

Investment Research Application Based on Mutual Fund Knowledge Graph

Huihua Chen^{1,*}, Bowen Yuan¹, Rui Yan², Zhengliang Wu¹, Dianxing Liu¹, Kaiqi Xu³

¹*CITIC Securities Co., Ltd, Beijing, 100026, China*

²*School of Economics and Management, University of Science & Technology Beijing, Beijing, 100083, China*

³*Transwarp Technology (Shanghai) Co., Ltd, Shanghai, 200233, China*

**Corresponding author*

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Abstract: Mutual funds have become one of the main participants in the A-share market. Analyzing their investment direction and holdings can help investors conduct market research and make more reasonable investment decisions. In order to improve the ability to analyze mutual funds, this article proposes a technical solution for an intelligent research system based on mutual fund knowledge graph, which constructs a knowledge graph covering all mutual funds and fund managers information in the A-share market, and sets 8 calculation indicators to comprehensively analyze the fund's holdings, adjustments and performance. Finally, the technical solution is launched on the company's internal system, greatly improving work efficiency.

1. Introduction

With the A-share market system becoming more and more mature, mutual funds are gradually becoming one of the important ways for residents to invest and manage their wealth. Because of this, the scale and proportion of mutual funds in the market are also increasingly becoming one of the most important circulating funds in the A-share market. Therefore, it can be seen that the analysis of the overall investment direction and position of mutual funds can greatly help individuals or organizations to conduct market research and investment.

In traditional investment research, data processing is mainly based on the researchers' own knowledge reserve and analysis ability to manually process data, while intelligent investment research is based on artificial intelligence technology for automatic analysis, with a more comprehensive thinking dimension and more stable logical reasoning. Among these artificial intelligence technologies, one of the cornerstones is the knowledge graph. The knowledge graph is essentially a large-scale semantic net with entities and concepts as nodes and various semantic relationships between them as edges. Since the data information contained in mutual funds, such as fund company, fund, fund manager and fund position, has reached more than 10 million level and has various correlation relationships, and there is a need for multi-level relationship query. Adopting knowledge graph technology to conduct overall analysis and research on mutual funds is undoubtedly appropriate.

Bogle John C (2009) examined the relationships among risk, return, and cost in the nine categories of the Morningstar equity style box and found the relationship between style of mutual fund and its performance. Bajracharya R B (2017) evaluated the performance of five mutual funds of NEPSE on the basis of monthly returns and Sharpe ratio compared to benchmark return. Alibakhshi R (2016) mentioned methods including similarity-based approach to compare mutual funds. Haslem J A (2010) wrote a book which covers a broad range of topics including evaluating stock/bond allocations within fund portfolios. On the basis of extensive research on the new intelligent investment research information technology, we put forward the technical scheme of the seller's intelligent investment research system based on Mutual Fund Knowledge Graph closely combined with the investment research business of securities brokerages and completed the launch on the internal system, an investment research platform developed by CITIC Securities, realizing the combination of industry and research and improving the efficiency of researchers[1].

2. Seller Intelligent Investment Research System Based on Mutual Fund Knowledge Graph

2.1. The Scheme of Mutual Fund Knowledge Graph Construction

This study is based on the StellarDB graph database system that supports trillion-scale storage and integrates Wind and the company's internal data sources, including basic information of Chinese funds and fund managers, fund portfolio, fund net value, fund classification, stock industry classification and other data. It contains 7 types of entity nodes including fund company, fund manager, fund, stock according to three levels of industries by CITIC Securities, and 6 types of relationship edges including relationships between fund companies and fund managers, relationships between fund managers and funds, relationships between funds and stocks, relationships between stocks and industries and relationships among industries. Then, combined with the data, it constructs Mutual Fund Knowledge Graph. Finally, the graph structure of "fund company ->fund manager ->fund ->stock<- third level industry<- second level industry <- first level industry" is formed, and meanwhile, the graph analysis is responded in seconds level.

2.2. The Scheme Based on the Graph Algorithm of Mutual Fund Knowledge Graph

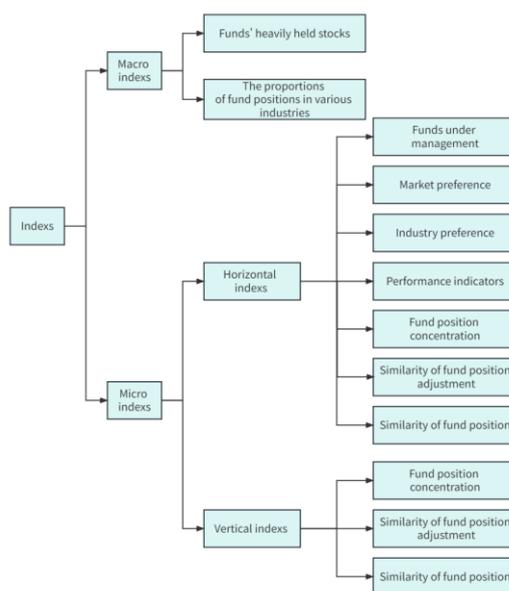


Figure 1: Display of analysis level of calculation index

In the research and analysis of fund investment based on knowledge graph, eight calculation indexes are set to study and analyze the funds from macro to micro level, from vertical to horizontal level, as shown in Figure 1.

