Artificial Neural Network for Prediction of Data by Recurrent Neural Network Model

Arpitha K Shetty[1], Pratheksha Rai N[2], Bhargavi K[3]

[1, 2]*Assistant Professor, A.J Institute of Engineering and Technology, Kottara Chowki, Mangalore, Karnataka, India*
[3]*Assistant Professor, Krupanidhi Degree College, Bengaluru, Karnataka, India*

***Abstract*— Dollar rate prediction is a classification problem, which helps to forecast the next day dollar rate based on the history of dollar rate. The motivation for this work is that the prediction of dollar rate which helps the untrained traders to make decisions. The technical analysts trace the patterns that archived by study of charts and graphs to predict the future dollar rate. The advantage of using neural network is that it will predict the future even in the presence of hidden data. The proposed work is to forecast the dollar rate series data for various applications by using neural network. The dollar rate prediction using Recurrent Neural Network (RNN) is proposed. The dollar rate prediction problem is built by using the mathematical operations, so that this project is implemented in R language.**

***Keywords*— Data mining, Artificial neural network, Neural Network Training, Neural Network Testing, Recurrent Neural Network (RNN) model**

I. INTRODUCTION

Predictive modelling create a mathematical model, which is used in the predictive analysis to Predict the future data. A predictive model is built by 'n' number of predicting models that helps to forecast the future. In financial marketing it is possible to predict the next day dollar rates based on the history of dollar rates. Predicting the dollar exchange rate is a complex task, due to consequences of unsystematic changes in behaviour of a dollar rate time series. Trading community uses different methods for prediction tasks. In recent years, the concept of neural networks has been an emerging technology among them. The Artificial Neural Network (ANN)is built based on association of human brain biological neuron system. Neuron systems are formed from trillions of neurons these will exchange succinct electrical pulses called action potentials. These biological structures are adopted to the computer algorithm formally called Artificial Neural Networks.

ANN can be used to solve following categories of problems:

- Prediction: This is one of the applications of neural networks. The neural network takes a time based series as input data and then it will predict future data.
- Classification: Repeatedly, the neural network is trained by providing input as a sample set of data set along with details regarding which class every data sample element belongs. This process will provide capacity to neural network to learn the characteristics.
- Optimization: Optimization problems include assembling circuit boards, resource allocation etc.
- Abstraction: To filter noise out of imperfect inputs, thereby increasing its integrity

II. OBJECTIVE

The main objective of the research is to gain knowledge about variations in the exchange rate and better support for marketing people to make the decision. In predictive modelling, data is collected from ECB and it is pre-processed according to the requirements of prediction methods. A statistical model is formulated, predictions are made and accuracy is detected by the plot of observed and predicted data.

A Artificial Neural Networks

These are mathematical models stimulated by central nervous system of the human that are able to perform machine learning and pattern recognition. Computers try to copy biological neural networks by realizing ANNs. ANNs are implemented similar to biological neural network model. Programs that can be written using flowcharts are the problems for which neural networks are not suitable. ANNs are useful for finding solutions for problems that cannot be expressed as a sequence of steps, such as recognizing patterns, prediction, data mining and classification.

1) Neural Network Training

Training is the process by which the connection weights are assigned. Supervised training is the most common type of neural network training. In this training a set of experimental data along with the expected outputs from each of these samples are input to neural network. In training process the neural network is processed through a number of iterations called Epoches. This process continues until the neural network predicted output matches the expected output and error is less than the specified error rate.

2) Neural Network Testing

Testing is the final step after training neural network. The weights are adjusted based on the validity of the results. This procedure is recurring until the error is equal or less than the acceptable limit. Testing is extremely important since it help us to determine further training of network required or not. To test the correctness of generated model by trained neural

network, testing dataset must be selected in such a way that it is completely different from the training dataset.

III. PROBLEM STATEMENT

To design a Predictive Model for dollar exchange rate by using Recurrent Neural Network(RNN) and build using the mathematical operations, and predict the efficiency.

