CrossMark

Monitoring Data Management Information System for Securities Market

Yong Li[1]

Abstract Long-term monitoring the key indicators of the securities market could detect market risk structure and risk behaviors in real time and ensure the safe and smooth operation of the securities system. In view of the large number monitoring indicators, high frequency sampling data acquisition in the online monitoring system, it is necessary to use advanced information management tools to efficiently manage and utilize the massive data, as the scale of securities market grows geometrically. Based on the online monitoring of BP neural network, this paper develops a management information system for the monitoring data of the securities market of China to realize the structure analysis and prediction of market performance and market risk structure and carry out automatically early warning and alarm with reference to pre-set threshold parameters, which provides a technical platform for real-time query, analysis statistics, prediction and alarm of market risk structures.

Keywords Securities market · Monitoring data · Management information system

1 Introduction

Securities market is a component of the wider financial market where securities can be bought and sold between subjects of the economy. By monitoring key indicators' data reflecting the operating status of the securities market, one can understand the flow direction and configuration of social capital, and find out whether the role of the securities market allocating social funds is valid and reasonable. Monitoring key indicators and

✉ Yong Li
yongli@cupl.edu.cn

1 Business School, China University of Political Science and Law, 27 FuXue Road, Changping District, Beijing 102249, China

🖄 Springer

setting the early warning mechanism is also a guarantee on sound operation of securities market.

China has paid great attention to market monitoring at the same time of making effort to develop various financial markets. The existing monitoring indicators are relatively a few, data acquisition frequency is not high [1, 2], the amount of data that needs to be processed is not large, so the relatively simple data management is applied for monitoring data analysis and census. But as we know, many factors could be influential to securities market volatility, including price, interest rate, exchange rate, investment rate, saving amount, economic situation, listed securities quantity and their price movements, etc. [3–5], also with the scale of securities market growing geometrically, monitoring indicator data management information system is needed by building up database or information file system to accumulate a large amount of information and long-term data, and efficiently use the monitoring data to support the normative institutional operation of the securities system.

Many information management systems on the securities company level have been established at home and abroad, The American COSO issued Enterprise Risk Management-Overall Framework in 2004, which expanded the connotation of internal control, and made a more detailed statement on the broader subject of enterprise risk management. In June 2006, the state-owned Assets Supervision and Administration Commission of the State Council drafted and published the Guidance of Central Enterprise Wide Risk Management in China. The commission requested the central enterprises to gradually establish a comprehensive risk management system, and clarified the requirement of risk management information systems in the Guidance of Central Enterprise Wide Risk Management. It is conducive to the risk management of securities market. But we haven't found a management information system on the securities market level in China on the retrieval of existing literature.

Drawing on the experience of existing management information system, based on B/S (browser/server) mode, this paper develops a monitoring data management information system to monitor the key indexes of securities market, complete the real-time massive data analysis, statistics, and realize the prediction and early warning function, which would provide a powerful guarantee for the financial system's safe operation. The remainder of this paper is structured as follows. Section 2 gives a brief description about system framework. Section 3 discusses data acquisition, transmission, backup and processing. Section 4 describes the system structure and the method of data query. Section 5 develops the data report and alarm function of the management information system. The last section concludes.

2 System Framework

The online monitoring data management information system of securities market is developed in accordance with the B/S mode, and the monitoring end users access the system only by browsing the Internet, and the operation is very simple. The monitoring data management information system mainly includes the data acquisition and storage backup module, data remote transmission module, data analysis and processing module, alarm and auxiliary decision module, and a Web browser module, as is shown in Fig. 1.

Based on SQL Server database, the data acquisition and image collection are completed by Delphi programs to perform data transmission and classification autonomously. The
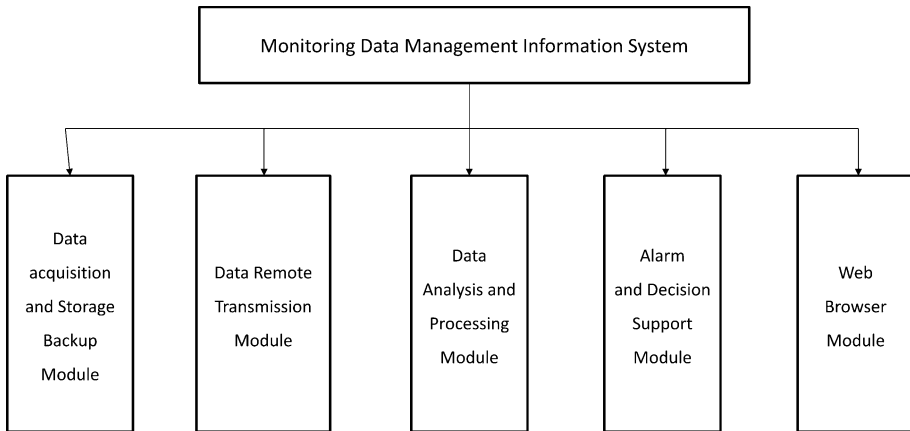
Fig. 1 The system composition

background server function is implemented by Java programming, which is responsible for data acquisition, processing, storage and backup. The foreground browser function is implemented through JSP and Flex, which is responsible for the foreground data query, display and export.

