

The Integration of Machine and Human Knowledge by fuzzy logic for Improving the Reasoning Performance

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The decision support literatures have long recognized that multiple sources of knowledge is more effective rather than a single kind of model in solving unstructured problems. This implies that knowledge integration can improve the reasoning performance in unstructured problems.

This paper proposes the knowledge integration of the machine and human knowledge in the purpose of achieving a better reasoning performance in the stock price index prediction problem using Korea Stock Price Index (KOSPI).

Machine and human knowledge are complementary in real world. In general, human knowledge (or expert knowledge) is subjective and adaptive in nature. Experts have highly organized and domain-specific knowledge and perform reasoning using their experiences and knowledge. The cognitive science literatures have been suggested that expert knowledge is especially better at diagnosis than at

predicting.

Meanwhile, machine knowledge is the objective because it is derived from historical instances that possess the regularities useful for interpreting some part of phenomena in a specific domain. The most significant difference between machine and human knowledge is that the former relies on the objective method and the latter on human expertise. Each knowledge has unique and to a large extent complementary features. This implies that these two kinds of knowledge can be cooperatively used in solving the stock price index prediction problem.

The human knowledge is the judgmental knowledge of experts about various factors that might affect stock market. The following four factors such as macroeconomics prospects, internal situation of stock market, foreign economic trend, and political situation are used to generate the human knowledge in this study.

Causal model using 7 factors such as Leading index as one of the composite business indicator, exchange rate of Won to U.S. dollar, M2 average, balance of current account, trading value of stocks, corporate bond yields, and trading volume of stocks is used to derive the machine knowledge.

The knowledge integration of machine and human knowledge is achieved by fuzzy logic-driven framework to generate the integrated

knowledge. Fuzzy rule base resolves the conflicts among the integrated knowledge.

The experimental results show that the integration of machine and human knowledge rather than a single kind of knowledge can improve reasoning performance in the unstructured stock price index prediction problem so that it can provide a better reasoning performance and understanding on the stock price index prediction problem.

This study has the twofold contribution. One is that stock market analysts have complementary used machine and human knowledge in their problems such as the prediction of stock price index and portfolio selection. However, it is a difficult work to integrate deterministic machine knowledge and subjective human knowledge. The knowledge integration of this study can be a useful tool to support them and generates a more robust knowledge so that it can improve the reasoning performance and the explanatory capability in the stock price index prediction problem. The other is that this study proposes a more rigorous application of fuzzy theory. Fuzzy theory plays an important role in generating of knowledge, the integration of multiple kinds of knowledge and the synergistic combination. Such fuzzification provides the enhanced ability to deal

with the fuzziness in information and knowledge of stock market.

The further research issues still remain as follows:

- 1) There exist several methods for determining fuzzy membership functions such as singleton-typed, triangular-typed, and bell-typed fuzzy membership functions, but the selection criterion for appropriate fuzzy membership function is subjective to researchers. Thus, the more refined and objective methods for determining fuzzy membership functions are required.
- 2) The fuzzy rules obtained from fuzzy rule base can be converted into fuzzy expert systems. This conversion provides the better understanding and more effective inference.