

PREDICTION OF GOLD PRICE USING BACK PROPOGATION NETWORK ALGORITHM

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Abstract

Gold price plays a crucial role in the economy of any country, due to its unique features and the various purposes it is used for. In this research paper Back propagation algorithm is used for forecasting the gold price. In the research implementation number of activation functions and implemented along with some of the macro economic factors of the World Economy such as Dow Jones Index, Oil prices, Currency exchange rates etc., The historical values of the above mentioned variables for the past two years and then forecasting is done based on the trends and patterns in the history. The algorithm is trained and tested considering the performance measures i.e. Coefficient of determination (R²) and Mean square error (MSE).

Index terms – Artificial Neural Network, Back Propagation, Gold price and Forecasting.

1. INTRODUCTION

Gold is a very valuable metal available on the Earth. It is also termed as one of the Investment avenues and it is one of the top four asset classes available. In Indian context, gold plays a significant role due to its cultural and social reasons. It is termed as a symbol of status, wealth, security and protection. Generally Indian families buy gold on various occasions and festivals like child birth, marriage, wedding birthday, Diwali, Akshya Tritiya etc., Gold is an unproductive asset and its prices are largely determined by supply and demand. Its price tend to rise over the years with the growth in demand. It is always used as a safe-haven asset.

It is used as a short and medium term investment if we are looking to play safe with our funds.

The main advantage of gold is that it is the most liquid asset among all other asset classes available. It has no time limit like how you have time limit for equity markets and real estate. It is so easy that you can walk into a jewellery shop on a Sunday afternoon and buy or sell gold.

The macro economic factors influence the gold price to a great extent. Most of the investors use gold investment to safeguard their funds. Generally if the stock market falls then there is a huge demand for gold as most of the investors shift their investment from capital markets. Due to the huge demand for gold the price is displayed the graph.

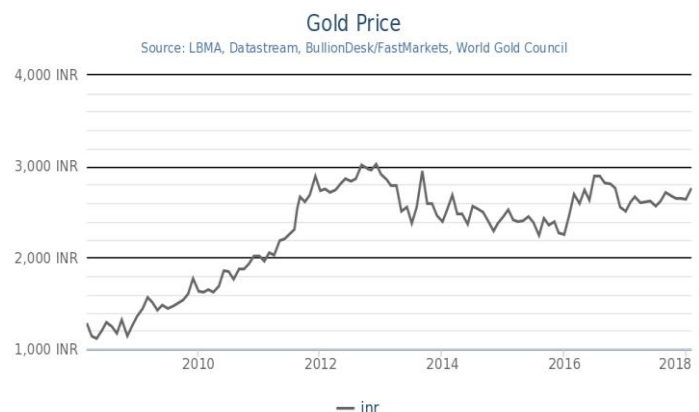


Fig 1: Price of 1gm of gold from 2008 – 2018.

2. ARTIFICIAL NEURAL NETWORKS

Artificial Neural Network is a technique which was emerged as very powerful modelling tool that can be applied for a lot of scientific and other engineering applications like pattern recognition, data processing, process control and classification. It has a unique feature that distinguishes it from various other data systems which has the ability to work in a successful manner even if they are partly damaged, normalisation, processing parallelly, ability to generalize and having a little vulnerability towards the error in the sets of the data provided. ANN works just as how human brain works.

Artificial Neural Networks is developed as per the biological neural network where the neurons are treated as the basic building blocks. An artificial neuron is nothing but a model of a biological neuron. It receive signals from other neurons when they transmit, process them, analyse them, and interpret them and finally sending the data to other neurons or giving the output.

An Artificial Neural Network depends on gathering of associated units which are also called as Simulated Neurons, comparable to natural neurons in the mind of any living being. Each association can be compared to a neurotransmitter between fake neuron that can transmit from one onto the next. The simulated neuron that get the signal can process and afterward signal neurons associated with it.

The principle target of the ANN was to deal with problems comparatively to that of a human personality. After sometime, thought focused on planning specific mental limits, inciting divergence from science. ANN has been used in a variety of errands which includes Computer vision, talk affirmation, machine understanding, casual association isolating, playing board and PC amusements and remedial assurance.

The ANN basically consists of 3 layers namely, the input layer, the hidden layer and output layer. This is the basic ANN program.

Depending on your requirement you can increase the number of hidden layers as the hidden layers play a major role in analysing and processing the data and giving the desired output. The input layer takes the input and sends it to the hidden layer. Here the neurons analyses the data processes it and then sends signals to the next layer neurons. Those neurons accept the signals from the previous layer and then process it and send signals to the output layer. The output layer decodes it and displays the output.

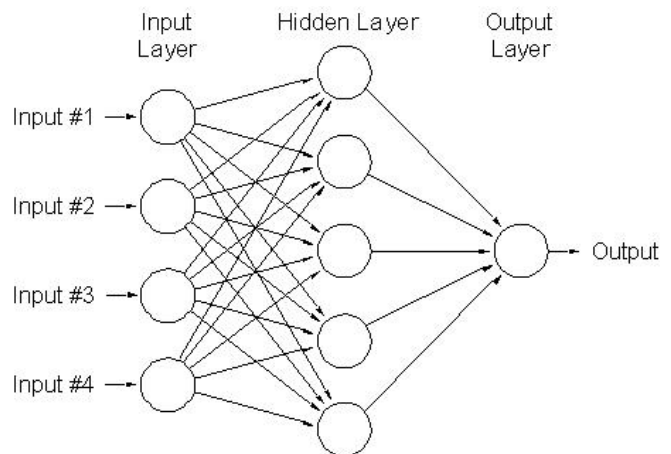


Fig 2: Typical Artificial Neural Network Structure

As seen in Fig.3 x_i ($i = 1, 2, 3, \dots, n$) is the input signal of n neurons to another neuron j and $f(S)$ is activation function i.e. where the actual processing takes place and the output is given. Here w_{ij} represents the weight of x_i variable on the dependent variable.