3 Data Acquisition, Backup and Processing

Data acquisition and processing is the core of risk monitoring data management information system. The data is stored and backed up mainly by the background server database.

3.1 Data Acquisition and Storage Backup

The acquisition Server of the information system collects and stores data by the collection and storage backup module, which collect and store data into the SQL Server database through Delphi, waiting for further classification and processing. The acquisition server will back up the monitoring data in case the system crashes or breaks.

3.2 Data Transmission

The management information system is based on wireless network to monitor data and information transmission. The acquisition server uses the wireless network to transmit sensor monitoring data to the back-end processing server. The data query analysis module stores and maps the monitoring data according to the preset procedure so that it can be queried in time. Meanwhile, combining Internet network with the Java programming to upload data, on the query website the latest monitoring data and analysis results can be queried on anytime and in anywhere.

3.3 Background Data Processing and Analysis

The processing and analysis module of the information system using the self-programming will classify raw data by sensors in securities market into various types: the national production, the price level, the exchange rates and interest rates, and the stock data. Video images through level gradient integral operator are automatically interpreted as trend deviation, and data is stored into the database in terms of their types. The system will convert the monitor data into a unity type by the built—in design programs and stored them in the database. After being processed, the data are divided into five types:

1. Domestic production. It includes GDP growth rate, external debt repayment rate, external debt–GDP elasticity ratio, average enterprise asset–liability ratio, bankrupt enterprises proportion;
2. Price level. It includes social retail commodity price index, investment good price index, import commodity price index;
3. Interest rates and exchange rates. It includes bank working capital turnover rate, bank capital adequacy ratio, banks non-performing loan ratio, capital outflow growth, interest rate change, deposit–lending ratio, the currency exchange change;
4. Security indexes. It includes stock price index, stock turnover rate, listing stock added rate, the Dow Jones Industrial Average, Nikkei Stock Index, the Hang Seng Index.

4 System Structure and Data Query

The browser part of the B/S mode is based on the browser query platform established by the Java programming program and the background server. After processing, the monitoring data and its analysis results are uploaded to the network in real time and the query is realized through Internet login. Monitoring systems is networked, and also can be extended to geographically distributed networks.

4.1 System Management

Users login to the Web browser website through user name and user password. The user name is set in advance by the system requirement, but the user can change the login password. To ensure the security and stability of the system, the system automatically records the basic information of the login personnel and the basic operation of the login personnel. The basic functions of the information system include on-site monitoring view, monitoring the latest data and historical data query and analysis reports, logs, and forecast alarm, system configuration, system help, etc., a friendly interaction environment between user and monitoring system is established.

The monitoring view section can show the monitoring situation about key indicators, industries' distribution of data acquisition, relative deviation diagram of key indicators and their basic values, and the overall state diagram of various financial markets.

The section of Monitoring the latest data and historical data query mainly perform the query function of each sensor, query condition could be subjected to time, structure and so on. The analysis report could be the forms or charts according to user requirements, and is passed to the user's computer by the remote transmission module. The log and prediction alarm section mainly record the user login operation information and realize the state

prediction, alarm and so on. The system configuration section could carry out the query and sensor configuration, monitoring class configuration, monitoring item configuration and monitoring point configuration. The system help section mainly includes the user instructions and clearing the cache of the management information system.

4.2 The Latest Data Query

The query is the most basic function of the management information system, which includes the latest data query, and the historical data query. After being processed, the data stored in the background server can be queried on the platform at any time through the Internet network. Information system query platform provides a variety of information query and display modes.

In the latest data query, indicators could be queried in real-time, or could be queried in terms of time period. The test curves of all sensors for the queried indicator would show out, and the sensor test data displays at the time point where the mouse click location.

4.3 Historical Data Query

Historical data query section can accomplish data query according to the sensor, monitoring items, transfinite data in different period with the help of the server default function. More advanced query manner could be carried out by a comprehensive query project. The function procedure is set up in the background server, which can unify of the data unit and process drawing, and study the correlation of data and the relationship of risk structure deformation and evolution.

