A Mining Algorithm for Relevance of Business Administration Based on Complex Social Information Network

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Abstract. With the rapid development of economy, the reform of business administration system in our country has changed the contents of business administration. Based on this, this paper analyzes the present situation of business administration in our country under the new situation, and advances an algorithm for mining the relevance of business administration based on complex social information network. Through collecting the characteristic behavior of business administration and integrating the structure of complex social information network, this paper analyzes the correlation parameters of business administration behavior. By using the basic idea of association rules mining and extending the traditional methods of co-word analysis and text clustering, a mining model of association rules based on topic keywords and abstract salient words is constructed, and combined with the econometric analysis of related business management behaviors in social information network and Web Science database, the steps of mining association of business management behaviors are optimized. Finally, the experiment proves that the algorithm of mining association of business management behaviors based on complex social information network is highly effective in the practical application and fully meets the research requirements.

Keywords: Social information network · Wireless network · Business administration · Relevance mining

1 Introduction

In the current environment of economic development, the management and law enforcement activities of industrial and commercial administration departments play a pivotal role in its economic operation and development. But many problems in its development can not be ignored. First of all, the business administration department lacks professional management personnel and is unable to perform management functions effectively [1]. Secondly, since China's reform and opening up, the pace of economic development is relatively rapid, industrial and commercial departments for its management, the lack of a sound management mechanism. In the concrete management behavior, because the system is imperfect, the local protectionism is widespread, causes its law enforcement dynamics to be weaker. In management, the lack of effective supervision of its

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internal control management [2]. Therefore, the industrial and commercial administration departments should pay more attention to the existing problems and take effective countermeasures in time. Under the current economic development environment, the business administration department of our country is not only facing the opportunity of development, but also facing the huge challenge. Therefore, it needs the business administration department, according to its concrete development present situation, to carry on the discussion of the solution, and proposes the optimization of the mining algorithm of the relevance of the business administration behavior based on the complex social information network, in order to carry on the effective consummation to the management method, thus promotes the comprehensive and stable development of the market economy of our country [3]. To solve the above problems, in order to promote the management effect realization, promote our country economy's long-run, the health, the stable development. Therefore, a mining algorithm of enterprise management relevance based on complex social information network is proposed. According to the characteristics of enterprise management behavior, H-P filter is used to analyze the trend of enterprise management behavior characteristics and estimate the characteristic components, so as to analyze the related parameters of enterprise management behavior. The association rule mining algorithm is used to statistically analyze the distribution of high-frequency keywords and the probability distribution of unexpected events in the process of enterprise management behavior, and the association rule mining model is constructed with subject keywords and abstract salient words. Combining social information network and database, the operation process of association mining enterprise management behavior is optimized.

2 Algorithm for Mining Association of Business Administration Behaviors

2.1 Feature Mining Algorithm for Business Administration

In order to ensure the effectiveness of the relational mining algorithm for business administration, firstly, the characteristics of business administration are mined, and the association relationship between business administration related parties is calculated based on the characteristics of business administration. Due to the strong concealment of the relativity of business administration characteristics of business administration, in the process of mining the characteristics of business administration, it is necessary to make a comprehensive analysis on the processes of surplus manipulation such as purchase and sale of commodities and transfer of assets [4]. Profit achieved through earnings manipulation in order to avoid losses and achieve listing purposes [4]. This paper studies and analyzes the relevant characteristics of the behavior characteristics of business administration. In this paper, H-P filter is used to decompose the trend of typical business management behavior characteristics, so as to explore the relevance of business management behavior characteristics. The principle of H-P filtering is to treat the trend value of the feature sample as the potential level, and then estimate the feature

component by minimizing the deviation between the true sequence and the trend value of the sample.

$$\min A_{x_e,t=1,2,\ldots,T} = \left\{ \sum_{i=1}^{T} (Y_i - X_t)^2 + \lambda\left[(X_{t+1} - X_i) - (X_t - X_{t-1})\right]^2 \right\} \quad (1)$$

