. It can systematize, model and digitize the decision-maker's complex decision-making thinking process, and solve the multi-objective, multi-level and multi criteria decision-making problems. Especially for the determination of each evaluation index weight factor. The main ideas are as follows: 1) the various factors in complex problems are organized by dividing them into ordered levels; 2) quantitative expression of the relative importance of each level is given according to the judgment of certain objective reality; 3) the weight of expressing the relative importance order of all elements in each level is determined by mathematical method; 4) the problem is solved by analyzing the sorting results.

#### 3.2 Steps of Analytic Hierarchy Process

The process of AHP can be divided into the following steps:

1) Establish the hierarchical structure model. According to the nature of the problem and the goal to be achieved, the problem is divided into different components of meat, and according to the correlation between the factors and the subordinate relationship. A multi-level analysis structure model is formed by combining factors with different levels. The factors in the same level belong to the upper level or have influence on the upper level. At the same time, it also dominates the underlying factors or is affected by the underlying factors. It is mainly divided into the highest level, the middle level and the bottom layer. Among them, the highest level is the target layer, which indicates the purpose of solving problems. That is, the general goal of AHP. Intermediate layer: including the criteria layer and the indicator layer, which indicates the intermediate link involved in taking a certain scheme to achieve the predetermined overall goal. Bottom layer: it is the scheme layer, which indicates various measures, strategies and schemes to be selected to solve problems.

2) The judgment matrix is constructed. Any system analysis is based on certain data information. The data information basis of analytic hierarchy process (AHP) is mainly the judgment of the mutual importance of each element of each layer given by the decision maker, that is, the judgment matrix. The judgment matrix can express the relative importance of the relevant elements in the F-layer which is supported by a certain element in the upper layer. That is to say, the lower level factors are compared, which one is more important and how important is it. In order to make the decision-making judgment quantitative and form numerical judgment matrix, the 1-9 scale method recommended by A.L. Saaty is usually used.

**Table 1.** Financial Indicators

Category	Name	Number	Formula
Profitability indicators	Net sale profit	I11	Net sale profit / Sales revenue
	The total assets yield	I12	Net sale profit / Total assets
	Return on equity	I13	Net sale profit / Net assets
	Retained earnings to total assets ratio	I14	Undistributed profit / Total assets
Solvency indicators	Gearing ratio	I21	Total liabilities / total assets
	Interest coverage ratio	I22	(Net income + interest expenses + income) / Interest expense

3) Single sort in hierarchy. On the basis of the judgment matrix, the influence degree of a factor in a certain level on a factor in a higher level can be obtained by mathematical method, and the order of exclusion can be obtained. Because the judgment matrix itself has considerable error, and the weight value of each factor in the hierarchy but ranking is essentially the expression of qualitative concept, so approximate method can be used to solve the maximum eigenvalue and eigenvector of judgment matrix. TABLE 1. shows the financial indicators.

4) The eigenvalues and eigenvectors of the judgment matrix are obtained by the normal geometry method. Specific financial ratios are as follows:

Debt protection ratio = cash flow / total debt

Gearing ratio = total liabilities / total assets

Assets yield = net income / total assets

Figure 2 shows scree plot of each factor.

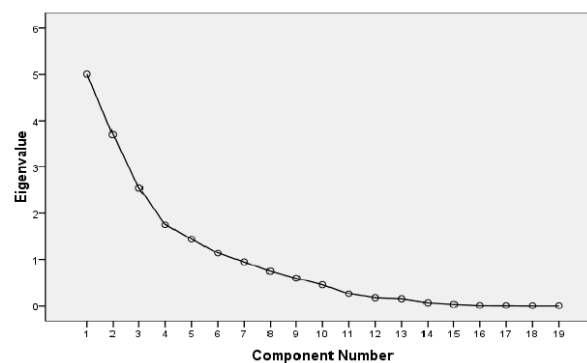


Figure 2 Scree Plot of Each Factor

#### 4. Application of Data Mining Algorithm in Enterprise Financial Management

##### 4.1 Shortcomings of Traditional Data Analysis Methods in Enterprise Financial Management

Enterprises have accumulated a large number of financial related data in the process of production and operation. If the traditional data processing and analysis methods are used, some financial statements and financial results in a certain period of time can only be simply generated. These statements can only reflect the financial management status of the enterprise in a period of time, and can not provide decision support for the financial management and production and operation of the enterprise. On the other hand, the traditional data processing methods do not have the hardware foundation to deal with the huge amount of data, so it is impossible to obtain and analyze the valuable data information from the massive data. At the same time, the traditional data processing can not connect with the data of multiple departments, resulting in the data of each department being isolated, and finally unable to get the connection between the data. In the long run, the financial data of enterprises can only be stored in the database for a long time, but can not provide help for the financial management of enterprises. Application status of data mining algorithm in enterprise financial management

The financial management of enterprises mainly includes financing management, investment management, cost management and asset structure management. If enterprises want to get good development, they must start from reducing production and operation costs and increasing income. Taking the production cost of enterprises as an example, enterprises can realize the dynamic real-time tracking and recording of data (including raw material data, inventory data, packaging data, product price, etc.) in the process of using data mining technology. After a period of time accumulated cost data can be used to analyze the relevant factors affecting the cost level by using association rule method, so that enterprise managers can have reasonable control over the cost. Enterprises in investment, financing or asset structure management is the same, enterprises can use the genetic algorithm in data mining to find the optimal allocation of assets according to the changes of external market data and internal business data, so that enterprises can make reasonable investment and

liabilities, so as to avoid excessive risks caused by poor capital management. Enterprises can also screen and analyze the financial data in the past, find the rules of financial data, so as to predict the financial management status and business success of enterprises in the future for a period of time, and can also find the problems in their financial management in time.

