Short-Term Prediction Model for Multi-Currency Exchange Using Artificial Neural Network

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***Abstract*—: Forecasting the exchange rates is a serious issue that is getting expanding consideration particularly as a result of its trouble and pragmatic applications. Artificial neural networks (ANNs) have been generally utilized as a promising elective methodology for an anticipating task as a result of a few recognized highlights. Research endeavors on ANNs for gauging exchange rates are extensive. In this paper, we endeavor to give a review of research around there. A few structure factors fundamentally sway the exactness of neural network gauges. These elements incorporate the determination of information factors, getting ready information, and network design. There is no accord about the components. In various cases, different choices have their own adequacy. We additionally depict the combination of ANNs with different strategies and report the correlation between exhibitions of ANNs also, those of other anticipating techniques, and finding blended outcomes. At long last, what's to come inquire about headings around there are examined. This paper presents the forecast of top exchanged monetary utilizing diverse Machine learning models which incorporate top foreign exchange (Forex) monetary standards utilizing a hybrid comparison of Support Vector Regressor (SVR) and Artificial Neural Network (ANN), Short-Term Memory (STM), and Neural Network with Hidden Layers. They anticipate the exchange rate between world's top exchanged monetary forms, for example, USD/PKR, from information by day, 30-39 years till December 2018.**

Keywords—Artificial Neural Networks, Support Vector Regression, Short-term Memory, Time Series.

I. INTRODUCTION

Prediction of stock market refers to determination of a company's stock or some other financial entities' future values that tend to be traded via exchange. Predicting stock market rates successfully is essential as it can result in substantial profit. The hypothesis of efficient market indicates that currently available information is reflected by stock prices and they are not reliant on new information and thus are unpredictable. In this project, we have proposed a stock market prediction model using Neural Network. This technique utilizes seven distinct features as the input parameters for training and gives 'Closing Price' of the stock as the output. Neural networks are widely used for prediction due to their ability to learn from existing examples and determine non-linear and hidden dependencies even when training set has a significant noise.

Neural networks are more suited for optimization problems. Hence, it is used to optimize the parameters of the Neural Network for more accurate predictions. A programming language must be combined with special tools that support the task that has to be performed, whether one is modelling data or analyzing an image. Therefore, for this project, NNTOOL OF MATLAB is used as the NNTOOL OF MATLAB have been professionally developed, carefully tested and completely documented functionality to offer, for scientific and engineering applications.

II. RELATED WORK

Currency is a portion instrument used in national budgetary exchange as a money exchange device. It gives genuine impact on close by and worldwide financial angles promote. At overall trading, the regard contained in fiscal principles can be unique, from now on it needs a base rule monetary structures that can use all around. It is outside exchange or generally called Forex. Forex meant to as a market where exchange exchanged [1]. In any case, currency-related time arrangement conjecture as a champion in the midst of the (BP LMA) Algorithm created to foresee Multi-Currency Exchange Rates [1]. An upgraded Artificial Bee Colony (ABC) plotting used for streamlining heaps of the ANN for anticipating multiple times arrangement. The ABC variation is Artificial Bee Colony Differential Evolution that is a combination calculation of unique ABC with two assorted change methodologies of Differential Evolution

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(DE) utilized for Estimating Currency Exchange Rates [2]. The exploration is done to look at the exactness of stochastic, ANN, SVR models in anticipating the everyday exchange rates. [3]. A crossover model got from the direct pattern model, Auto-Regressive Moving Average (MA) model, artificial neural network and applied hereditary calculations to the forecast of currency rates [4]. Discussed the diverse normal examination strategies and neural framework method to foresee the currency discussion likewise.

III. PROPOSED WORK

A. Support Vector Regression Prediction

Support Vector Regression is an increase of the Support Vector Machine (SVM). As demonstrated by, SVM uses the immediate model to execute non-straight point of confinement classifier through some non-straight mapping into a brilliant dimensional component space. A straight model inherent the segment space can address a non-direct decision limit in the primary space. A perfect disengaging hyperplane, worked in the component space named as "most noteworthy edge hyperplane." It gives the last segment between decision classes. While updating the hyperplane, the arrangement tests that push the hyperplane called reinforce vectors are considered for the improvement issue while various models saw as irrelevant for describing twofold class limits. This thought is changed in SVR to fit a backslide line. [3] Short memory and has the limit of serious learning. [10]

B. Artificial Neural Network Prediction

It very well may be known as a Neural Network (NN) is a framework building showing created by the human tactile framework (cerebrum) when it is doing explicit assignments. This model relies upon the human cerebrum's ability to deal with its constituent cells (neurons) being able to finish certain endeavors, especially with the propriety of the framework plan affirmation which is high. There is a supposition that shows the non-straight numerical model of a neuron generally speaking [1].

