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Design of Competitive Intelligence System Based on Business Process and Analysis of Information Transformation Standard

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Abstract: This paper studies a set of competitive intelligence system based on business process, which aims to help enterprises obtain valuable strategic information in the fierce market environment through efficient data acquisition, processing and analysis. With the rapid development of the Internet, the amount of information faced by enterprises has increased sharply, and how to screen out the information with practical value has become a big problem. To this end, this paper deeply analyzes the specific needs of enterprises, and puts forward three modules of the system architecture: intelligence acquisition, intelligence processing and intelligence service. Information acquisition realizes preliminary information collection through keyword search and URL fetching, and combines text processing technology to clean and structure data to improve the accuracy of data. On this basis, this paper puts forward the information conversion standard, and adopts SVM classification algorithm and K-means clustering algorithm in machine learning to carry out fine classification and unsupervised clustering of text data, so as to optimize information management and distribution. The system can effectively improve the efficiency of information collection and utilization, and help managers to make more accurate decisions in complex market environment, which has important application value.

1. Introduction

In the context of the accelerated global informatization process and the increasing development of Internet technology, enterprises are facing increasingly fierce market competition, and traditional competitive advantages, such as capital, technology and talent, are no longer enough to meet the complex challenges in the modern business environment. Competitive intelligence, as a new strategic resource, has gradually become the key factor for enterprises to maintain competitive advantage. By building an efficient competitive intelligence system, enterprises can quickly extract valuable information from massive market data, and effectively predict market trends and competitive situations, so as to formulate more accurate business strategies. However, faced with the exponential growth of unstructured data in the Internet, how to efficiently extract, integrate and transform this information to support decision-making has become the core problem of enterprise

intelligence management.

Today, the traditional intelligence gathering methods that most businesses rely on often lack precision and timeliness. Although search engines and general information collection platforms can provide basic data support, due to their extensive and messy data sources, they cannot meet the precise needs of enterprises for high-quality competitive intelligence. Especially in modern enterprises whose business processes are highly dependent on real-time information, the information system must be more professional, targeted and dynamic. Therefore, building a customized competitive intelligence system based on business processes, combining advanced data processing technology and information conversion standards, and conducting in-depth mining and intelligent analysis of intelligence information has become a key way to enhance the competitiveness of enterprises.

By analyzing the core business process of enterprises, this paper designs and implements an efficient competitive intelligence system to meet the diversified needs of enterprises in different business links. The system uses advanced text mining technology to clean, classify and transform a large amount of unstructured data obtained from the Internet by formulating information conversion standards, so as to generate accurate intelligence in line with enterprise business logic. This paper also focuses on the key elements of system design, the realization process of information conversion standards, and how to improve the intelligence level of the intelligence system through automated analysis and machine learning technology, to provide enterprises with high timeliness and high precision competitive intelligence support, and ultimately help enterprises to obtain strategic advantages in the complex and changeable market environment.

2. Relevant Research

In this study, many related research results provide important support and guidance for the theoretical development and practical application of this field. For example, J Wang's research proposed a multi-collaborative service model [1], which aims to enhance the service efficiency and overall competitiveness of regional industries through the joint participation of enterprises, governments, universities, scientific research institutions, industry associations and for-profit organizations. Through the integration of resource, demand and data intelligence, the model promotes the collaborative development and innovation of regional industry, and provides a systematic service framework for the design of competitive intelligence system in business processes.

N Oraee's research focuses on the information acquisition behavior of universities in the process of competitive intelligence [2] and designs a paradigm model of information acquisition. Through two-stage sampling and semi-structured interview, the purpose, characteristics and influencing factors of information acquisition are revealed, supporting and hindering factors are identified, and the influence of these factors on success and failure is discussed, which provides an empirical basis for the design of competitive intelligence system based on business process.

Based on rough set theory, DB Sassi proposed a four-stage competitive intelligence solution [3], including action collection, action clustering and association, rule generation and rule aggregation. This method has been verified in the practical application of telecom industry, which shows the practical value of the design of competitive intelligence system based on business process.

By establishing the value transmission analysis model of competitive intelligence [4], JL Ding discussed the value increment process of internal and external competitive intelligence of enterprises, and provided operational references for the formulation and implementation of competition and cooperation strategies. This model provides a new perspective for optimizing the design and application of competitive intelligence system.

S Ozturk's research explores the application of business intelligence (BI) in Ankara's IT industry [5] and finds that BI has a positive effect on competitive advantage, but the competitive environment of the industry is complex and changeable. Leading foreign companies gain competitive advantages through differentiation strategies, while local BI solution companies face greater cost pressure and need government support and guidance to enhance market competitiveness.