The macro-level is to enable investment researchers to quickly understand the market investment environment, including hot stocks and industry fund positions, and analyze the recent hot industries and stocks that invested heavily in equities.

The micro level is the specific analysis of the fund situation, including the diachronic change of a single target fund, and the horizontal comparison of multiple fund positions in the same period.

According to the characteristics of the indicators, our calculation indicators are divided into traditional and innovative reference indicators.

(1) The important reference indicators of traditional investment funds are the basic situation, market preference, industry preference and performance indicators of funds under management, which can accurately evaluate the performance of the fund in the past history, meeting the traditional fund analysis from macro to micro research, and helping to evaluate the investment value of the fund combined with the historical performance.

Hot stocks with large positions: in the current quarter, the stock market value is less than or equal to 20 billion for the small and mid-cap, more than 20 billion for the large-cap, ranked as the institutional position of small and mid-cap or the large-cap in the circulation of the market value of each stock[2].

Industry fund positions: ranked as the positions of each industry in the three levels of industry in the current quarter.

Funds under management: the return of all funds in the current quarter.

Fund holding style:

- 1) Market preference: the fund's market position and value growth position in the current quarter.
- 2) Industry preference: fund positions in various industries in the current quarter.
- 3) Performance indicators: fund drawdown, return and Sharpe ratio and the average of peers in the current quarter.

(2) Innovative reference indicators include similarity of fund position and similarity of fund position adjustment, which can meet the horizontal and vertical comparative study of funds. They visually show the results of the comparative data, fully excavate the correlation between funds and describe the overall picture of the fund, and correct personal experience in the evaluation of fund investment value brought by the misjudgment, making the fund research more three-dimensional. It is an important metric of the fund manager's investment ability and the fund's future performance.

Similarity of fund position/concentration: The similarity and concentration of positions across multiple funds from three sectors to a single stock during the same quarter.

Similarity of fund position adjustment: The similarity of multiple funds positioning from three sectors to a single stock in the same two quarters.

2.3. The Scheme of Innovative Application Based on Mutual Fund Knowledge Graph

The investment style and overall preference of fund managers is an important direction to study the market. In the topic, the main task is to analyze the indexes including net worth, drawdown, Sharpe ratio and the fund industry position of a fund manager.

For example, taking the fund manager of Lombarda China Fund as the starting point, the query of this node can be directly extended to the fund under management, as shown in Figure 2.

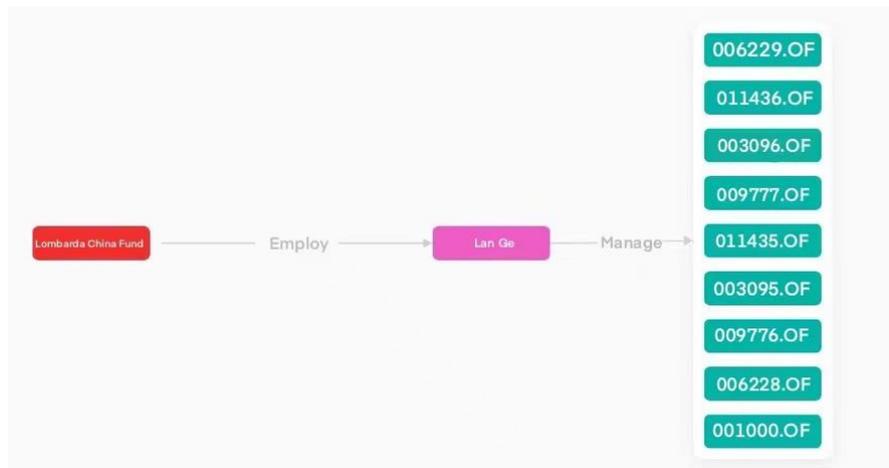


Figure 2: Fund association example

For each fund under management, there are drawdown and return indicators as well as industry rankings. The Maximum Drawdown is an important indicator to measure the risk control ability of a fund manager. The Maximum Drawdown refers to the maximum range from the peak to the bottom of the net worth curve of the fund and represents the maximum value at risk of the fund in the past. This index tests the fund manager's ability to grasp risks and trends. The smaller the Maximum Drawdown index is, the less risk the fund faces. The Maximum Drawdown of the fund is proportional to the risk of the fund. The return represents the rate of return in the fund manager's tenure, which represents the profitability of the fund in the past. The higher the return, the more sensitive the manager is to the market and the better the manager's ability to seize opportunities. The Sharpe ratio can be used to measure the fund's ability to obtain excess return after adjusting for risk. For simplicity, the Sharpe ratio is the return-risk ratio, which represents the excess return expected to be obtained by taking unit risk. For funds with similar rates of return, the less risk fund is better; while for funds with similar levels of risk, the greater return fund is better, as shown in Figure 3.

