

Research on digital management method of market information based on fusion information

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Abstract: In order to overcome the problems of low management efficiency and long management execution period of traditional market information management methods, this paper proposes a digital management method of market information based on fusion information. Firstly, the original market information is counted, and the chart information and literature information in the original market information are digitised. By then calculating the similarity of market information, the digital information is clustered and fused. Based on the results of clustering and fusion of digital information, the market information management database is constructed, and the comprehensive digital management of market information is realised from the aspects of confidentiality management, authority management, literature information management and so on. The experimental results show that the management efficiency of this method is always over 96%, and the management efficiency is the highest; the management execution cycle is between 1.4 min to 1.9 min, and the management cycle is the shortest.

Keywords: fusion information; market information; digital information; information management methods.

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1 Introduction

Market information refers to all kinds of information, information and data generated in the process of market commodity exchange. With the development of China's economy and trade, the amount of market information is gradually increasing, and the scope involved is more extensive. Nowadays, market information mainly includes languages, symbols, data, images, vouchers and reports. Under the influence of commodity economy, market information plays a key role in the operation and decision-making of the industry market, and has attracted wide attention from the state and industry. Market transactions are being carried out all the time in various industries. Market information updates rapidly. Therefore, market information has the characteristics of timeliness, decentralisation, compressibility and storage. Due to the large amount of market information and many fields involved, there are many problems in the process of market information management, such as incomplete management and inefficient management. Therefore, it is necessary to realise the digital management of market information by means of science and technology (Liu et al., 2017).

Gu (2018) proposes a digital management method of market information based on XML and Web services. In this method, XML literature is used as the main carrier of data storage and data transmission between different systems, and Web service interface is used as the service interface to improve the openness of the system. Moreover, in the process of designing the digital management method of market information, the solutions of key technologies such as identity authentication and secure data transmission are also given. However, there is a problem of low management efficiency in the practical application of this method. Cheng (2018) proposes a digital management method of market information based on evidence reasoning. From the point of view of marketing ability and information management level, this paper analyses the main factors affecting the digital management of market information, and establishes the index system of market management. On this basis, the D-S evidence reasoning method is used to design a market information management scheme, but there is a problem of long management execution cycle in the implementation of this method. Yang (2017) presents a digital management method of market information based on SID. Firstly, the method divides the market network data into three dimensions, constructs a market digital information management model, decomposes the modelling process into three steps: data abstraction, model representation and relationship mining, and uses object-oriented method to manage from different granularity through the concepts of dimension, domain, TOP (top-level) class and subclass. The information model is described to realise the digital management of market information. However, this method has the problems of low management efficiency and long management execution cycle. Wang et al. (2018) proposes a market information digital management method based on data integration. Based on the analysis of information business process, this paper constructs three main

lines of information management based on production flow, material flow and capital flow, puts forward multi-level view progress monitoring model under the leadership of project and multi-level early warning model of capital flow based on internal control index, and realises the city with key technologies and methods such as data integration based on Data Transmission Middleware and process reorganisation based on authority and reconstruction Digital management of field information. But this method has the problem of low management efficiency. In Wei et al. (2017), a digital market information management method based on multi algorithm fusion is proposed. First, we obtain the relevant information of market information, and make a series of different management rules according to the different information. Then, through a series of feedback, we use the machine learning algorithm, that is, keyword extraction algorithm and dependency syntax analysis algorithm to add and modify the management rules, so as to realise the digital management of market information. However, the implementation cycle of this method is relatively short long problem, the actual application effect is not good.

In the application process, the above-mentioned management methods make use of the corresponding digital processing technology to realise the digitalisation of information, and further carry out specific management operations according to different types of industries. However, after a long period of application, it is found that the traditional digital management method of market information has the problems of low security and accuracy. Aiming at the above problems, in order to achieve the expected goal of improving the management efficiency and reducing the execution cycle, a market information digital management method based on fusion information is proposed. Its core step is to cluster data with high similarity, fuse different parts of data information, and eliminate the same part of data information, and then get the final information. By using the method of fused information, the repetition rate of market information can be reduced, and the efficiency of digital information management can be indirectly improved.