IV. RELATED WORK

Sharda, R. and Patil, R[3] proposed autoregressive and autoregressive moving average for forecasting and trading the USD rates of one year as input in-sample-data and next one year data set as an out-of-sample data set. In this AR and ARMA model is benchmarked with Naive strategy prediction model. This study concludes that, the ARMA model is the best for in-sample data set where as ARMA and AR is best in out-of-sample data set

Kalyani Dacha[1] proposed analysing and comparing the ability in forecasting the daily rates US dollar using ANNs and GARCH and ARCH models. In this proposed system he failed to work with different kinds of neural networks instead of single NN.

Bishop, C.M[5] explains about Markov model implementation for exchange rate forecasting. He proposed Markov-switching method is lit for I8 rates in the basis of quarter frequencies instead of single day. He worked with in-sample data sets of many exchange rates. He proved that the forecasts of the Markov model are greater at predicting if change in the exchange rates.

Tang, Almeida and Fishwick[4] proposed six nonlinear architectures to forecasting the dollar rate. The results conclude that GMDH and GP will provide more accurate predictions as compared to other over all the currencies. GMDH is the best predictor because it will be combination of the many forecasting techniques.

V. PROPOSED WORK

RNN contains at least one feed-back connection in network. The activations in the network can flow round in a loop. This feed-back future enable the networks perform learn sequences and temporal processing. The features of RNN include the powerful non-linear mapping capabilities of the MLP, and some form of memory. Others have more complicated uniform structures. Each neuron connected to all the others, each neuron has a stochastic activation functions. For deterministic activation functions and uncomplicated architectures, training can be performed by using relevant procedures back-propagation algorithm for feed-forward networks. In this proposed system we will use a Elman recurrent neural network to predict the dollar rate. A typical training example of the RNN is shown in the Figure 1. A typical training example of the RNN is shown in the Figure 1

Where

- $x_t^{[1]}, x_t^{[2]}, \ldots\ldots x_t^{[n]}$ are the inputs at time t
- $h_t^1, h_t^2, \ldots\ldots h_t^m$ are hidden nodes outputs at time t
- h_{t-1}^1, h_{t-n}^n are hidden node outputs at time t-1
- $\hat{Y}$t is the RNN output at t
- U_{ij} are network weights of input to hidden nodes
- W_{jk} are network weight of hidden to output layer connection
- is the transfer sigmoid function, given as $s(x) = \frac{1}{1-e^{-x}}$
- is the linear function, given as $F(x)=\sum_i x_i$
- The linear function is minimizes is
- $E(d_t, w_j)= \frac{1}{T}\sum_{t=1}^{T}(y_t - \hat{y}_t(d_t, w_t))^2$ With y_t target value.

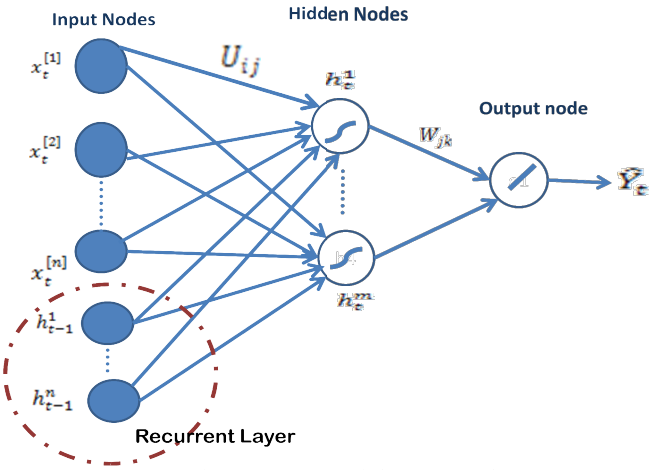

Figure 1 structure of elman Network

A Requirement Specification

In the software development life cycle The Software Requirement Specification (SRS) phase is an important step. It describes the complete performance of the system. This specification should describe the common factors that influence the requirements of product. The SRS document will specify the system goals and details of tasks that need to be achieved. User requirement is the abstract statement of the system requirement for the user of the system. System requirements are the more comprehensive specification of the user requirements and serve as convention between user and developer. Some of the system requirements are- Intel CORE i3 processor, 3 GB RAM, 120 GB Hard Disk, CD-ROM, Mouse and Keyboard, Windows XP /Windows 7, Programming Tool : R i386 3.1.2