The emergence of data mining algorithm has eclipsed the traditional way of data processing, and the financial management of enterprises is related to the survival and development of enterprises. The application of data mining algorithms in financial management of enterprises can play an early warning role in financial risks of enterprises. Dynamic and continuous financial data record can make enterprise managers find the problems in enterprise financial management, so as to provide support for managers' decision-making.

#### *4.2 Application of Data Mining Algorithm in Marketing Planning*

With the continuous improvement of people's living standards, different groups often have different consumption needs. Through the algorithm of data mining, customers with similar consumption needs can be clustered, so as to provide personalized marketing and services for them. This can reduce the cost of marketing planning of enterprises, and avoid the adverse effects caused by a large number of blind marketing advertisements for customers. The foundation of precision marketing is to have a large number of relevant customer information. On the basis of mining and sorting out these information, we can find the characteristics of customers, so as to carry out effective marketing promotion and provide personalized products and services. The purpose of precision marketing is to reduce the marketing cost, improve the efficiency of marketing planning, and finally make higher profits for enterprises. Precision marketing is produced with the emergence of data mining technology. Traditional data processing technology can't do this. Using clustering analysis, decision tree and association analysis to find the consumption characteristics of customers, on this basis, we can make personalized service plans and Countermeasures for customers.

In addition to precision marketing, data mining algorithm is the most widely used in retail industry. The most classic is to use association rule algorithm to find relevant goods, and adjust the location of goods. By analyzing the consumer behavior of customers, we can infer which goods will be easier to buy together, which will greatly increase the sales of supermarkets.

#### *4.3 The Case of Data Mining Algorithm Applied to Marketing Planning*

The ultimate goal of precision marketing with big data is to find potential target customer groups, and subdivide the relevant target customer groups, so as to be able to cast their favor and make products accurately connect with suitable customers. The process of precision marketing is inseparable from the steps of data collection, data collation, data extraction and data classification. The successful cases of precision marketing in China include BYD Company in the automobile industry. Before going public, BYD automobile will understand the demand of potential customers for automobile products, the family status and family population of potential customers through the national service call center. And understand the feelings of these potential customers for the upcoming models, through the accurate positioning and division of potential customers, so as to carry out accurate advertising, and finally achieved good sales results. The credit card marketing of industrial bank is also a successful case of precision marketing. Through the consumption behavior of customer data in the bank, Industrial Bank classifies customers, so as to locate their credit card target customer groups, and carry out accurate advertising on these customers. In the end, these customers become credit card processors of industrial bank. This is the advantage of data mining algorithm.

## **5. Countermeasures and Suggestions**

### *5.1 Introduce Advanced Data Mining Technology Tools and Talents for Enterprises*

With the continuous progress of information technology, the traditional data processing tools and methods can no longer meet the business and development of enterprises, enterprises must seek

change in the road to obtain development and progress. This requires enterprises (especially large enterprises) to introduce advanced tools and talents of data mining technology, so that the data of enterprises can create value, not just occupy the memory of database.

### *5.2 Realize the Interconnection and Intercommunication of Enterprise Internal Data*

Each enterprise is composed of many departments, but fundamentally speaking, the enterprise is a whole, and the data information of each department should not be isolated from each other, which will only limit the development of the enterprise. Only by summing up the data of various departments, can enterprises see the development and operation status of enterprises in an all-round and multi angle way. On this basis, enterprises can use data mining algorithm to analyze and predict the relevant financial management and marketing data, and provide suggestions and help for the decision-making of the management.

### *5.3 Using Data Mining Technology to Customize Marketing Plan*

The original intention of using data mining technology to achieve precision marketing is good, but due to the different industry environment of different enterprises, precision marketing has different performance in different industries. In the process of operation and management, enterprises must carry out marketing investment according to their own industry conditions and the characteristics of customers, and customize marketing programs suitable for their own development.

## **6. Conclusion**

Data mining algorithm is based on big data, using mathematical model to analyze data. With the continuous development of China's economy, all walks of life have accumulated a large number of business management data. If these data are only stored in the database, it is meaningless. Only by using data mining algorithm, can we dig out the valuable data information for the development of enterprises in this massive data. This paper takes data mining algorithm as an example, through the brief introduction of data mining algorithm, analyzes that the mathematical model has a very important guiding significance for enterprise financial management and marketing planning. Only by grasping the trend of the times and actively using data mining algorithm can enterprises have a clear grasp of the risks and development direction of enterprises.

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