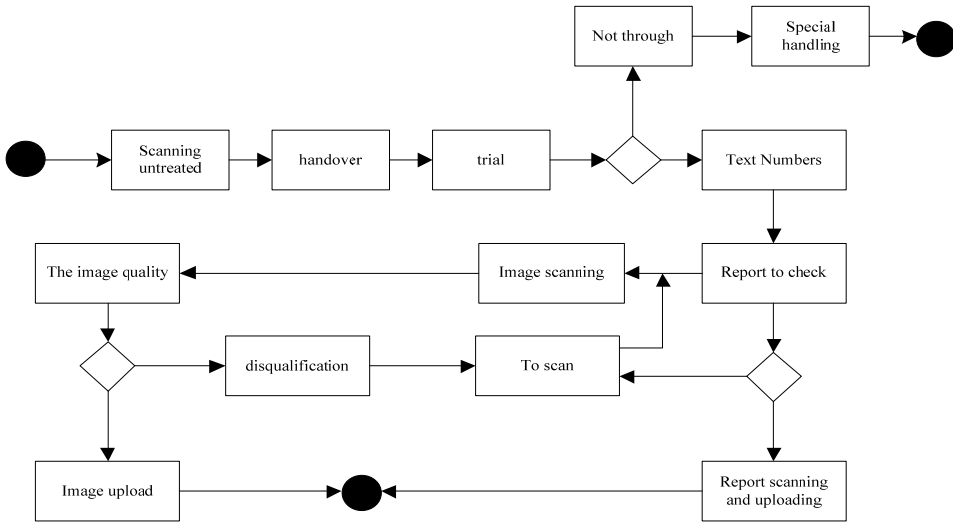
2 Design of digital management method of market information

2.1 Market information collection

The original market information is collected by scanning method. The main types of original market information are product information, channel information, consumer information and marketing strategy information. The specific scanning acquisition framework is shown in Figure 1.

According to the scanner acquisition framework in the graph, specific acquisition is carried out for three types of report, image and literature data in market information. In the process of acquisition, the data in the report and the quality of the image need to be tested (Efendia et al., 2018). The standard of data detection in the form is accuracy. If the data in the report is checked correctly, it can be uploaded further. The detection of image quality is the detection of image clarity and resolution. Fixed detection threshold can be set. If the detection result is larger than the threshold, image upload can be carried out, otherwise the re-scanning acquisition program can be started. The accuracy of the original market data information collected can be ensured by quality inspection and data checking.

Figure 1 Scanning and acquisition framework of original market information



2.2 Design of digital processing method for market information

The standardisation of market data information is divided into three parts: standard deviation standardisation, comprehensive standardisation and range normalisation (Geras'kin, 2018). When standardisation transformation of market data information is carried out, the market data acquisition value is subtracted from the average value of data, and the difference is divided by the standard deviation of the variable. That is to say:

$$X = \frac{X_{ij} - \bar{X}_j}{S_i} (i = 1, 2, \dots, m; j = 1, 2, \dots, n) \quad (1)$$

In the formula, \bar{X}_j is the average value of data, which can be calculated by formula (2).

$$\bar{X}_j = \frac{1}{n_j} \sum_{j=1}^n X_{ij} \quad (2)$$

The parameter n_j in formula (2) is the total data amount of market information collected (Kashi, 2017). In addition, S_i in formula (1) represents the standard deviation of market data information variables, and its calculation formula is as follows:

$$S_i = \sqrt{\frac{1}{n} \sum_{j=1}^n (X_{ij} - \bar{X}_j)^2} \quad (3)$$

The calculation results of formula (2) and formula (3) are substituted into formula (1) to standardise the standard deviation of market information. Secondly, the function of standardising the sum of market information is to make all the elements in the information matrix of the table changed into (0, 1) interval data representation, and the

sum of information values of each variable in the transformed result is 1 (Cheng, 2017). The expression of summation standardisation treatment is shown in formula (4).

$$X'_{ij} = \frac{X_{ij}}{X_j} (i = 1, 2, \dots, m; j = 1, 2, \dots, n) \tag{4}$$

Formula (2) is combined with formula 4 and the transformed results are obtained. The expressions are as follows:

$$X'_j = \sum_{i=1}^n X_{ij} = 1 \tag{5}$$

The last step is the range normalisation transformation of market information. When there is a big difference between the dimension of the collected value and the real data, the range normalisation processing is started (Lima et al., 2018). The minimum value of each collected data in the market information is subtracted from the minimum value of the real value, and the difference of the collected data is divided into two operations, namely:

$$X'_{ij} = \frac{X_{ij} - \min X_{ij}}{\max X_{ij} - \min X_{ij}} (1 \leq j \leq n) \tag{6}$$

The collected market data information is always within the closed interval of [0.1] after standardisation.