O Dalfovo's research project focuses on the strategic information systems approach based on the data warehouse concept [6] and develops a computer system based on data warehouses and data networks. The project also plans to provide a free portal to collect information related to regional economy, master's programs and PROTEUS project content, which verifies the feasibility of the application of information system in enhancing market competitiveness.

Hakmaoui's research points out that in A highly competitive and dynamic market environment [7], banks need a prediction system to generate future knowledge to formulate effective strategies. The research shows that competitive intelligence and firm forecasting, as components of the forecasting system, focus on weak signals and major trends of business and competitor intelligence as well as market, respectively, through knowledge creation in the social interaction and externalization stages.

D Silva's research proposes that competitive intelligence systems can help organizations keep up with market trends and anticipate business opportunities by extracting information from large amounts of unstructured text data [8]. The MapIntel system utilizes multi-dimensional vectors to represent documents and processes complex natural language queries through retrieval and reordering engines, supporting efficient decision making, while visualizing documents with two-dimensional projections that reveal clusters of semantically relevant topics.

These research results provide a comprehensive theoretical basis and practical guidance for the design of competitive intelligence system based on business process and the analysis of information transformation standards. By combining various research methods and practical application cases, the design requirements of competitive intelligence system can be more deeply understood, and the practical application effect of the system can be improved.

3. Design of Competitive Intelligence System

3.1 Combination of System Requirement Analysis and Enterprise Business Process

When designing an enterprise competitive intelligence system, it is crucial to ensure the close integration of system requirements and business processes. The system not only needs to meet the requirements of technical functions, but also can effectively integrate into the actual business operation of the enterprise to enhance the overall competitiveness and decision-making efficiency. Information resource management is one of the core components of competitive intelligence system. In this process, the system realizes the unified storage and management of information through the information resource database to meet the needs of enterprises for multi-source data integration. The information resource database should be connected with the key business links of the enterprise such as supply chain management, market analysis and technology development to ensure the integrity, accuracy and real-time of the information. At the same time, through the role allocation mechanism, the system can provide targeted intelligence services to ensure that employees in different departments can obtain information related to their business, so as to achieve effective sharing and efficient use of information.

In the modern business environment dealing with the information explosion, the automatic information collection function is particularly important. Enterprises can use competitive intelligence system to automatically collect information from market dynamics, competitors, technological development, etc. This automation not only reduces labor costs, but also improves the

efficiency and accuracy of information collection. The information collected by automation can directly serve business processes such as product development, marketing and strategic planning, and help companies quickly adjust their strategies to adapt to market changes. In addition, the integration of the system with the enterprise's internal ERP, CRM and other management systems further optimizes the data flow and processing efficiency, and realizes the integration and utilization of information across departments. This integration capability enables intelligence information to be effectively applied in different business processes of the enterprise, improving the overall operational efficiency and market responsiveness of the enterprise.

The integration of system requirements analysis and enterprise business processes must closely align actual business operations with system design to ensure that the system can effectively support the operational and strategic objectives of the enterprise. In this process, the role of the system administrator is crucial, they are responsible for the overall maintenance of the system, including the management of users and data. Administrators not only need to deal with daily data backup and recovery, but also to ensure the stability of the system and data security. The design of the system should take these requirements into account and provide enough support to ensure the smooth operation of the system.

The information chief's job focuses on setting the direction and specific topics of intelligence gathering. Their responsibility is to develop intelligence themes according to the needs of the enterprise, a process that requires the system to have flexible topic management and setting capabilities. Information leaders need to ensure that the system can adapt the intelligence collection strategy to the needs of different contexts to provide strong support for business decisions.

The main task of intelligence collectors is to obtain relevant data from a variety of information sources. These data include the information on the network, but also cover a variety of information within the enterprise, such as sales, production, finance and other departments of data. In order to ensure the accuracy and timeliness of information, information collection personnel need to screen and de-noise the information, and the system must have efficient data processing capabilities to ensure the quality of the original data.

After information collection is complete, intelligence analysts are responsible for transforming this raw data into valuable intelligence. They use advanced text mining techniques to analyze the data and generate detailed intelligence reports. The analysis function of the system needs to be powerful and flexible, and can support the deep mining and information extraction of complex data, so as to provide accurate and practical intelligence support.

The task of the intelligence service personnel is to present the analyzed intelligence information in an appropriate format to the users of the system. The system must have powerful intelligence display and authority management functions to meet the needs of different users. Intelligence service personnel set the corresponding browsing rights according to the user's role to ensure the security and confidentiality of information, and enhance the competitiveness of enterprises in the market.