Among them, y is the growth rate sequence of the characteristics of business administration, and x is the trend component of the growth rate, which is used to describe the long-term trend of the economic growth rate of a country over time, and is mainly determined by the basic characteristics of the economic development of that country. Parameter λ is the penalty factor of the fluctuation of the trend component, and the difference of t is the deviation of the variation of the trend component of the adjacent two periods. Command C = y − x, representing the feature components, if C and 2x are subject to independent congruent distributions, when $L = \mathrm{var(C)}/\mathrm{var(2x)}$ filtering can achieve a minimum. The trend component may be expressed as follows:

$$X_i = \left[1 + \lambda\left(1 - L^2\right)^2\left(1 - L^{-1}\right)^2\right] Y_t \min A_{x_e,t=1,2,\ldots,T} \quad (2)$$

$$C_2 = \frac{\lambda\left(X_i - L^2\right)^2\left(1 - L^{-1}\right)^2}{1 + \lambda\left(1 - L^2\right)^2\left(1 - L^{-1}\right)^2} Y_t \min A_{x_e,t=1,2,\ldots,T} \quad (3)$$

Based on the abovementioned algorithms, further advance the arrival of the modern economic era with business administration and features and categories as units, collect data, communicate information, share knowledge, transform knowledge into wisdom, realize knowledge innovation and business process reengineering of business administration, transform traditional business administration marketing strategies and production processes with knowledge management and knowledge commerce, build business administration into a learning, innovative and intelligent business administration, and enhance the core competitiveness of business administration [5]. According to the understanding of industrial and commercial administration, the characteristics of information behavior management are mainly reflected in the four-level model, which is shown as follows (Fig. 1):

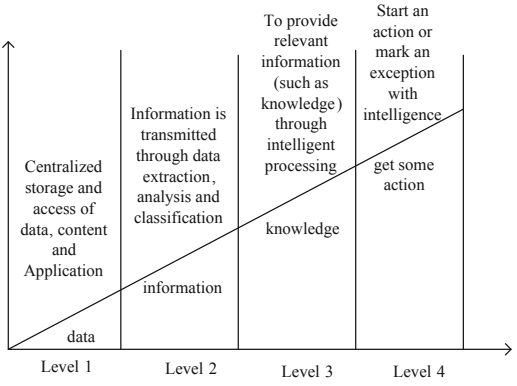

Fig. 1. Business administration information transmission maturity type

Facing the complex and changeable competitive environment, many business management can only make routine decisions, it is difficult to timely understand the abnormal situation and potential behavior management characteristics. At this point, business administration requires the use of appropriate intelligent software and social networks to assist policymakers in freeing them from duplicated efforts [6]. And set up customized rules, application scenarios, business needs and other ways to achieve the timely discovery of effective information, and automatically take necessary measures [7]. In the process of data feature mining, the data features are similar to the maturity model of business administration information transmission. The process of feature mining for business administration behavior management is a complete process composed of data collection, integration, analysis, application and decision-making, and several links. The main procedures and basic characteristics of competitive intelligence work of business administration are summarized, and different mining process models for the relevance of competitive intelligence features are constructed. The specific mining steps are shown in the figure below (Fig. 2).

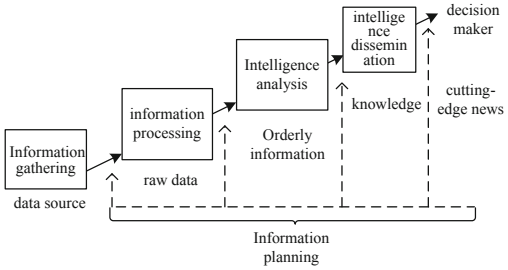

Fig. 2. Business administration behavior feature processing flow

It can be seen from the contrast graph that there is a main line of data-information-knowledge-wisdom in both the information transmission maturity model and the competitive intelligence processing process of business management to achieve the effect of business management.

2.2 Feature Association Algorithm for Business Administration

Based on the current status of research on the feature association of business administration behaviors, optimize the feature association algorithm of business administration behaviors based on the structure of social information network, and conduct statistical analysis on the distribution of high-frequency keywords and the probability distribution of emergent words in the process of business administration behaviors by combining statistical principles [8]. In the process of managing and mining the behavioral characteristics of business administration, it is necessary to comprehensively evaluate the change process of relevant data and information respectively, and realize the process of understanding from low level to high level. The higher the level is, the extension, depth, meaning, conceptualization and value are explored. The specific steps for mining

behavioral characteristics of business administration without business administration are shown in the following figure (Fig. 3).