2.3 Market digital information clustering

The process of clustering and fusion is divided into two steps: information clustering and information fusion. The basis of information clustering is the result of similarity calculation of market information, and information fusion is to reduce the weight of clustering information in the same group and fuse them together (Zhang et al., 2018). Taking the market literature data information as an example, the text similarity calculation method includes three levels: word similarity, sentence similarity and paragraph similarity. Assuming that the two adjacent words in the market literature are Y_1 and Y_2 , and the distance between them is $Dis(Y_1, Y_2)$, the similarity between them can be calculated by formula (7).

$$Sim(Y_1, Y_2) = \frac{\partial}{Dis(Y_1, Y_2) + \partial} \tag{7}$$

The similarity threshold of market information is set to be a, and the first a of similarity is taken as the feature element of text, and the similarity is taken as the weight. The formula is as follows:

$$W_i = \frac{\sum_{k=1}^n Sim(Y_i, Y_k)}{n} \tag{8}$$

On this basis, the sentence similarity and paragraph similarity of market information are calculated. The calculation of sentence similarity is based on word similarity, and the calculation of equivalent paragraph similarity is based on the result of sentence similarity (Taylor and Osborne, 2018). The market information whose similarity is greater than the threshold value is divided into one group, and all the clustering results of market information are synthesised to achieve the same kind of fusion of market information.

2.4 Construct market information management database

The results of clustering and fusion of digital information are built into a database of market information management. The database is mainly used to preserve the basic information including department information, employee information, grouping information, etc. (Lacson et al., 2017). The data stored in the process of database building need to be updated in real time according to the actual situation, and cannot affect the actual management process. Some results of the establishment of the market information management database are shown in Table 1.

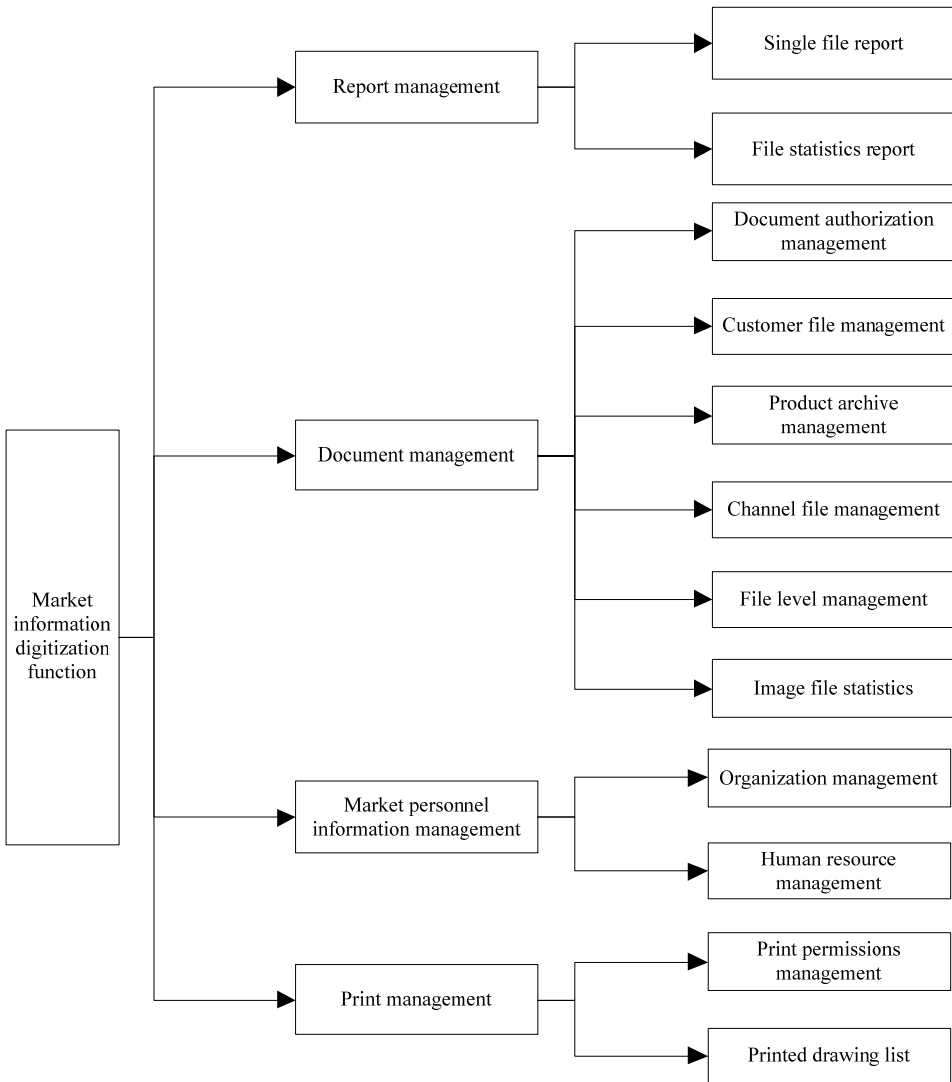
Table 1 Partial file attribute tables in database