This paper utilized the model of multicurrency exchange rates what's more, executing machine learning calculations utilizing machine learning. It utilizes the monetary forms sets, and comparison between ANN and SVR accompanying some other model of Machine Learning as stated below:

1. *Time Series Prediction*
   Time series prediction is an assessing that uses an association of data status asserted as time game plan. It might be each day, consistently, or then again yearly depend upon the inspiration driving data' attempting to watch.

2. *Short Term Memory*
   Short-term memory there are a few structures of STM units. Typical engineering made of a Cell, the memory part of the STM unit and three "controllers," more often called gates, of the stream of data inside the STM unit: an input gate, an output gate and a forget gate. A few varieties of the STM unit do not have at least one of these doors or perhaps have different entryways. Instinctively, the cell is in charge of monitoring the conditions between the components in the input grouping.

C. Features

The research project uses following features:

1. Opening Price: This refers to price used by security for first exchange on the exchanging day at opening time.
2. High Price: Highest price attained for stock exchange throughout a particular day. It is usually ordinarily higher than the ending price or opening price.
3. Low Price: Lowest price attained for stock exchange throughout a particular day. The present low is ordinarily lower than the opening or ending price. Basic moving normal (SMA): The straightforward moving normal is the most essential of the moving midpoints utilized for exchanging. To calculate a simple moving average, the average shutting price of stock is taken for the past “x” periods.
1. Simple moving average over 10 days: This value is the average of any stock’s closing price for the last 10 days
2. Simple moving average over 50 days: This value is the average of any stock’s closing price for the last 50 days.
3. Exponential moving average over 10 days: This value is the exponential average of any stock’s closing price for the last 10 days
4. Exponential moving average over 50 days: This value is the exponential average of any stock’s closing price for the last 50 days.

The exponential moving average (EMA) refers to a type giving higher weightage to recent prices as an attempt for making it more responsive when new information arrives.

D. Procedure

The Prediction model for Multi-Currency Exchange Rates based on NNtool framework of MATLAB. After training system repeatedly, the following parameters set for the best results. The ANN and an STM use a single hidden layer with twelve and seven neurons. Neural Network with two hidden layers with 50 neurons each. ReLU activation, lecun uniform as kernel initializer, Adam optimizer with a batch size of 16 and 100 epochs for ANN and STM. While 20 neurons for Neural Network with two hidden layers with 20 epochs as the datasets used for this work consists of near about 30 – 39 years of data by day and divided into training data and testing data in the 80%-20% proportion since the 1980s till December 2018, the test data is from January 1, 2011, till December 2018, and the following results based on that training dataset.

Step 1: Calling the optimtool (Optimization Toolbox)

The first step involves calling the optimtool function in the NNtool MATLAB command window. In the solver type select neural network. Set the lower and upper bounds of the neural network they define the number of hidden nodes in the hidden layer.

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Step 2: Creating Repetitive Neural Networks for different number of hidden nodes

The neural network selects the various values of the number of nodes in the hidden layer and calculates and compares the mean square error (M.S.E) which is the performance function. The no. of hidden nodes which correspond to the least Mean Square Error is defined as the 'Elite' population and is further used for computation.

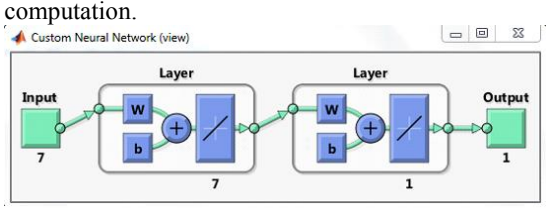

Figure 1: Hidden layers and neurons of the projects

Step 3: Plotting the Final Data Plots (for over 400 points ~ 2 years data)

Case 1: For ANN epoch 12

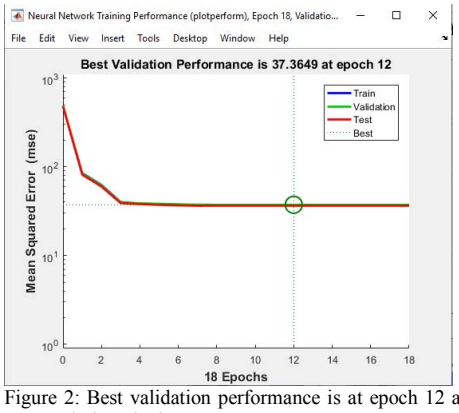

Figure 2: Best validation performance is at epoch 12 and 37.3649 where the exact solution obtains.