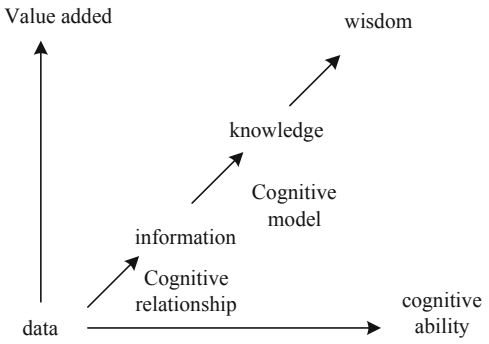

Fig. 3. Steps for mining characteristics of business administration behavior

The system framework of intelligent analysis of competitive intelligence of business administration based on data mining is to develop and implement intelligent activities in the environment of data mining, such as semantic organization of competitive intelligence of business administration, design of intelligent analysis strategy and method, visualization of intelligent analysis results, etc., in order to realize the intelligent processing of data information, including the research of supporting theory and method, intelligent analysis strategy and method, and display of intelligent analysis results, such as graph (Fig. 4).

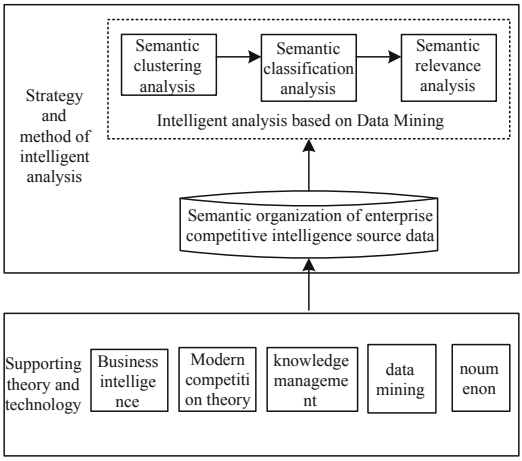

Fig. 4. Information intelligent analysis model based on data mining

In the process of management mining, each indicator (variable) has its own dimension and unit of order of magnitude, and the conversion rules between indicators are different.

In order to compare the data of different orders of magnitude and different dimensions, it is necessary to convert the data accordingly. In general, the central transformation is used, that is, the average value of each training set variable is calculated, and then the mean value of the training set variable is subtracted from the original data [9]. The result of the transformation makes the data mining of each column not only a simple retrieval, query and call oriented to a specific database, but also a micro-, meso-and even macro-statistics, analysis, synthesis and inference of these data, so as to guide the solution of practical problems, and try to discover the relevance between events, even use the existing data to predict future activities. Each indicator (variable) has its own dimension and unit of order of magnitude, and the conversion rules between indicators are not the same. In order to be able to compare the data of different orders of magnitude and different dimensions, it is necessary to convert the data accordingly. In general, the central transformation is used, that is, the average value of each training set variable is calculated, and then the mean value of the training set variable is subtracted from the original data [10].The result is that the sum of the columns is 0, the sum of the squares of the columns is $n-1$ times the variance of the column, and the cross product of any two different columns is $n-1$ times the covariance of the two columns. Let U be the total number of objects to be classified. Build the similarity coefficient on U between r and r_{ij} for the similarity between i and j. When U is a finite set, R is a matrix called the similarity coefficient matrix. There are eight common methods for building similarity matrices for data sets.

$$r_{ij} = \frac{C_2 \sum_{k=1}^{m} (x_{ik} - \bar{x}_i)\left(x_{jk} - \bar{x}_j\right)}{\sqrt{\sum_{k=1}^{m} (x_{ik} - \bar{x}_i)^2} \sqrt{\sum_{k=1}^{m} \left(x_{jk} - \bar{x}_j\right)^2}}, (i, j \leq n) \tag{4}$$

