Utilization of Genetic Algorithms and Neural Networks For Constructing Reliable Decision Support Systems for Dealing in the TOPIX

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1. Introduction

In this paper, we propose a decision support system for dealing in the TOPIX (Tokyo Stock Exchange Prices Indexes), which utilizes genetic algorithms and neural networks.   In the proposed system, the neural network is utilized in order to make a forecast of the TOPIX four weeks in the future. Genetic algorithm is utilized in order to find an effective way of dealing. Several computer simulations confirm the effectiveness of the proposed decision support system.

2. Application of ANNs for Constructing a Decision Support System for Dealing in the TOPIX

A. Neural Network Model and Input Variables

Fig. 1 shows the neural network   model which consists of the eight input units, one hidden layer having fifteen units, and two output units. As inputs into the neural network, we have chosen the eight variables which may significantly effect the changes of the TOPIX such as changes of the amount of the buying volume by foreign traders, changes of the TOPIX, turnover in the Tokyo Stocket Market, PBR in the Tokyo Stock Market, and etc.

The reason we have considered the neural network model with two output units is to predict   the increase rate of the highest price of the TOPIX and the decrease rate of the lowest price of TOPIX up to four weeks in the future by using the output sequences from the upper output unit and the lower output unit, respectively.
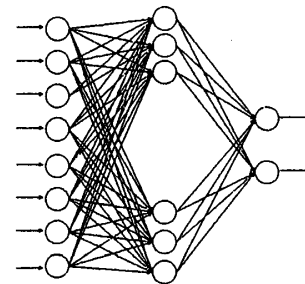

Fig.1.   Neural network model with two output units

B. Teacher Signals and the Training Algorithm

Due to space limitation, we don't go into details. (Interested readers are kindly asked to read the papers [1]-[5])

C. A Decision Support System for Dealing TOPIX

By utilizing the output from the upper output unit of the trained neural network, one can make the forecast of the highest price of TOPIX up to four weeks in the future.   On the other hand, one can make the forecast of the lowest price of TOPIX up to four weeks in the future by utilizing the output from the lower output unit.   Below, let us propose a decision support system (DSS) which utilizes this

information effectively for dealing in the TOPIX:

DSS

1. Let α and β be the positive parameters.

2. Calculate the average of the prediction of the highest price of the TOPIX up to four weeks in the future and the prediction of the lowest price of the TOPIX up to four weeks in the future. Let Av be the average of the above.

3. If (Current TOPIX)×(1+α) is below Av, then buy. When the TOPIX goes above Av ×(1+ β), then sell.

4. If Current TOPIX is above Av×(1+β), then sell. When (TOPIX)×(1+α) drops below Av, then buy.

5. Otherwise, wait.

3. Utilization of GAs for Making the Decision Support System More Effective

we have carried out several computer simulations. Almost all of them have shown that the proposed decision support system DSS is quite effective in yielding considerable return under the specific combination of parameter values α and β. However, in order to check the effectiveness of the DSS, one has to investigate it regarding various numbers of combinations. Further, the proposed DSS does not specify how to deal in the TOPIX under the general condition that one may use only limited funds. In the decision support system DSS introduced in the previous section, one has to sell all of the stocks which he had bought at a time when the TOPIX surpassed the specified level. On the other hand, one has to buy all of the stocks which he sold at a time when the TOPIX went below the other specified level. However, one should consider the possibility that he could have received greater return by dividing dealings. Moreover, DSS assumes that Av should be kept constant during one cycle of dealing in the

TOPIX. However, this assumption sometimes may become harmful.

we will try to utilize GAs for the following three objectives:

1) To utilize GAs in order to find appropriate parameter values α and β.

2) To utilize GAs in order to find successful way of dealing in the TOPIX.

3) To utilize GAs in order to check whether the Av should be kept constant or the current average estimate should be used as the value of Av.

Utilization of GAs

In the following, we shall show how GAs are utilized in order to find appropriate parameter values α and β and appropriate dealing rules for TOPIX. The following figure shows the chromosome which we have used for the above objective.
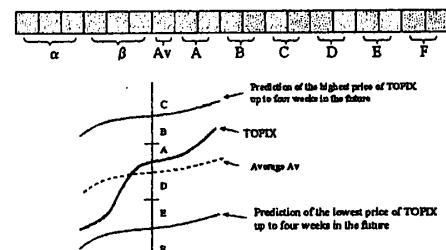

Fig.2. Structure of the chromosome

Due to space limitation, we omit details. Interested readers are kindly asked to attend on our presentation.

References

[1] N.Baba, Proceedings of the ICSC Congress on CIMA'99, 1999.

[2] N.Baba et al, Proceedings of IJCNN'99,1999.

[3] N.Baba et al, Proceedings of IJCNN'2000, 2000.

[4] N.Baba , Proceedings of KES'98, 1998.

[5] N.Baba et al, Neural Networks, 1994.