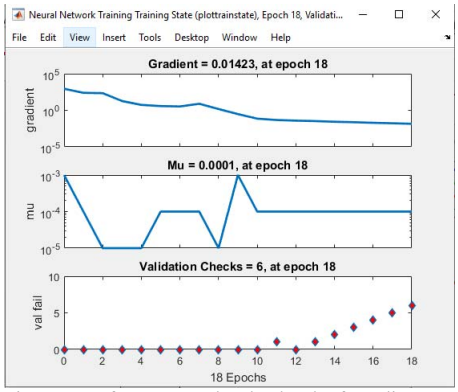

Figure 3: After 18 epochs the level of gradient, Mu and Validation Fail approaches to stability.

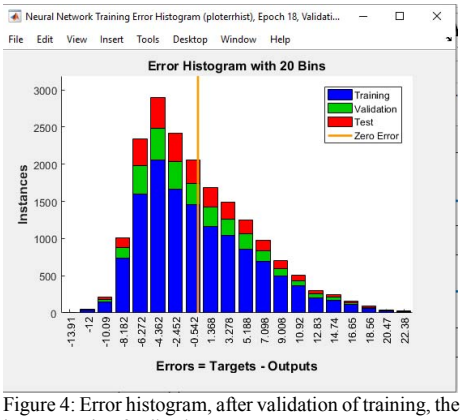

Figure 4: Error histogram, after validation of training, the zero error shows there is no negative feedback.

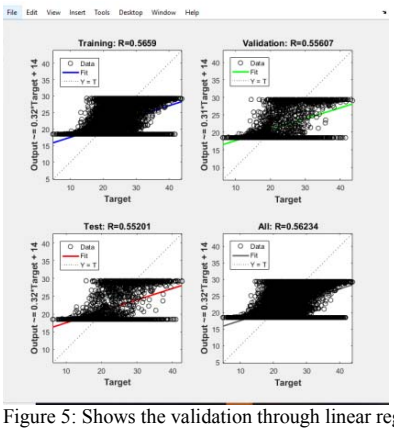

Figure 5: Shows the validation through linear regression of ANN model

Case 2: For epoch 25

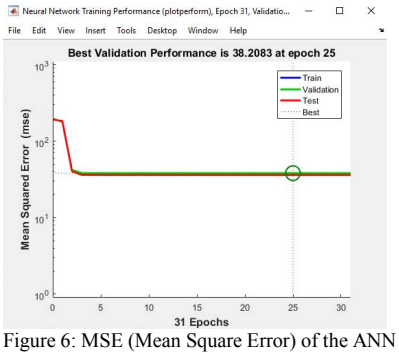

Figure 6: MSE (Mean Square Error) of the ANN has decreased. A well-trained ANN should have a very low MSE at the end of the training phase, equals to 38.2

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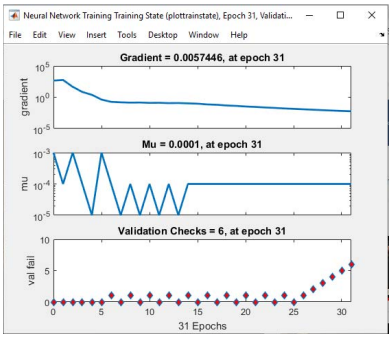

Figure 7: Shows gradient near to zero.

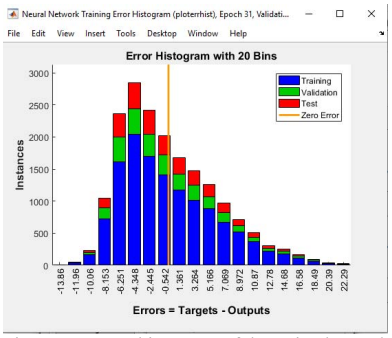

Figure 8:1 Error histogram of the trained neural network. It depicts that the data fitting errors to be distributed within a reasonably good range around zero.