Performance indicators

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Maximum Drawdown	Average of peers	Rank
0.0719	0.0412	145
Return	Average of peers	Rank
-0.0056	0.0042	1119
Sharpe ratio	Average of peers	Rank
-0.5354	-2.477	160

Figure 3: Fund evaluation index

On the one hand, if you are interested in a certain fund manager, the above functions can easily let investors know the funds under management, as well as the overall performance of each fund, so as to have a general understanding of the investment ability of the fund manager. On the other hand,

although some funds are managed by the same fund manager, the specific positions and the corresponding stock ratio are not the same, so the "market preference of funds under management" function module is extended[3-4].

The market preference analysis module has several indicators, such as the proportion of positions of stocks in small and mid-cap/large-cap, the size of positions, the proportion of growth stocks positions, and the total proportion of fund positions in the first, second and third level industries. To some extent, the proportion of positions of small-cap and medium-cap stocks and large-cap stocks can be used as a standard to judge the floating degree of a fund's net worth. Compared with the funds with a larger proportion of large-cap stocks, the fund net worth curve tends to be more stable and less volatile. And the proportion of growth stocks can also reflect the degree of risk of a fund. Funds with a large proportion of growth stocks can be called growth funds. Growth stocks refer to those stocks whose enterprises are still in the stage of rapid development at present. As most growth stocks are in the growth stage, the income and profit situation is not very stable, and the stock price often fluctuates greatly because the profit and development are not as expected, so they belong to the investment varieties with high profit and high return. The same goes for the growth fund, as shown in Figure 4 and Figure 5.

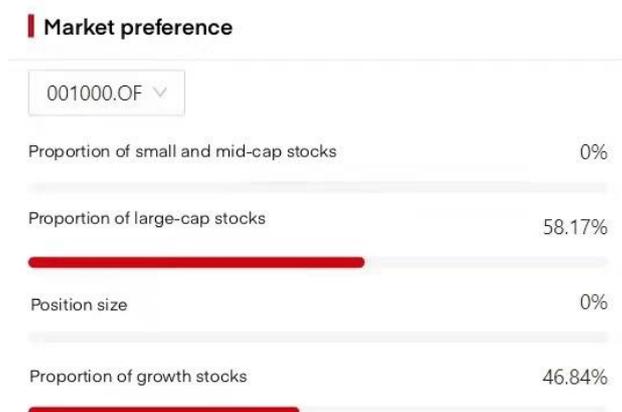


Figure 4: Analysis of market preferences

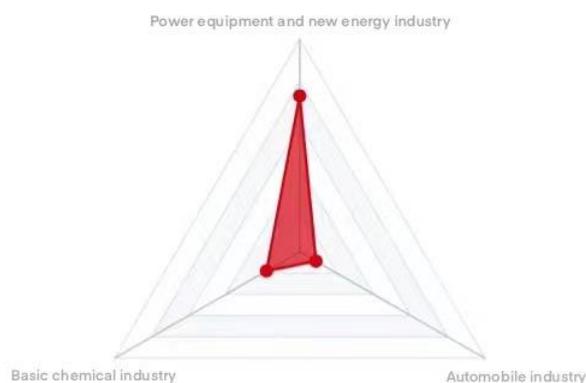


Figure 5: Industry investment preferences

In addition to risk investment preference, industry investment preference is also one of the important factors to observe the investment style of the fund. This function module shows the proportion of fund positions in different industries under the first/second/third tier industries.

Different funds managed by the same fund manager will also have different layouts in terms of positions and industries. Through this function, the funds under the fund manager can be well compared horizontally, so that investors can have a full understanding of the fund manager and the fund under management.

3. Summary and Outlook

The mutual fund knowledge graph covers the overall information of nearly 10,000 public funds and thousands of fund managers in the A-share market, completing the task of fully reflecting the fund correlation and describing the overall picture of the fund. Based on position analysis, it can not only help investment and research researchers quickly understand the overall distribution of fund position and fully understand the market in a short time, but also help investment and research researchers carry out position analysis and comparison in various aspects such as return, drawdown, industry distribution of fund positions, similarity of fund positions, so as to make a more reasonable investment strategy. Market preference of fund managers and funds with large positions can assist investment researchers to analyze the current market investment hot spots of the market. Quarterly position adjustment analysis module can assist investors to understand the trend and change of going long funds in the market, mastering the future investment direction that may become the hot spot of the market. At present, the fund knowledge graph has been used stably for 3 months on the internal platform. Compared with traditional data reports, the visualization form of the graph has been praised by researchers and institutional investors, which greatly facilitates the work of business personnel and greatly improves the working efficiency of users.

Due to the time constraints, the mutual fund knowledge graph will be improved later. For example, FOF and debt holding relationships can be added to the graph for further exploration and a deeper level of graph algorithm processing can also be carried out, such as analyzing fund clustering and abnormal position adjustment behaviors. In addition, the function of the front-end interface after production can be improved. It will be upgraded and iterated according to the experience of investment and research personnel.

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