<i>The field name</i>	<i>Field meaning</i>	<i>The data type</i>	<i>The length</i>
FileID	The file number	Varchar	20
FileName	The file name	Varchar	50
FileType	The file type	Varchar	20
FilePro	File professional	Varchar	20
FileAutor	File the author	Varchar	20
FileDate	To generate the time	Varchar	20
FileSort	The file type	Varchar	20
FileProject	Subordinate to the project	Varchar	20
FileCondition	Working condition of belonging to	Varchar	20
FileTask	Subordinate to the task	Varchar	20
FileSource	File source path	Varchar	500
FileDesc	The file	Varchar	800
FileIsDel	Whether the file has been deleted	Number	40
FTPLocation	FTP file save path	Varchar	100
IsToDB	Has been converted to a database	Varchar	20

2.5 Digital integrated management of market information

Supported by the database of market information management, the digital integrated management of market information is realised from various perspectives in accordance with the corresponding basic management principles. The specific management task module is shown in Figure 2.

Figure 2 Task block diagram of integrated digital management of market information

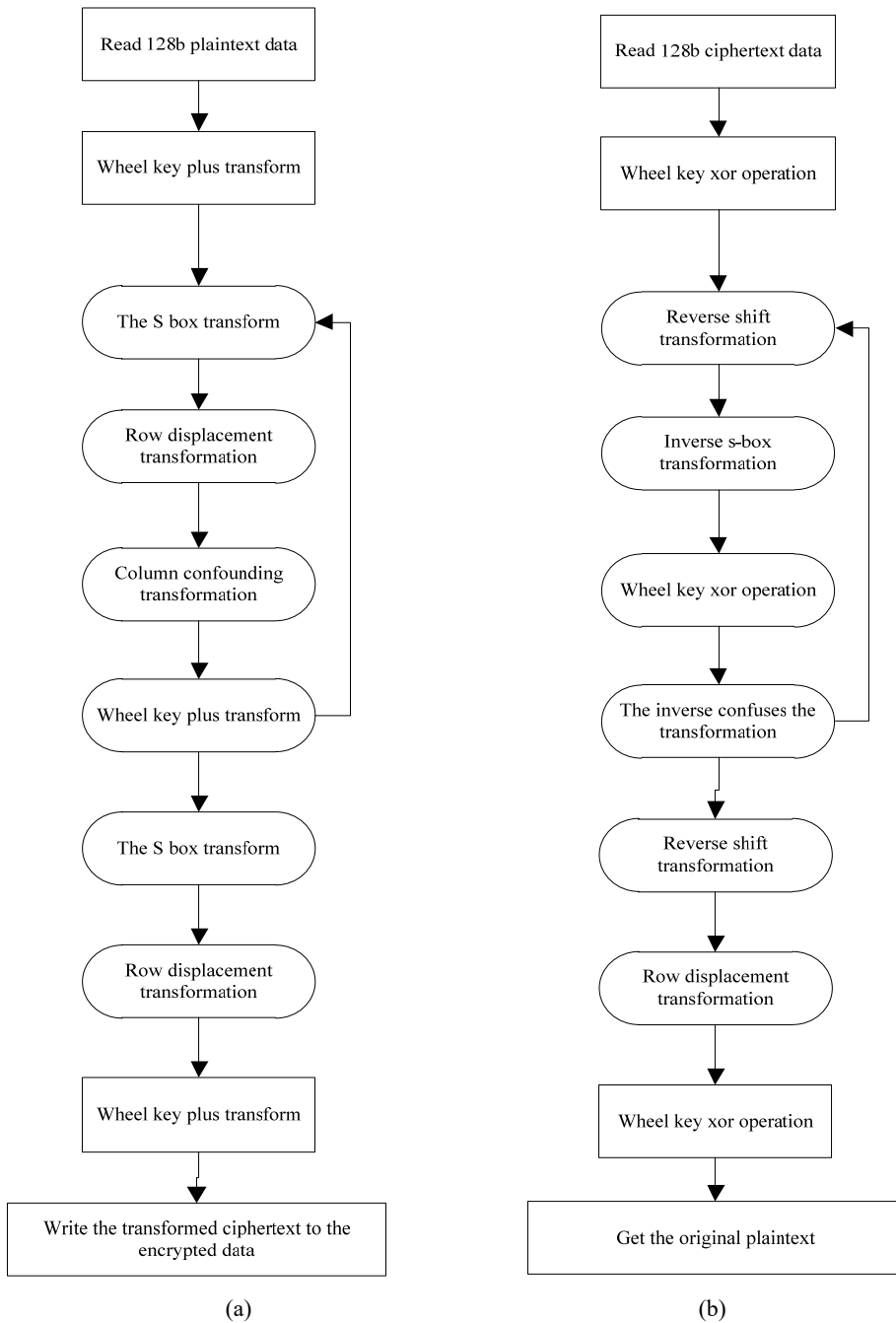


This paper designs and analyses the functions of some management tasks in the integrated management module of market information digitalisation.

2.5.1 Fixed-secret management

Fixed-secret management is aimed at market information with confidentiality requirements. General fixed-secret management is divided into two steps, compression encryption and decryption (Zhang et al., 2018; Foroudi et al., 2017). Fixed-secret management architecture is shown in Figure 3.

Figure 3 Encryption management and decryption management architecture, (a) the encryption process (b) the decryption process



According to the management architecture shown in the figure, the fused market information is encrypted and compressed according to different encryption levels, and the corresponding decryption program (Zhu, 2017) is obtained according to the inverse process of different encryption modes. Digital decryption management is a comprehensive scheduling and management of functions such as authority management, file filing management, data sharing and exchange. It guarantees the management security of market information fusion to the greatest extent through the decryption management program.

2.5.2 Personnel management

Personnel management module in market information digitisation management, according to the actual market operation structure, establishes various departments under the management data node, and marks the department number. The relevant departments accordingly give the authority to modify, delete and sort the department name (Yuan et al., 2018). Adding staff information within the department, the department can select from the established organisation, personnel can be modified, deleted, and query according to different needs. The significance of personnel management task execution is to ensure the normal operation of market information. It can also trace the ultimate responsible person of market information through this management function.

2.5.3 Authority management