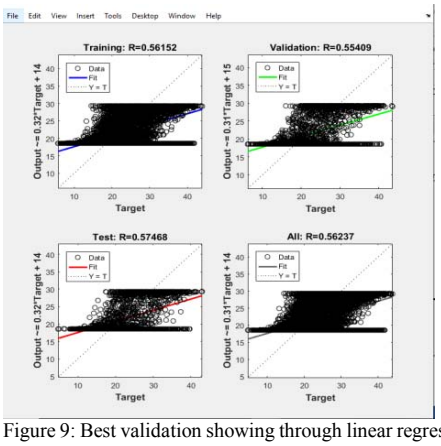

Figure 9: Best validation showing through linear regression of the ANN Model.

Case 4: For SVR epoch 14

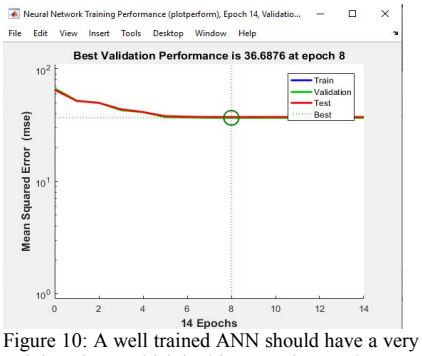

Figure 10: A well trained ANN should have a very low MSE at the end of the training phase, which in this example, equals to 36.6

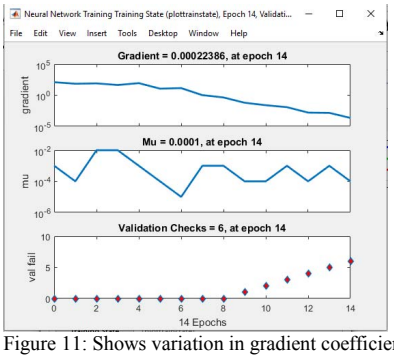

Figure 11: Shows variation in gradient coefficient near to zero

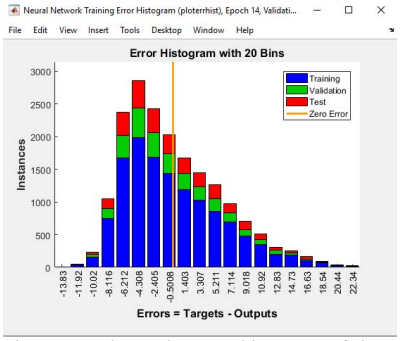

Figure 12: Shows the error histogram of the trained neural network for the training, validation and testing steps. This figure shows that the data fitting errors are distributed within a reasonably good range around zero.

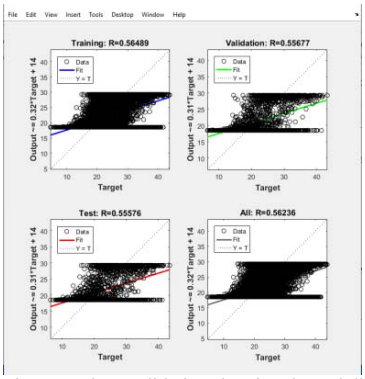

Figure 13: best validation showing through linear regression of the ANN Model

IV. Experiment Results

In this section we have presented the output of the neural network for predicting the future values for training for different number of years i.e. 5, 10 and 19 years.

A. 1. 5 years

The mean square error offered in this case was 1.1902 x 107 while the number of nodes selected which corresponds to best optimization results was 6.

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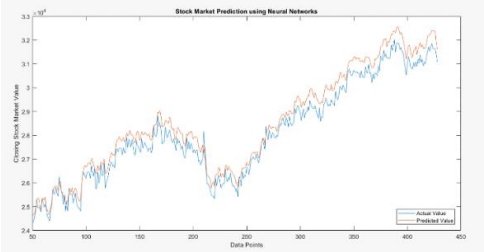
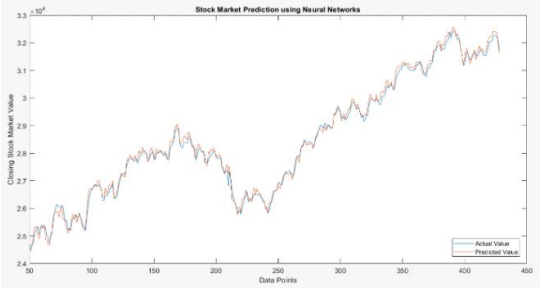


B. 2. 10 years

The mean square error offered in this case was 1.132 x 105 while the number of nodes selected which corresponds to best optimization results was 6.



