Stock Trading System: Framework for Development and Evaluation of Stock Trading Strategies

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Abstract. Intelligent stock trading models are becoming valuable advisors in stock markets. While developing such models a big importance is given to its evaluation and comparison with other working models. The paper introduces trading system for stock markets, which is adesigned as a framework for development and evaluation of intelligent decision–making models.

1 Introduction

There is a number of existing stock trading systems, which allow users to make technical and fundamental analysis of stock markets' changes, to analyze the historical fluctuations of stocks or options prices etc. Systems like WinnerStockPicks [8], NasTradingSystem [3], TradingForProfits [6] generate trading signals and allow the users to make an analysis of behavior of stock market through the application of technical analysis. Trading system UltraTradingSystem [7] for generating of trading signals is using a balanced approach of technical analysis and news research. All these systems miss an intelligent mechanism for decision–making and do not allow to integrate other analytical tools and to make comparison of trading results, which were achieved by using different trading models and strategies. Many commercial software packages for technical analysis offer both a comprehensive programming language, and a simulation mode, where the performance can be computed. However, most available products do not take this very seriously, and real trading simulation with a multi–stock portfolio is seldom possible [2].

The realization of the proposed real time trading system was developed using MATLAB. The system allows to download real time data, develop different intelligent trading models, compare trading results and make a detailed analysis of the trading results.

The paper is organized as follows: first sections describes the system and introduces its architecture, the second section is focused on the analysis of trading system applications for the analysis of different strategies. This section presents two trading strategies and discusses the analysis possibilities of the results. Finally the conclusions and future work is given.

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2 Stock Trading System

The development of trading system was instigated by several reasons:

- *The need of framework for evaluation of stock trading algorithms and strategies.*
- *The need of real data management for the analysis of trading algorithms.*
- *The need to increase speed of computations.*

The architecture of the developed trading system is presented in Fig. 1.

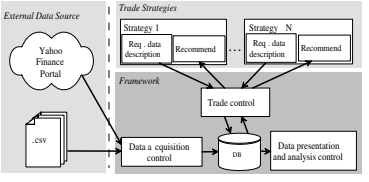

Fig. 1. Trading System Architecture

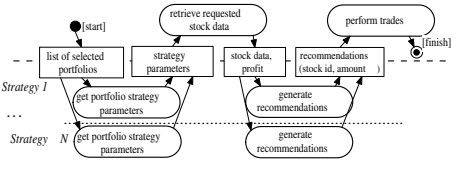

Fig. 2. Trading Scenario

Architecturally the system is divided into three parts: external data source and two internal parts — framework and trading strategies. External data source is only used to retrieve real time or historical stock data. The most important part of the system is the framework. The main tasks of the framework are: to download data from external data source; to preprocess downloaded data and store it in the database; to prepare data according to settings of the trading strategies; to perform trades for the created portfolios; to provide graphical user interface for the above mentioned controls; to provide means for data analysis. Based on a created portfolio and stock returns, data presentation and analysis control allows to do technical analysis of the results. One of the main requirements for the developed framework was to provide common interfaces for trading strategies and in this way to ensure easy integration of new trading strategies. Each trading strategy has to be implemented according to the given template. From an perspective of object oriented paradigm, each trading strategy is an object with two main methods. One provides information about required data quantity for given strategy and the other performs trades.

After the trade action is started the system scenario could be described in the following steps(see Fig. 2): (1) user is asked to enter interval dates for sequential historical trades or trades are started for the current day; (2) system for all selected portfolios determines trading strategies and asks each strategy to issue date requests; (3) system checks for data in the database (at this moment system can inform the user about missing data and can ask to retrieve data from external data source); (4) strategy performs calculations and returns recommendations; (5) after the recommendations are retrieved from strategies the framework performs trades and updates the database.

For the possibility to tune the analyzed strategy, framework allows for each strategy to change strategy settings. This is made through strategy options window, which is called from the main window using 'strategy options' button. This feature allows to use several portfolios with the same strategy but with different strategy parameters, as all parameters are referenced to strategy and portfolio. This allows to analyze the importance of different strategy parameters and results.

3 Trading System Application for Analysis of Different Strategies

For the analysis of the proposed trading system and its possibilities two different trading models were selected: intelligent decision–making model [5] and model of moving averages [1]. A detail presentation and evaluation of the intelligent decision–making model for stock markets are introduced in our previous works [4], [5]. The intelligent decision–making model combines the application of Artificial Neural Networks(ANN) and Particle Swarm Optimization(PSO) algorithm. The second model is a well known moving averages method.

There were created two portfolios with identical coincidental parameters. For the analysis of the models there were taken 130 stocks from SP500 index group and time period from 01-Jan-2000 to 01-Mar-2000. The main window of introduced trading system is presented in Fig. 3.

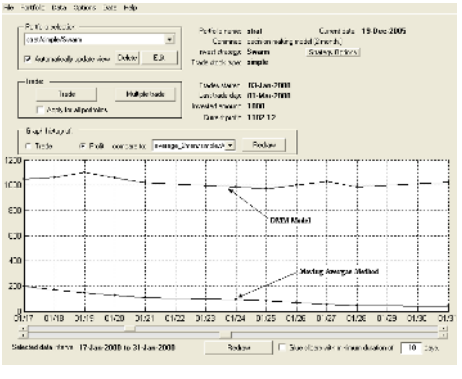

Fig. 3. Trading Systems Main Window

Figure 3 presents trading results of two portfolios. The descriptions of the selected portfolio are shown on the right side of the screen. Each portfolio is described by its name, investment strategy, trade stock type (stocks or indexes), trade start and last dates, and investment amount. The user can select what strategy options he/she wants to use. For intelligent decision–making model user can select the periodicity of trading, how many stocks should be recommended for the investment, size of the sliding window, number of deltas and the size of

population (nubmer of ANNs). For the analysis of the results there is possibility to draw the graphs which allow to make detailed analysis on training of ANNs; selection of stocks or ANN which have shown the best performance. for the method of moving average the user is able to select the periodicity of trading, number of recommended stocks and size of period which is used for moving average calculation.

Trading results of each portfolio can be compared to the results of any other selected portfolio. For example, comparison shown in the Fig. 3, shows that the trading using intelligent decision–making model has much better performance for the selected time period. It is important to mention, that for any implemented trading strategy there is a possibility to create many portfolios with different strategy parameters. In that case, the presented stock trading system makes the evaluation of the trading strategies easy and fast.

4 Conclusions and Future Works

Because of the limited space available, this paper is merely an introduction to the architecture and framework provided by stock trading system. It was decided to emphasize on presentation of the general idea. The paper gives an illustration and explains the architecture and scenario of stock trading system. The main task of this paper was to show that the presented stock trading system is a powerful tool for development and tuning of intelligent decision–making models. The benefits of trading system were shown through the implementation of two models. It was shown, that new trading models can be easily integrated, extended, and evaluated with different parameters for the identical data sets.

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