Privilege management in market information digitisation management method is mainly a form of authorisation management for market users. When users operate information, whether users have this privilege is judged. In the process of privilege management, the security of digital encryption management can be guaranteed. In permission management, we need to realise permission configuration and interface. In the process of market information management, different types of user roles have the same and different permissions. The user's permission function is determined by establishing the relationship between users and roles (Hu and Dong, 2017). User permission settings can be divided into many parts, including user management, role management permission settings, user-role settings and so on. The input and output information of permission settings is shown in Table 2.

When adding or deleting the privileges of one user, to ensure that it does not affect other users, each privilege is represented by a bit, and the whole market information privilege management function forms a bit sequence. If the user's permission is UA, the value is:

$$UA = \sum_{i=1} P_i \quad (9)$$

In the formula, the parameter P_i denotes the value of the i^{th} permission. The result of the solution is input into the input data of permission management to realise the assignment and management of permission (An et al., 2017).

Table 2 Privilege settings input and output information

<i>Function name</i>	<i>Input</i>	<i>Output</i>
Adding users	User number, username, password, permission and level	Added successfully added user to user data table and prompted 'added successfully'. Otherwise, the 'add failure' is prompted.
Adding roles	Enter role number, role name, role description information	Added successfully added roles to the database and prompted 'added successfully'
Setting role permissions	Select a role to set permissions and select several functions from the list of market information functions	Set up successfully to add the role and function related data to the database, the role has several functional permissions, add a few related information
Role-user settings	Select roles to add users to the selected roles	Display the list of roles and users. After successful setup, add or delete several records in the user role table in the database

2.5.4 Literature information management

Literature information management covers a wide range, mainly for the management of product literature information and the management of channel literature information, the digital literature information that will be fused will be used for literature information management (Davis et al., 2019; Lee and Cho, 2018). The general functions of literature information management include literature upload, literature download, literature deletion, literature attribute modification, literature content modification, literature catalogue, literature attribute management, literature template management and dynamic literature catalogue generation. The implementation process of the specific literature information management function is shown in Figure 4.

