Short term stock selection with case-based reasoning technique

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ABSTRACT

Stock selection is an important decision making problem. Trading strategies and rules based on fundamental and technical analysis can be used for decision making process. In this paper, we propose an intelligent stock selection method, which is called case-based reasoning (CBR). This technique uses the fundamental and technical indicators to identify the winning stocks around the earning announcements. CBR method is compared with other artificial intelligence techniques such as multi layer perceptron (MLP), decision trees (QUEST, Classification and Regression Trees, C5), generalized rule induction (GRI) and logistic regression. We show that the performance of CBR is better than the performance of other techniques in terms of classification accuracy, average return, Sharpe ratio and ideal profit.

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1. Introduction

Stock selection is regarded as a challenging task for portfolio optimization. With the growing importance in the role of equities, the selection of attractive stocks for the short and long term investment has been the most important decision. Therefore, a reliable tool in the selection process can be of great assistance to investors. An effective and efficient system gives investors the competitive edge over others as they can identify the performing stocks with minimum effort. Trading strategies and rules based on fundamental and technical analysis have been used by both academics and practitioners for decision making process. Trading strategies can be transformed to computer language to exploit the logical processing power of the computer. This greatly reduces the time and effort to find attractive stocks.

Many papers have focused on fundamental indicators to understand how they affect future earnings and stock prices [8,64,23,18,60]. Developing investment strategy based on fundamental indicators result in significant abnormal returns. In addition to this, analysts' recommendations, stock market rumors and earning surprises can lead to abnormal returns. Many studies find that stock prices respond positively to the announcements of increase in earnings and negatively to the announcements of decrease in earnings for the U.S. firms [59,29,10,16]. Some researchers prove

evidence of the informational content of earning announcements in a number of non U.S. markets [5,15]. Based on these findings, we can develop a model for selecting winning stocks around the earning announcements.

There have been many studies using machine learning (ML) techniques in stock selection and stock price prediction. Most of these studies have focused on stock market index and individual stock prediction [7,29,28,6,17,13,14]. Recent studies have presented encouraging results on stock selection using data mining techniques such as rule induction, neural network, and combination of classifiers [20,24,25,58,4,31,27,14,34].

CBR technique is one of the popular methodologies in knowledge-based systems. It is a novel paradigm that solves a new problem by recalling and reusing specific knowledge from past experience [1]. Concurrently, it is already an established and powerful methodology for intelligent problem solving and has been used for developing a variety of applications. Due to its strengths, researchers have successfully applied CBR to many areas: supply chain management and scheduling [44,50,45], bond rating [54,33], business failure prediction [43], business control system development [11], bankruptcy prediction and credit analysis [3,49,32], and stock market prediction [20,21,36].

This study proposes a short term stock selection model based on CBR. A combination of technical and fundamental indicators is used as an input the CBR model for effective stock selection around the earning announcement. Portfolio managers focus on long-term portfolio management. Therefore, they try to choose fundamentally strong stocks with low volatility. On the other hand, some investors,