User could query the relationship of multi-target indicators within a certain time period. The system would directly extract monitoring data in that time period from storage database, according to user requirements. The background processing analysis module makes tables and charts, and passes them to the user computers directly by remote transmission module, and displays the processing results on the browser query platform.

The correlation analysis of stock price index, price level, interest and other indicators can be carried out through a multi-purpose query. Figure 2 shows curves of a trend deviation of stock price index and that of RMB against U.S. Dollar exchange rate from August 1, 2017 to December 4, 2017, the deviation of stock price index can be analyzed
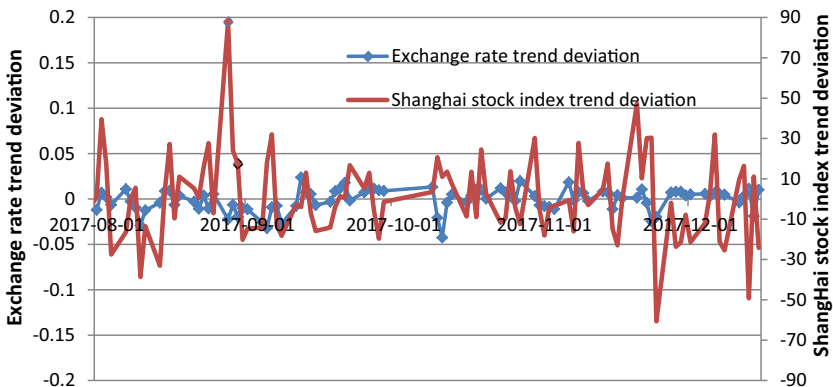

Fig. 2 The relative curves of stock price index and RMB against U.S. Dollar exchange rate

under the action of exchange rate. Under the long-term monitoring, the correlation analysis of multi-indicators can reveal the interaction mechanism between structures in complex environment and provide optimizing methods to enhance performance and avoid risk.

The monitoring of historical data could reveal the evolution and deterioration of securities market structure risk, and provide important data support for the study of its risk characteristics under long-term operating conditions. In addition, it can provide guidance for on-site risk aversion.

5 Report and Alarm Function

The analysis report and prediction alarm are two important parts of the monitoring data management information system. The analysis report is helpful for the operation department and researchers to quickly understand the situation of the market risk status, and the prediction alarm is helpful to guide risk management operation.

5.1 Data Reports and Exports

Data analysis reports section of the risk monitoring data management information system can accomplish the compared analysis of data, weekly report, monthly report and quarterly report. The data report includes the various statistical reports in a certain time period, for certain index, etc., with a consistent format and completed accurate content.

When the display mode provided by the platform does not meet the user requirements, these statistics can be called in the system and exported in Excel form so that users can directly use it later. For example, if the user needs the day data of the stock index for nearly half a year, the statistics of this data could be carried out and exported.

5.2 Prediction and Alarm

The information system uses BP neural network [6] to analyze and predict the long-term monitoring data. Monitoring system is based on MATLAB software programming, the processed data is used as the basic input data, and trained by the middle tier of training network consistently until the error meet the requirements. The prediction results are output used to judge the indicators' evolving trends, and predict operation performance and
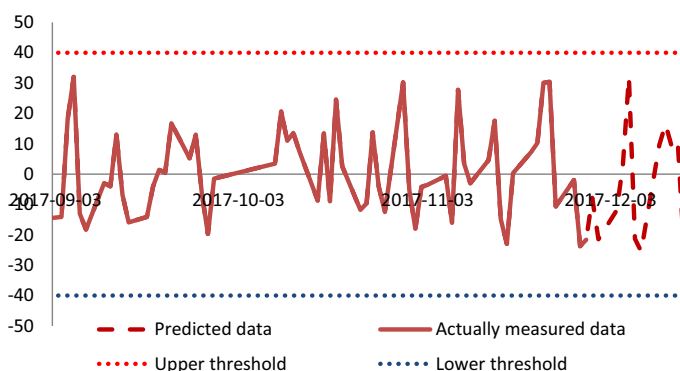