In the process of realising the literature management function, besides the basic market literature information, there are also image information and market report information (Zhang and Zhai, 2019). In the market report information, the electronic literature administrator can use the management function to output the relevant management results, facilitate the sharing of electronic literature files, and effectively improve the operational efficiency of electronic literature management.

2.5.5 Market information query management

Fusion of market information query management is used to query all kinds of information users need, query updated information, relevant industry information and other new message reminders (Wei et al., 2018). User login related management platform executes corresponding information query and management through the following schematic diagram.

Figure 4 Literature management function implementation flow chart

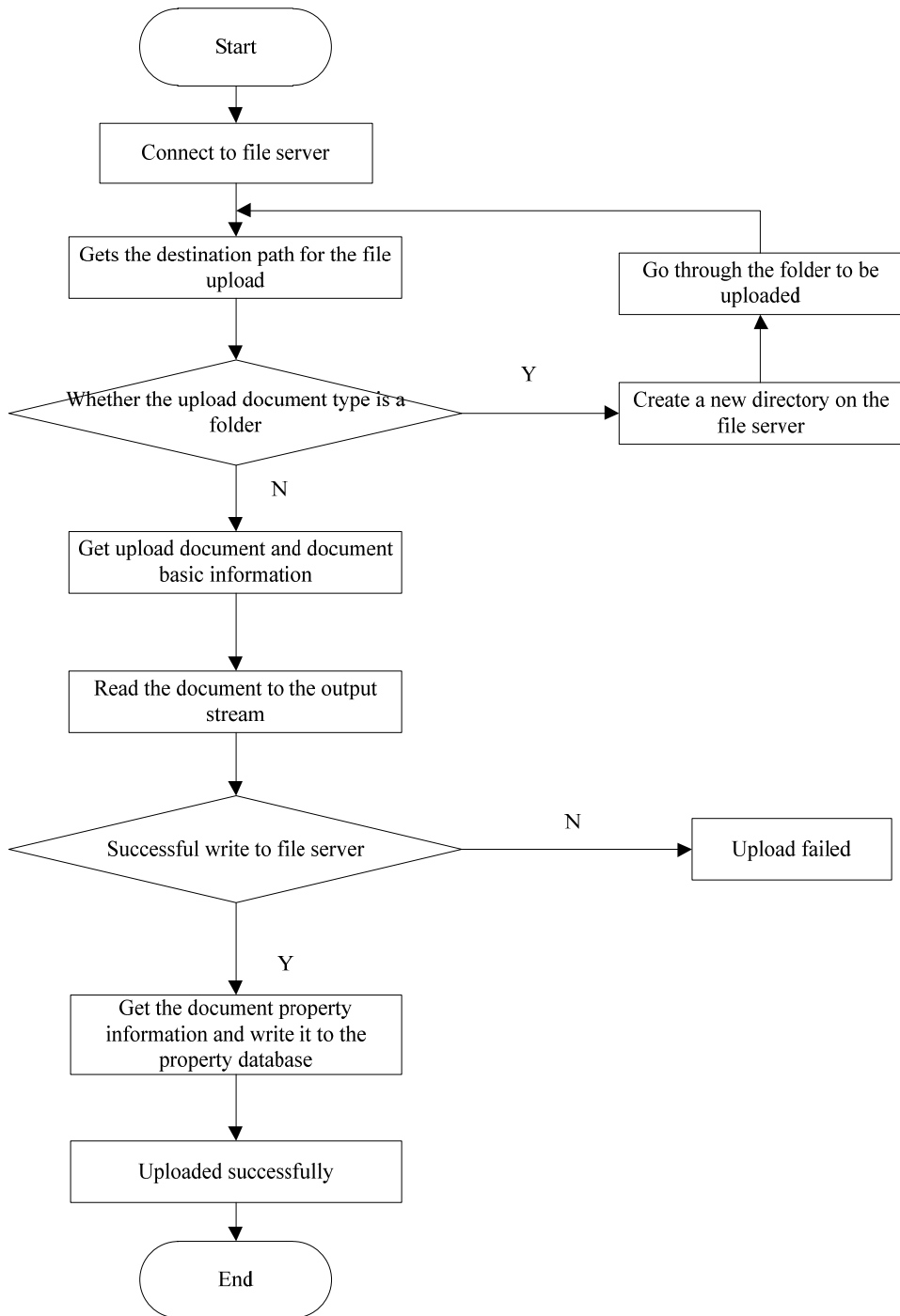
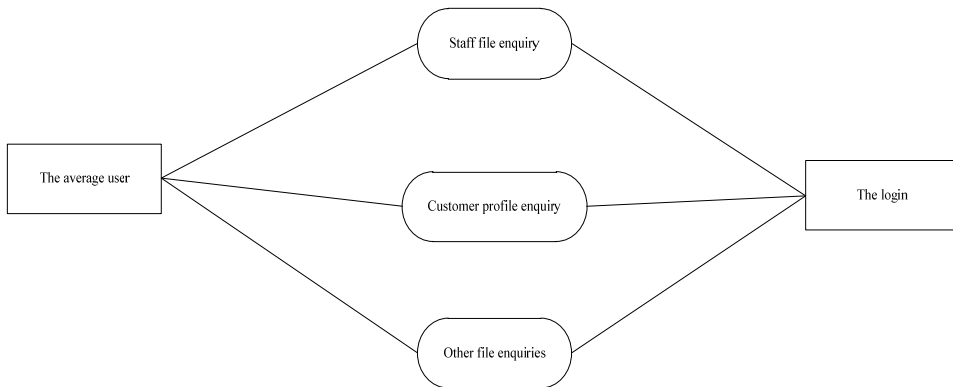