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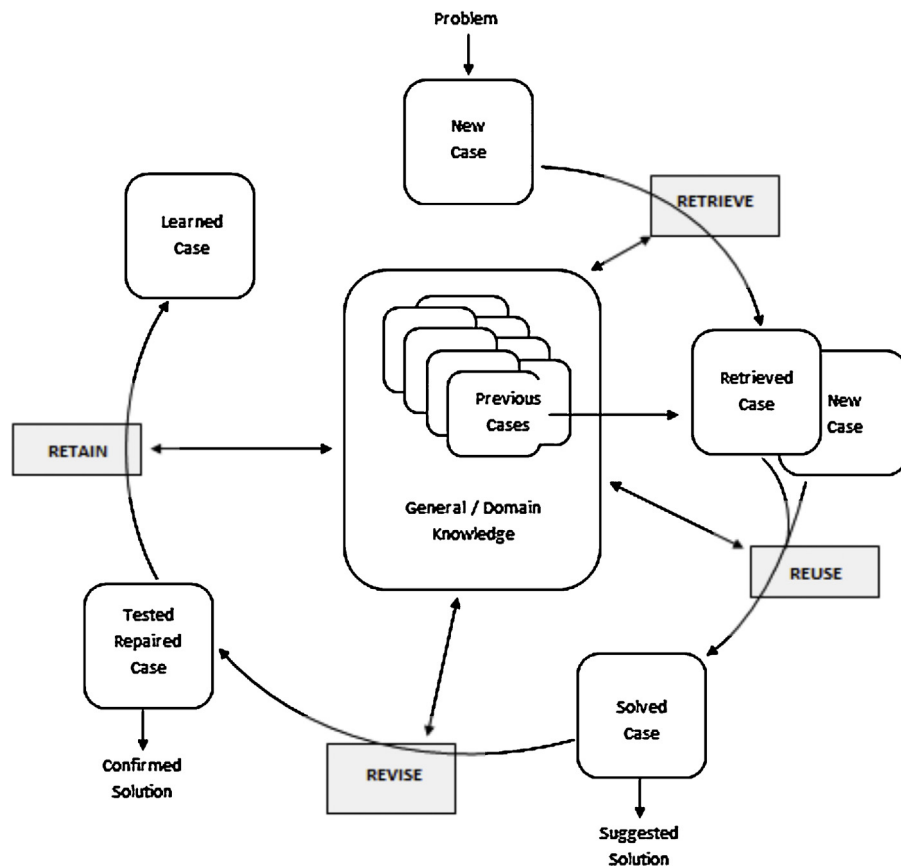E-mail addresses: ince@yahoo.com, h.ince@gyte.edu.tr

Fig. 1. A CBR cycle.

Source: Adopted from Aamodt and Plaza [1].

especially small investors, focus on short term stock selection. They try to develop investment strategy based on fundamental and technical analyses. We propose an intelligent stock selection model around the earning announcement periods that uses combination of fundamental and technical indicators. There are some researches that use the CBR approach to forecast the stock indices and direction of movement [37,35]. As far as we know, there are no researches applying the CBR technique to short term stock selection or stock classification problem. The primary contribution of this study is to show that CBR can be used for short term stock selection. Another contribution is that we combine the fundamental and technical indicators.

The rest of this paper is organized as follows: The next section briefly describes the CBR approach. Section 3 presents the proposed stock selection model. Section 4 explains the experimental design and the results of the evaluation experiment. The final section presents the conclusion.

2. Literature review and proposed model

2.1. Case-based reasoning approach

Case-based reasoning (CBR) technique is one of the popular methodologies in knowledge-based systems. While other artificial intelligence techniques depend on generalized relationships between problem descriptors and conclusions, CBR utilizes specific knowledge of previously experienced problem situations. It solves a problem by retrieving, reusing, revising and retaining past cases based on their degree of match and usefulness to the current situation. This is done by partial matching of the past cases with the current case, and by ranking across case dimensions until a smaller set of matching and useful cases is retrieved [3,1]. The usefulness of past cases for the current situation, on the other hand, may be assessed by assigning weights. A high degree of similarity or usefulness presents a good reason for adaptation. CBR methodology has been used in a broad range of domains to capture and organize past experience and to learn how to solve new situations from previous solutions.

In general, a CBR system can be viewed as a composition of two modules, i.e., a case library and a problem solver [3]. The case library, which contains historical problems and their corresponding solutions, acts as a source of knowledge. Given a new problem, the problem solver performs two actions, i.e., (i) retrieves similar cases from the case library based on some similarity measure; and (ii) adapts the retrieved cases so that a solution to the new problem can be proposed.

CBR system is composed of four sequential steps which are called into action each time that a new problem is to be solved [3,1,38]. Conceptually CBR is commonly described by the CBR cycle shown in Fig. 1. It involves four major steps which are recalled every time that a problem needs to be solved [3].

  i. Retrieve the most relevant case(s).
 ii. Reuse the case(s) to attempt to solve the problem.
iii. Revise the proposed solution if necessary.
 iv. Retain the new solution as a part of a new case.

The purpose of the retrieval step is to search the case base to select existing cases sharing significant features with the new case. The key issues in this step are computing case similarity to match