Absolute index method [11]:

$$r_{ij} = e^{-\sum_{k-1}^{m} 1 x_{ik} - x'_{jk}}, (i, j \leq n) \tag{5}$$

The similarity relation r_{ij} established by the above method only satisfies the reflectivity and symmetry, but not the transitivity, so it is not a fuzzy equivalence relation. Therefore, it is necessary to use the transitive closure method to find R fuzzy equivalent matrices. That is, r_{ij} from the transformation into R, and then from the $R-$, so continue, until a step $R^{2k} = R^k = R^*$. At this point R satisfies the transitivity, that is, for the fuzzy equivalence matrix of R, the semantic proximity range of a concept c is defined as all its direct subconcepts and direct hyperconcepts, which are expressed as follows:

$$V(c) = r_{ij}\{R^{2k} b \in C \Big| \ c \pi b \quad \text{or} \quad b \pi c\} \tag{6}$$

Second, get the set of keywords in all concepts within the semantic proximity of concept c that can express these concepts:

$$U(c) = \cup \text{Ref}^{-1}_{b \in V(c)}(b) \tag{7}$$

Disambiguation function is used to obtain the most appropriate concept for the meaning of keywords t based on d context [13]. The meaning of disambiguation function $dis(d, t)$ is as follows: the concept corresponding to keyword t should be the first concept corresponding to those keywords which obtain the largest weight value in text d in keyword $U(c)$ set. The formula for calculating the disambiguation function is:

$$\mathrm{dis}(d, t) = \mathrm{first}\{c \in \mathrm{Ref}_C(t) | \quad c\, maximizes\, w(d, U(c))\} \tag{8}$$

Calculate the weights of Concept c in Text d using the following formula:

$$w(d, c) = \mathrm{dis}(d, t) w(d, \{t \in T | \quad dis(d, t) = c\}) \tag{9}$$

Through data selection, preprocessing, transformation, pattern extraction, knowledge evaluation and process optimization, we use discriminant analysis, clustering analysis and exploratory analysis to discover and acquire knowledge. The basic process of knowledge discovery is a multi-step process, including data selection, preprocessing, data transformation, data mining and result interpretation and evaluation, as shown in the figure (Fig. 5).

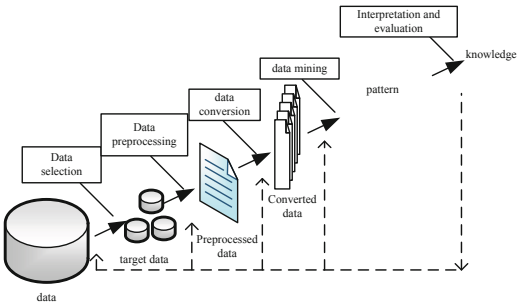

Fig. 5. Analysis of the characteristics of industrial and commercial administration

The application of complex social network technology in competitive intelligence analysis of business administration makes the analysis system of competitive intelligence of business administration automatically analyze the data and information in database, data warehouse and interconnected network, from which the potential comprehensive intelligence knowledge can be mined and the automation and intelligence of competitive intelligence analysis and knowledge discovery can be realized.

2.3 Realization of Business Administration Behavior Relevance Mining

As long as we follow the market rules, standardize the behavior of business administration, and enhance the openness and transparency of the relevance of business administration characteristics. At present, the disclosure of the relevance of business management characteristics in most companies' financial reports is incomplete and untrue, which reduces the efficiency and reliability of the use of accounting data. Below is a brief introduction to the key factors in mining the relevance of business administration behavior, as shown in the table below (Table 1).

Table 1. Factors affecting the mining of relevance of business administration behaviors

Name	Meaning
Motivation purpose	The effect of equity incentive plan
Incentive object	The object of equity grant is the beneficiary of equity
Incentive mode	The way to grant equity to the incentive object, that is, how the incentive object benefits
Stock source	It mainly refers to the source of the stock at the time of exercise
Incentive level	Number of shares granted to incentive objects
Exercise price	The price of the company's stock when the incentive object exercises the right
Source of funds	The source of funds used by the incentive object to exercise or purchase shares
Effective period of incentive	Time range of equity incentive implementation process
Exercise arrangement	The setting of waiting period (sales restriction period), unlocking period and exercise period
Performance evaluation index	The criteria to judge whether the incentive object can exercise the right include performance indicators and non performance indicators

Association rules are simple statements about the probability of certain events occurring together in a database. Mining association rules can reveal the dependencies among specific objects, and then infer the information of other objects from the information of one object. For itemset I, transaction dataset D, each transaction T_i, where $T_i \subset I$.