VI. SYSTEM DESIGN

The system design is define as "The process of applying various techniques and principles for the purpose of defining a process or a system in sufficient detail to permit its physical realization". The input designing is performed to make input data automation as easy as possible and free from errors. The input data collection is the most expensive and important phase of the system design, to achieve good input data we needs to be study through the modules. Output design is most important and direct source to the user to get output from system. The accurate and efficient output improves relationship between system and source/ destination. The research is implemented as Recurrent Neural Network model

- RNN Training
- RNN Testing

The three important implementation decisions that have to take preceding to implementation are shown below.

- Platform selection.
- Selection of the programming language.
- Coding guidelines to be followed.

VII. EXPERIMENTAL RESULTS OBTAINED

In this step, Recurrent neural network is trained with pre processed dollar rate data. The recurrent Neural Network used in implementation is Elman Neural Network. In this work supervised learning method is used, this contains set of input and desired output. RNN neural network consists of twenty inputs, nine hidden and one output nodes. So twenty values indicate inputs and twenty first value is the desired output, this training is done by Back propagation Algorithm.

The predicted output of the Recurrent Neural Network is shown below

61.164352, 61.027403, 60.981954, 61.031885, 61.072166 60.864347 61.056668 61.027679 61.1279610 61.1424011 61.1270512 61.0979913 61.1025214 61.1460515 61.2216716 61.0759017 61.0450418 61.0215319 60.8629420 60.7136221 60.5893322 60.5971823 60.4558624 60.3650125 60.3972126 60.2990127 60.2870328 60.4300629 60.5585230 60.6410731 60.6682132 60.6699133 60.6016334 60.3793735 60.2784936 60.1788837 60.0142638 60.0161939 59.9576140 60.0809041 60.18556

The plot of observed and predicted data of The Recurrent Neural Network is Shown below in the Figure 2

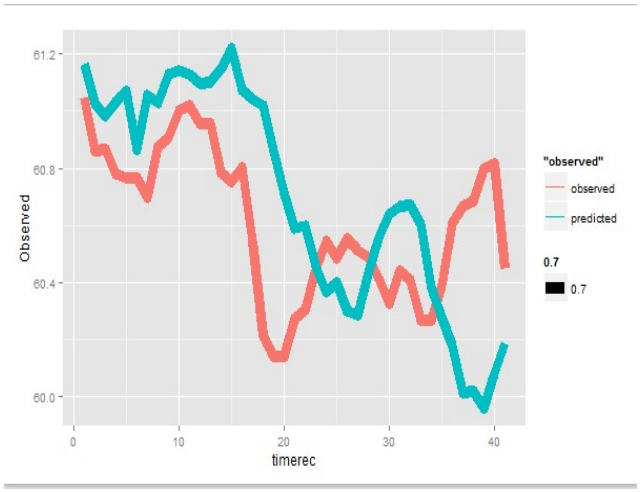

Figure 2. RNN plot of observed and predicted data

VIII. CONCLUSION AND FUTURE SCOPE

This work is mainly aimed to model Artificial Neural Networks like Recurrent Neural Network. RNN is trained using supervised learning algorithms called Back Propagation Algorithm. RNN has a slightly higher RMS error than MLP. The proposed work further can be extended by using different Neural Networks like Autoregressive Integrated Moving Average (ARIMA) model, Pesi-sigma Neural Network performance can be tested. The implemented methods can be configured in different Framework so that we can work with more amount of data set.

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