ANALYSIS OF THE PERFORMANCE OF ARTIFICIAL NEURAL NETWORK TECHNIQUE FOR FORECASTING MUTUAL FUND NET ASSET VALUES

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ABSTRACT

In this paper, the Net Asset Values of four Indian Mutual Funds were predicted using Artificial Neural Network after eliminating the redundant variables using PCA and the performance was evaluated using standard statistical measures such as MAPE, RMSE, etc.

Keywords: Artificial Neural Networks, Principal Component Analysis, Net Asset Values, Prediction.

1. INTRODUCTION

The Financial Market is the most complex area in an investment business where prediction often misfires since the number of variables that cause a price change is too many. Shares should be sold when their investment potential has deteriorated to the extent that they no longer merit a place in the portfolio. The investors are torn between the desire to protect profits or minimize further losses and the protection of price appreciation.

The selection of input data is an important decision that can greatly affect the model performance. There are hundreds of financial and macroeconomic variables available for analysis. However, many of the variables may be irrelevant or redundant to the prediction of stock returns. Principal component analysis (PCA) is a variable reduction procedure and is widely used in data processing and dimensionality reduction.
2. DATA FOR ANALYSIS

The Net Asset Values of four of the top ten Indian Mutual Funds namely

1. HDFC Mutual Fund –Top 200(equity)
2. ING Mutual Fund - Dividend Yield Growth option(equity)
3. ICICI Mutual Fund-prudential Growth option(equity)
4. Reliance Mutual Fund –Regular savings(equity)

were modeled using ANN for a period of five years between 2006 and 2010 (Source: amfiindia).

Based on the literature review, regarding the data access restriction and on consultation with Chartered Financial Analyst, 13 macro-economic and financial variables were selected as input variables for the Indian Mutual Funds. The input variables used are: BSE Index, NSE Index, Crude Oil (%), Gold/Gram (Rs), Silver/ Gram (Rs), Dollar Equivalent (Rs), Inflation (%), 91 Day Treasury Bill(Rs), Gross Domestic Product (%), Reserve Money(Rs), Unemployment Rate (%), Price/Earnings-Sensex, Dividend-Yield-Sensex.

3. OBTAINING RELEVANT VARIABLES USING PCA

The collinearity statistics of the inputs clearly shows that the Variance Inflation Factor (VIF) for most of the inputs is greater than 5, indicating potential multi-collinearity problem. In order to identify relevant variables and redundant or irrelevant variables, PCA (Principal Component Analysis) technique is used. High value of KMO (0.804>.05) indicates that a factor analysis is useful for the present data. The next step in the process is to decide about the number of factors to be derived. The rule of thumb is applied to choose the number of factors for which ‘Eigen values’ are greater than unity. The Component matrix so formed is further rotated orthogonally using Varimax algorithm which is the standard rotation method. Among the two factors identified, about 80% of the total variance was explained. The Scree plot obtained for the components best explains the prominence of the two factors. Using these two factors identified by PCA, the mutual funds are modeled using Artificial Neural Network.

Error Estimate and Bias of the predicted NAV’s using ANN

<table>
<thead>
<tr>
<th>Mutual Funds</th>
<th>HDFC</th>
<th>ICICI</th>
<th>ING</th>
<th>RELIANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAPE</td>
<td>0.0203</td>
<td>0.058</td>
<td>0.044</td>
<td>0.037</td>
</tr>
</tbody>
</table>
4. CONCLUSION

From the model developed using Artificial Neural Networks for the NAV of the four Mutual Funds namely ICICI Mutual Fund, ING Mutual Fund, HDFC Mutual Fund and Reliance Mutual Fund, it has been observed that the network predictions agree with the actual values reasonably well for all the other four schemes. The maximum value of bias is 0.829 for ICICI otherwise it is small for the rest of the mutual fund. The plot of actual rates versus predicted rates indicates that the model fits the given data well. The scatter plots of predicted and actual values for the four mutual funds confirms this.

5. REFERENCES