Figure 5 Market information query management diagram

According to the schematic diagram of query management in the figure, query customer files, employee files, file files and other query tasks in the management platform (Martinez-Aires et al., 2018). When the user enters the client file query page, he first needs to input the query conditions, and then submit them to the server after the query conditions are input. The administrator retrieves the customer data in the database according to the query conditions submitted by the user, and displays the data appended to the user's needs to the user.

3 Experimental analysis

In order to validate the practical application effect of the proposed digital management method of market information based on fused information, experimental tests are needed. The experimental scheme is to build an experimental environment and obtain experimental data. The experimental data comes from the website of EU Open Data Portal (<http://data.europa.eu/euodp/en/data/>). Through screening, the market information data is obtained and used as the experimental sample data. In order to make the data run smoothly on the simulation platform, the data length is lower than the maximum data input length of the simulation software, and the optimal simulation parameters are selected as the initial simulation parameters. This paper chooses Gu (2018), Cheng (2018) and Yang (2017) methods to carry out experimental tests. Firstly, the management efficiency of different research methods is tested. The higher the ratio of management output to input is, the lower the amount of various resources consumed by this method is. Then, different research management execution cycles are tested. The shorter the line cycle is, the shorter the time for this method to complete the digitised management of market information is. The specific experimental process is as follows.

3.1 Construction of verification environment

The hardware environment includes two main components: server and client PC. The server chooses dual-core processor and servers with memory capacity of more than 5 GB. In addition, the server's hard disk capacity is about 250 GB and equipped with UPS equipment. In the client PC, the computer with CPU over P4, memory of 1GB and hard

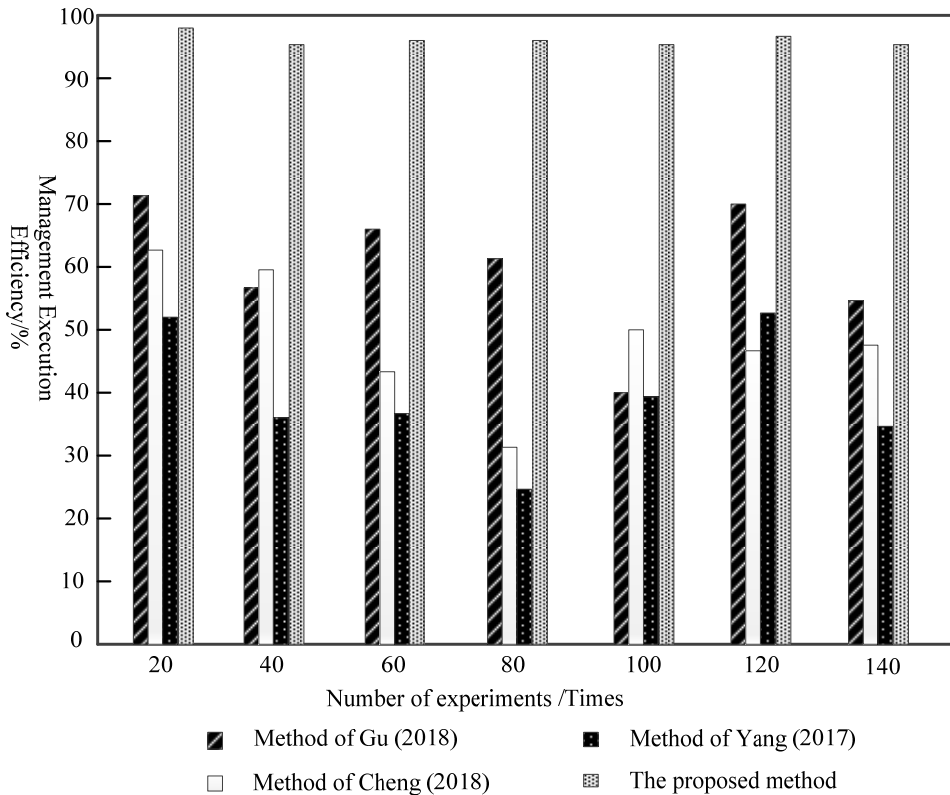
disk capacity of 40 GB is selected as the client PC. If the hard disk capacity of the client PC cannot meet the capacity requirement of 40GB, the corresponding external memory can be installed on the PC. The software verification environment is mainly composed of development platform and publishing platform. The development platform is to input relevant codes and databases of market information management methods into the platform and execute relevant management task instructions. The publishing platform is the platform to output or publish the final management results. The operating systems used in the software environment are all Windows XP, and the database chooses the version of SQL 2005.