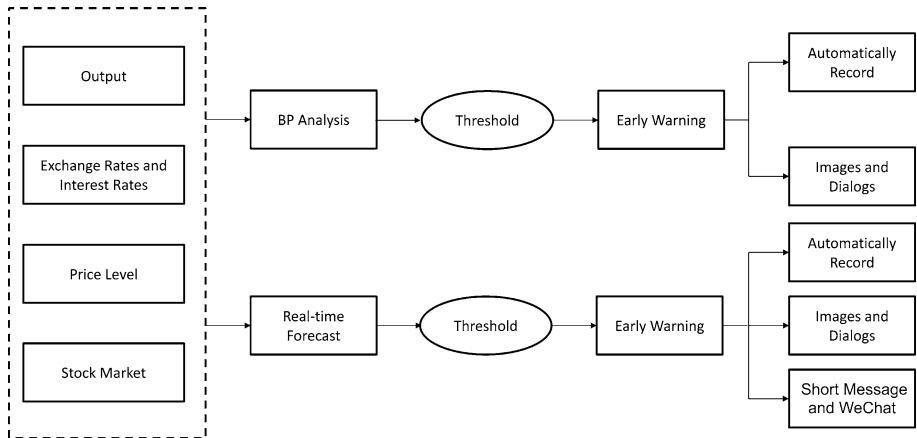**Fig. 3** BP neural network data prediction schematic diagram

Fig. 4 Early warning and alarm procedure

risk structure of securities market, as shown in Fig. 3. Considering different key indicators have different threshold values to assure the sound operation of the securities market, the assessment of information system of the securities market on operation performance and risk structure would provide the decision-making basis for risk management of securities market.

The monitoring data management information system has the function of early warning and alarm, as shown in Fig. 4. Compared with preset alarm threshold value, if Predicted results overrun, an early warning information is generated, and automatically is stored in the system database, and at the same time the pop-up dialog appear and the alarm bell is triggered as a warning prompt message. When the real-time sensor data exceeds the threshold, the second alarm will be triggered immediately, and the relevant person will be notified by short message and WeChat.

For the risk monitoring indexes, such as production index, interest rate and foreign exchange rate, market index, et al., all can be set the threshold test value, to carry on the real-time warning and alarm of the market risk structure. The realization of early warning and alarm function provides a strong guarantee for the safety securities market.

6 Conclusion

Based on the online monitoring of BP neural network, this paper develops a management information system for the monitoring data of the securities market of China. This monitoring data management information system could realize the efficient storage of mass monitoring data, comprehensive analysis, real-time query, statistics, and forecast the state of the risk structure and make early warning.

Backend server includes raw data and image data receiving, processing, storage and backup, data remote transmission for the use of processing server and front desk query, a built-in programming procedures is designed to complete the foregrounding function.

The foreground browser can monitor key indicator data acquisition and sensor network. Users could query the data online by sensor serial numbers, monitoring indicators, and they could make integrated query on history data for multiple indicators and different risk

structure, and can also obtain the structural state time-varying analysis and multi-structural correlation analysis by using historical data query and comprehensive data query.

The statistical report part can carry out data analysis over the same period of different year and the weekly, monthly, yearly reports. Moreover, it has the function of the data sorting for different indicators, and the data could be exported according to user requirements. In addition, the system is based on BP network to realize the prediction function of risk stress and risk structure, and to provide the guidance for the securities market operation in a safe and reliable status and to avoid any security risks.

References

1. Zhou, T. (2014). *Legal regulation of China's securities markets: Recent improvements and competing advantages.* New York: Social Science Electronic Publishing.
2. Stigler, G. J. (1964). Public regulation of the securities markets. *Journal of Business, 37*(2), 117–142.
3. Wang, Y.-C., Tsai, J.-J., & Li, Q. (2017). Policy impact on the Chinese stock market: From the 1994 bailout policies to the 2015 Shanghai–Hong Kong Stock Connect. *International Journal of Financial Studies, 5*(1), 4.
4. Chan, K. M., & Kwok, S. S. (2016). Capital account liberalization and dynamic price discovery: Evidence from Chinese cross-listed stocks. *Applied Economics, 48,* 517–535.
5. Tsai, J.-J., Wang, Y.-C., & Weng, K. (2015). The asymmetry and volatility of the Chinese stock market caused by the "New National Ten". *Emerging Markets Finance and Trade, 51,* 586–598.
6. Li, J., Cheng, J., Shi, J., & Huang, F. (2012). Brief introduction of back propagation (BP) neural network algorithm and its improvement. In D. Jin & S. Lin (Eds.), *Advances in computer science and information engineering. Advances in intelligent and soft computing* (Vol. 169, pp. 553–558). Berlin: Springer.

Yong Li earned her Ph.D. of Management Science and Engineering at University of Science and Technology of China in 2004, now work as a Professor and Tutor of Doctor in China University of Political Science and Law. Her main research areas is Financial risk management. She has published more than 30 research articles.