C. 3. 19 years

The mean square error offered in this case was 1.0192 x 104while the number of nodes selected which corresponds to best optimization results was 2.

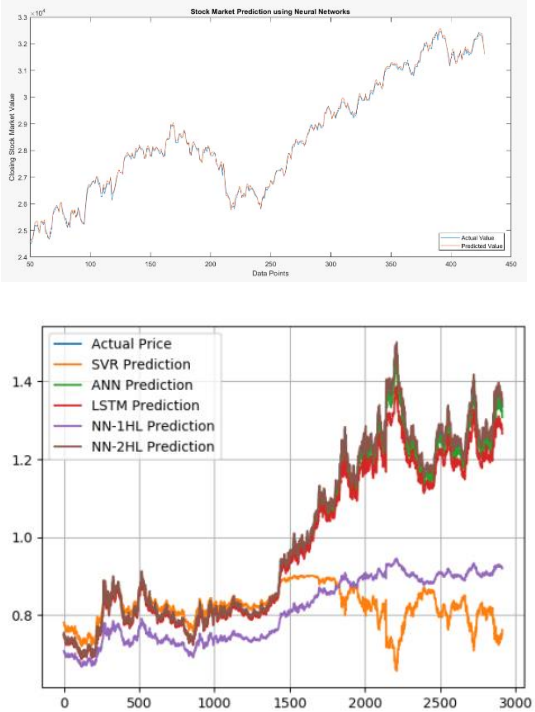


Figure 14: Hybrid Model Comparison

V. CONCLUSION

This paper applies the Machine Learning model utilizing Support Vector Regressor (SVR), Artificial Neural Network (ANN) with Short-Term Memory (STM), They predict the exchange rate between world's top exchanged monetary forms, for example, USD/PKR, from information by day, 30-39 years till December 2018.

REFERENCES

[1] Ramadhani Imaniar, Jondri, Rismala Rita, "Prediction of Multi-Currency Exchange Rates Using Correlation Analysis and Backpropagation," International Conference on ICT for Smart Society Surabaya, 20-21 ISBN: 978-1-5090-1620-4, July 2016.

[2] Worasucheep Chukiat, "Forecasting Currency Exchange Rates with an Artificial Bee Colony (ABC) Optimized Neural Network," International Conference on Advances in ICT for Emerging Regions (ICTer): 324 – 331, 2017.

[3] Nanthakumaran P., Tilakaratne C. D., "A Comparison of Accuracy of Forecasting Models: A Study on Selected Foreign Exchange Rates," Evolutionary Computation (CEC), 2015 IEEE Congress, September 2015

[4] Gao Tingwei, Li Xiu, Chai Yueting, Tang Youhua "Machine Learning with Stock Indicators and Two Dimensional Principal Component Analysis (PCA) for Closing Price Prediction System," 4673-9904-3/16/$31.00, 2016 IEEE.

[5] Rather Akhter Mohiuddin, "Computational intelligence based hybrid approach for forecasting currency exchange rate," 4799-8349-0/15, 2015 IEEE.

[6] Gill S.S., Gill Amanjot Kaur, Goel Naveen, "Indian Currency Exchange Rate Forecasting Using Neural Networks," 4244-6932-1/10, 2010 IEEE.

[7] Chang Jui-Fang, Kuan Chi-Ming, Lin Yu-Wen, "Forecasting Exchange Rates by Neural networks Based Back Propagation Network Model," 978-0-7695-3762-7/09, 2009 IEEE.

[8] Wang Tien-Chin, KuoSu-Hui, Chen Hui-Chen, "Forecasting the Exchange Rate between ASEA Currencies and USD," 4577-0739-1/11, 2011 IEEE.

[9] BIS, "Triennial Central Bank Survey - Foreign Exchange Turnover in April 2013: Preliminary Global Result", Bank Int. Settlements Rev., no. April, p. 24, 2013.

1. [10] Xiaoyun Qu, Xiaoning Kang, Chao Zhang, Shuai Jiang, Xiuda Ma, "Short-Term Prediction of Wind Power Based on Machine Long Short-Term Memory," 5090-5417-6/16/ $ 31.00 2016, IEE

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