If $A \subset D, B \subseteq D$, and $A \subseteq I, B \subseteq I, A \cap B = \phi$, then the expression such as $A \Rightarrow B$ can be called an association rule. The process of mining association rules is divided into two stages: finding all frequent itemsets from the original data set. Generate association rules from frequent itemsets. Item set I is a collection of data items, namely $I = \{i_1, i_2, \cdots, i_n\}$. D is the set of transaction transactions, that is, $D = (T_1, T_2, \cdots, T_n\}$, T_i represents the ith transaction, with each transaction corresponding to a transaction identifier TID. Support S is the ratio of the number of transactions containing both A and B in transaction set D to the total number of transactions, which can be expressed as:

$$S(A \Rightarrow B) = \frac{||(T \in D|\ A \cup B \subseteq T)}{w(d, c) * ||D||} \tag{10}$$

Confidence C is the ratio of the number of transactions containing both A and B in transaction set D to the number of transactions containing only A, which can be expressed as:

$$C(A \Rightarrow B) = \frac{||\{T \in D|\ A \cup B \subseteq T\}}{||\{T \in D|\ A \subseteq T\}} \tag{11}$$

All stochastic quantities are the process of mining business management behaviors that change within a specific scope and at a specific time. For the processing of business administration behavior, it is not to analyze and find its statistical law and probability distribution, but to analyze and find the law from the original data without laws, that is, after processing the original data in a certain way, make it become a relatively regular time series data, and then establish a model. Prediction mainly refers to the use of $GM(1, 1)$ model to predict the amount of time series data. For example, population forecast, labor force forecast, product output forecast, is the use of statistical data over the years, the future development of its forecast. Here are the basic steps to build a $GM(1, 1)$ model:

Do first order cumulative generation for the following series:

$$\left\{x^{(0)}(k)\right\} = \left\{x^{(0)}(1), x^{(0)}(2), \cdots, x^{(0)}(N)\right\} \tag{12}$$

Among them, k represents the time of data sequence, (1) represents a cumulative sequence. Make a first order cumulative generation of it:

$$\left\{x^{(1)}(k)\right\} = \left\{x^{(1)}(1), x^{(1)}(2), \cdots, x^{(1)}(N)\right\} \tag{13}$$

$$x^{(1)}(k) = \sum_{i=1}^{k} x^{(1)}(i), k = 1, 2, \cdots, N \tag{14}$$

Construct the cumulative matrix and the constant term vector, the first order mean of x to generate:

$$x = (x(2), x(3), \cdots, x(n)) \tag{15}$$

Of which:

$$x(k) = \frac{1}{2}\left(x^{(1)}(k) + x^{(1)}(k-1)\right), k = 2, 3, \cdots, n \tag{16}$$

Then:

$$B = \begin{pmatrix} -x(2) & 1 \\ -x(3) & 1 \\ \vdots & \vdots \\ -x(n) & 1 \end{pmatrix}, \quad Y_N = \begin{bmatrix} x^{(0)}(2) \\ x^{(0)}(3) \\ \vdots \\ x^{(0)}(n) \end{bmatrix} \tag{17}$$

Using the least square method to solve the grey parameter to construct the white differential equation:

$$\frac{dx^{(1)}}{dt} + ax^{(1)} = \mu \tag{18}$$

Solve parameters as follows:

$$\hat{a} = \begin{pmatrix} a \\ \mu \end{pmatrix} = \left(B^T B\right)^{-1} B^T Y_N \tag{19}$$

Based on the above algorithms, effective mining of the relevance of formula management behaviors is realized, and detailed provisions are made for the disclosure matters, disclosure methods and disclosure format of the relevance of business management characteristics according to the calculation results.