3.2 Analysis of experimental results

Management efficiency comparison

In the built experimental environment, the corresponding management efficiency comparison results are obtained through the experimental process, as shown in Figure 6.

Figure 6 Comparison of management efficiency of different research methods



From the analysis of the above Figure, we can see that the management efficiency of Gu’s (2018) method changes from 55% to 72%, the management efficiency of Cheng’s (2018) method changes from 35% to 63%, and the management efficiency of Yang’s

(2017) method changes from 26% to 52%, which is the lowest among the four methods. The management efficiency of this method is the highest, which is always more than 96%. The validity of the method is verified. The reason is that this method first counts the original market information, and then separately sends the chart and letter in the original market information. Information and literature information are digitised. By calculating the similarity of market information and clustering and fusion of digital information, the management efficiency of the proposed method is improved.

In order to further verify the practical application effect of the proposed method, a comparative test of management execution cycle is carried out. The test results are shown in Table 3.

Table 3 Comparative test results of management execution cycles of different research methods

<i>Number of experiments execution cycle /min</i>	<i>Gu's (2018) method</i>	<i>Cheng's (2018) method</i>	<i>Yang's (2017) method</i>	<i>The proposed method</i>
10	25.6	10.2	15.5	1.9
20	27.8	15.4	16.9	1.4
30	30.5	14.8	17.4	1.7
40	28.7	12.4	15.3	1.5
50	25.7	11.5	13.9	1.9
60	26.4	14.7	14.7	1.7
70	29.1	15.2	15.4	1.5

The data in the table shows that under the premise that all the four methods can successfully complete the relevant management tasks, the management execution cycle of Gu's (2018) method changes from 25.6 min to 30.5 min, and the execution cycle of the four methods is the longest. The management execution cycle of Cheng's (2018) method changes from 10.2 min to 15.4 min, the management execution cycle of Yang's (2017) method changes from 13.5 min to 17.4 min, while the management execution cycle of this method is from 1.4 min to 1.9 min, which is the shortest of the four methods. The results show that this method has a short execution cycle of market information digital management, which proves the superiority of this method. The construction of market information management database can realise the overall digital management of market information from the aspects of confidentiality management, authority management and literature information management, so it can effectively shorten the period of management and execution.

4 Conclusions

Because of the large amount of market information and many fields involved, there are some problems in market information management, such as incomplete management and low efficiency. In order to improve the management efficiency of market information, the method of fusing information is introduced, aiming at reducing the repetition rate of market information, indirectly improving the efficiency of digital management of information, and realising the digital management of market information. Therefore, a

digital management method of market information based on information fusion is proposed. The experimental results show that the management efficiency of the proposed method is always above 96%, and the management execution cycle fluctuates from 1.4 min to 1.9 min. Compared with the traditional management method, the proposed method has higher management efficiency and shorter management execution cycle. The proposed method lays a solid foundation for modern market information management. Because the management objective of market information is relatively clear, the digitised management method of market information developed meets the design requirements, ensures the consistency of archiving design electronic literatures and original drawings, and effectively improves the efficiency of management.

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