In the system design, the idea of modularity is particularly important. By decomposing system functions into independent modules, the system can be flexibly upgraded and maintained. The low coupling design between modules enables the system to maintain the stability of other modules in the face of changing requirements. This design not only improves the scalability and flexibility of the system, but also optimizes the maintenance and testing process of the system. The design of the system should not only consider the comprehensiveness of the function, but also pay attention to the optimization of the performance to ensure that the system can play the best effect in practical applications.

3.2 System Function Module Design and Information Acquisition Process

In the design process of enterprise competitive intelligence system, the construction of system function module and information acquisition process is very important. The design goal of this process is to ensure that the system can effectively support the needs of the enterprise in terms of intelligence collection, analysis and service, so as to comprehensively improve the quality of decision making and the competitiveness of the enterprise in the market.

In the information collection stage, the system can automatically obtain data from multiple channels through modular design. Users can use web crawler technology to grab information from specified websites and search engines by setting the initial URL and keywords. In this process, the URL setting management function allows the user to enter the initial URL, and after extracting the information on these urls, the system will further trace the link, thereby extending the coverage of the data source. At the same time, the keyword setting management function can locate and capture relevant data in the search engine by setting specific keywords. In order to improve the quality of information, the information denoising processing function cleans the captured data, removes irrelevant labels and noise, and converts the information into a structured format to improve the accuracy of subsequent analysis. As part of this process, the competitive intelligence capture management function also conducts an initial review of the collected data to ensure that the information is valid and relevant.

In the information processing stage, the information analysis module processes the collected data in depth. The text content analysis function extracts valuable information and patterns from original data by applying advanced text mining technology. At the same time, the information classification management function uses text classification and clustering technology to organize the topic of information for subsequent retrieval and analysis. In terms of the generation of analysis results, the Intelligence Analysis Report management module is responsible for presenting the analysis content to decision makers in a clear format to ensure the readability and practical application of the information.

In the information service phase, the intelligence service module provides support to the internal personnel of the enterprise based on the analysis results to assist in the decision-making process. The Intelligence Analysis Report Publishing function is responsible for managing the update and release of reports to ensure the timeliness and effectiveness of the report content. Rights management, on the other hand, sets access rights based on the user's role, ensuring that sensitive information is only available to authorized personnel, thereby protecting the confidential data of the enterprise.

Through well-designed functional modules and efficient information acquisition process, the system can cover all aspects from information collection to service. This integrated design not only improves the accuracy and timeliness of information, but also enhances the system's ability to support strategic decision-making of enterprises, thus helping enterprises to maintain a leading edge in the fierce market competition.

In the design of the function module of the enterprise competitive intelligence system, the system aims to systematically process and analyze the information related to the enterprise competition through efficient and integrated technical means, so as to provide decision support. The function module of the system covers three core parts: information collection, text preprocessing and text mining. Each part achieves its goal through precise technical design to ensure the comprehensiveness and accuracy of information.

In the intelligence collection part, advanced topic focused crawler technology and metasearch technology are adopted to realize automated information capture. By using web spider technology, the system is able to carry out in-depth crawling of specific topics and set websites, a process that

includes downloading the HTML source files of the pages from various websites. In order to ensure the comprehensive coverage of information, the system not only handles static pages, but also crawls dynamic content and multimedia information. In terms of data extraction, the system uses the HTMLParser parser to extract useful text information from web pages. Then, the system cleans up this information, removing irrelevant HTML tags and redundant links, so as to concentrate on valuable text data, laying the foundation for subsequent data processing and analysis.

In the text preprocessing stage, the system is committed to deeply processing the extracted text data to ensure the accuracy and practicability of the information. In order to remove impurities from web pages, the system uses the HTMLParser parser to clean up the text initially and remove irrelevant HTML tags and advertising content. Then, the extracted text is segmented into Chinese words, and feature extraction methods are applied, such as word frequency analysis, inverse text frequency calculation, semantic information extraction and syntactic dependency analysis. These processing steps ensure the accuracy of text representation and provide a reliable data basis for subsequent text classification and cluster analysis. The system also stores the processed text data in the database, and represents the text features through the vector space model. These features can be optimized to support the text classification and clustering operation effectively.

In the text mining stage, the system combines two analysis methods, text classification and text clustering, to realize the in-depth analysis and sorting of information. In the process of text classification, the system first converts the processed text into vector form, and then uses the support vector machine (SVM) algorithm to classify. This process classifies the text by SVM decision tree and outputs corresponding categories, thus providing clear classification results for decision making. On the other hand, the system uses K-means algorithm for text cluster analysis, and records the cosine similarity between documents by calculating the similarity matrix between documents. In the cluster analysis, the system first calculates the similarity matrix of the pre-processed text, selects the initial cluster center, and iteratively updates it, and finally generates several clusters, each cluster represents a text classification, so as to realize the effective organization and analysis of large-scale text data.