3 Analysis of Experimental Results

In order to verify the practical application effect of the association mining algorithm based on complex social information network, the empirical analysis is made according to arbitrage pricing theory. To ensure the research effect, the equipment and relevant parameters used in the experiment are standardized, which is shown in the following table (Table 2).

Table 2. Experimental parameter settings

Parameter	Measurement
Video editor	2
Media editing software	2
Particle editing software	1
Vehicle identification software	1

Based on the theoretical basis of the previous experiment, hypothesis 1 tests the earnings management of the company and the earnings management of the control group by matching samples T test, and carries on multiple linear regression analysis, and validates hypothesis 2 to hypothesis 5 according to the results of the analysis. According to this parameter, the experimental analysis is carried out. Based on the calculation of SPSS software, the characteristics of behavioural correlation can be calculated and expressed in terms of a1.a2.a3. In order to ensure the accuracy of the results, all the experiments were repeated 20 times, and the results were taken as the average. Because the calculation process is complicated, the calculation results of the correlation shall be directly displayed instead of being described here, specifically as follows (Table 3):

Table 3. Row as correlation feature calculation result

Result	Nonstandard coefficient		Standard coefficient	T	Sig.
	B	Standard error	Beta value		
Variable	−0.001	0.010	–	−0.112	0.027
X1	4982579.439	4582519.253	0.048	1.087	0.001
X2	0.044	0.016	0.125	2.791	0.000
X3	−0.065	0.018	−0.168	−3.714	0.000

Furthermore, the correlation coefficient between fiscal expenditure and output is only 0.41, which is a strong cis-character. But for the related variables of monetary policy, it has a weak correlation with output volatility, which shows that the impact of monetary regulation on output is more moderate. Further comparison of China's economic characteristics in the process of fluctuations, the primary industry, the secondary industry

and the tertiary industry in accordance with their own characteristics of the development of business management behavior characteristics of correlation mining results for comparative analysis, to judge the state characteristics of the entire feature fluctuations and mining results, the specific results are as follows. Tools Options Options Page (Figs. 6 and 7).

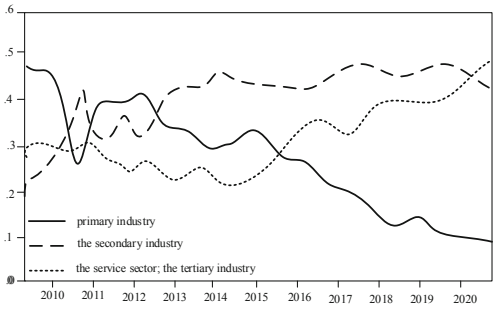

Fig. 6. Detection results of dynamic relational mining of business administration behavior under traditional methods

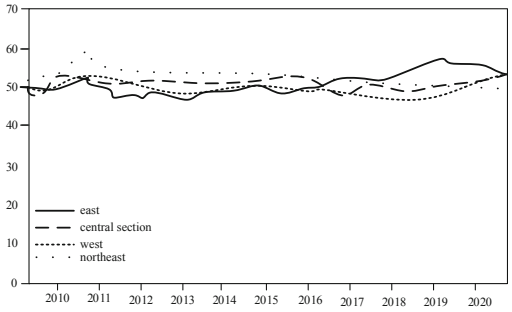

Fig. 7. Dynamic mining detection results of business administration behavior association under the method presented

Compared with the traditional methods, the algorithm based on complex social information network has higher accuracy and stability in the practical application, which fully meets the research requirements.

4 Closing Remarks

In the current rapid economic development situation, there are many problems in the business management activities of our country. Therefore, it is necessary for the managers of this department to put forward an algorithm for mining the relevance of business management behaviors based on complex social information networks, so as to update their management concepts and means in a timely manner, so as to make their specific management behaviors better adapt to the needs of the current economic development.By

collecting the characteristics of enterprise management behavior, the trend is analyzed, and the characteristic components are estimated accordingly. The association rule mining algorithm is used to statistically analyze the distribution of high-frequency keywords and the probability distribution of unexpected events in the process of enterprise management behavior, and the association rule mining model is constructed in combination with social information network. However, the method designed in this paper still has some shortcomings, which need to be further adjusted in practical application to make the method more applicable.

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