In the database design of the system, the use of ER diagrams (entity-relationship diagrams) provides a clear definition of the data entities and their attributes in the system. By defining entities such as enterprise resource information catalog, information of intelligence collectors, external enterprise information, department information, internal enterprise information, text category, intelligence information, intelligence analysis report and text structured information, the system ensures accurate data storage and efficient management. The relationship and data flow between these entities can be displayed intuitively through ER diagram, which provides a clear framework for database design. This design not only optimizes data management, but also supports the system's flexibility and efficient operation in a dynamic environment.

4. System Application and Benefit Evaluation

4.1 Implementation of Competitive Intelligence System

In this study, the development mode based on B/S architecture was selected in the system implementation process, the system programming language was selected Java, and the page layout and style design were carried out with CSS, and the dynamic effect was achieved by using jQuery. The combination of this design scheme and HTML5 technology significantly enhances the scalability and adaptability of the system. In addition, in order to improve the user experience, the system uses an adaptive functional framework to ensure that the page can automatically adjust the display effect under different screen resolutions. In the process of development, Eclipse is used as the main development tool, the background database is selected SQL Server 2008, and the

development and operation of the system is completed on the Windows 2007 platform.

In the realization of the information collection subsystem, we rely on the information subject set by the information director, construct the enterprise information resource catalog, and guide the information collection personnel to collect information through the catalog. Information collection is divided into two main modules, internal and external, where the internal module focuses on the acquisition of internal data of the enterprise, including information of various departments, while the external module focuses on the collection of external data, such as competitors and market dynamics. To support these functions, the system has designed several core classes, including the SourceList class, InternalInfo class, and OutsideInfo class, which are responsible for storing enterprise information resources, internal information, and external information, respectively, and provide a variety of operational interfaces such as search, filter, create, edit, and delete. The system realizes the automatic collection of information by setting web keywords and network retrieval. After constructing a specific URL request, the system can obtain the return result from the search engine, so as to complete the information collection task.

4.2 System Test and Benefit Evaluation

The guarantee of software quality is inseparable from system testing, which not only verifies whether the function of the software meets the needs of users, but also evaluates its performance. To do this, we used the LoadRunner tool, which played a crucial role in the testing process. Using LoadRunner's VuGen module, we recorded the user action steps and created 2000 virtual users with Controller to simulate the actual usage scenario. After the test is completed, the Analysis module makes a detailed analysis of the results and generates the test chart. The test results show that under the concurrent operation of 2000 virtual users, the performance of the system is stable, fully meets the expected standards, and there is no abnormal function or performance bottleneck.

The system function test is carried out after the design implementation to verify whether the system meets the specific needs of users and the design specifications. The main task of this stage is to ensure that the functional modules of the system can operate normally, and to check whether the data communication between the subsystems is smooth. In addition, the data processing and storage accuracy of the system is also tested to confirm its stability under high load conditions. We design and execute a series of detailed test cases to ensure the functional performance of the system. The test results show that the system performs well in information collection, data processing and report generation, which meets the needs of enterprises and effectively supports scientific management and decision-making.

In the process of functional testing, we pay special attention to the information collection module of the system, and confirm the accuracy and efficiency of the system in data processing through testing. Tests simulating high-load operations show that the system can remain stable under a large number of concurrent requests. The test results of response time also meet the design standards, and the system can quickly process user requests. In summary, the system has reached the expected target in function and performance index, which proves its reliability in practical application.

In addition, the system has been thoroughly evaluated for usability, security and compatibility. In the usability test, the user interface of the system was considered friendly and the user experience was good. However, in terms of the security of data transmission and storage, the system still has room for improvement and needs to be further optimized. In compatibility tests, the system can run properly on multiple browsers, with full functionality and no compatibility issues. At the same time, the maintenance, data entry, update and deletion operations of the database have been successfully completed, and the response speed and processing capacity of the database have reached the expectations.

5. Conclusion and Prospect

With the rapid development of China's economy and the increasingly fierce market competition, enterprise competitive intelligence system plays an important role in helping enterprises obtain key market information, understand competitors and optimize decision-making. This research systematically introduces the background, key technologies and implementation methods of enterprise competitive intelligence system, and successfully extracts effective information from network text through text mining and clustering technology. However, the system still has room for improvement in interface ease of use, file encryption storage, business model graphics and information display form. Future work will focus on improving the semantic mining ability of the system, optimizing the classification efficiency of SVM decision trees, and enriching the presentation of intelligence information to further enhance the practicality and user experience of the system, and provide more powerful support for enterprises in the competition.

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