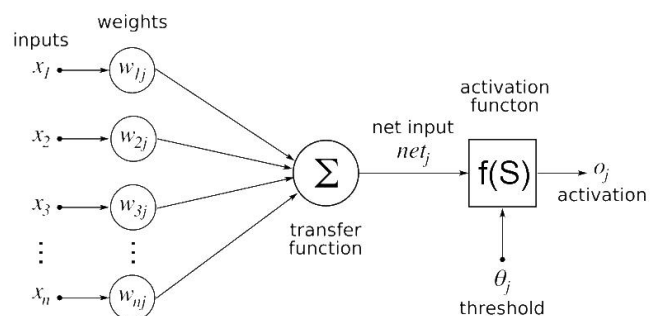


Fig 3: Artificial Neuron Model
Output $y_i = f(\sum_{j=1}^n w_{ij} x_j - \theta_j)$.

3. BACKPROPAGATION NETWORK ALGORITHM

Back Propagation algorithm is a technique to monitor learning. It uses the Mean Square Error method and the method of Gradient Descent to perceive the changes in connection to weight given to the network. The changes to the weight of the network are basically used to achieve the minimum error sum of squares.

An Error Minimization problem should be deciphered so as to train neural networks and to avoid a practical solution. For decades this technique was used until D. E. Rumelhart, C. E. Hinton, and R. J. Williams gave a practical example of a technique, called Back Propagation, and hence it was known widely (Nature 323, 533-536, 9 October 1986). It is true that even today, by continuing their methods many others are able to program and train neural networks with around 60 millions weights and getting astonishing result.

The Back Propagation algorithm can also be used in the case of recurrent networks. But to cater with such systems, we can use a time variable t as a discrete variable. At time t , all neurons compute the outputs, which are hence transferred at time $t+1$. By continuing this pattern, the system gives continuous output values each time when time varying input or which a constraint is input in the network.

BPN

Back propagation network algorithm is a common method used for training the neural network. In this algorithm the ANN assigned weights are altered by the algorithm for accuracy and are precisely weighed for accurate results. This algorithm trains the network and then it compares it with the actual output which is a part of training. Then based on the differences in the actual output to the output which the ANN gave error rectification is done and the weights are altered. Then it is tested on the actual data for a better output. This is how the backpropagation network algorithm works.

4. MODELLING OF GOLD PRICE

The data used in this study includes 495 daily observations of the gold price (per ounce) against affecting parameters from 4th January 2016 to 29th December 2017 excluding all the non-trading days. The change in the gold price during this period is shown in Figure 4. To develop BP NN model for the gold prices, a historical data set consisting of 495 input vectors along with their corresponding output vectors is provided. The data was hence separated into two sets namely, training and test sets. During the training phase ANN will automatically assign weights to it and as it is a backpropagation network algorithm it fine tunes the data for error minimization. The weights are modified and finalized and after finalization the data is tested and the output is taken.

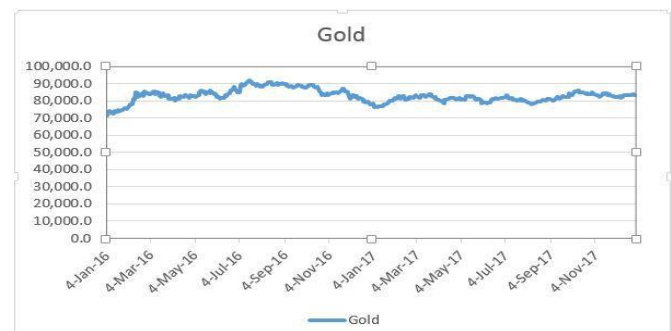


Fig 4: Gold price changes (World Gold Council)

One of the crucial steps in developing a forecasting model is choosing the correct input variables, which determines the structure of the model. As per experts review the research design considered 5 economic factors i.e. Dow Jones Index, World Oil Prices (Price per barrel), Currency exchange rate i.e. United States Dollar, Dirham UAE currency, Switzerland currency CHF. The reason for considering these currencies is that India imports Gold mainly form these countries only.

5. FORECASTING RESULTS

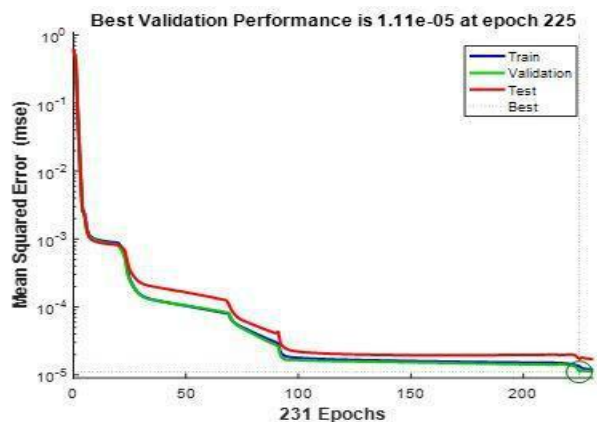
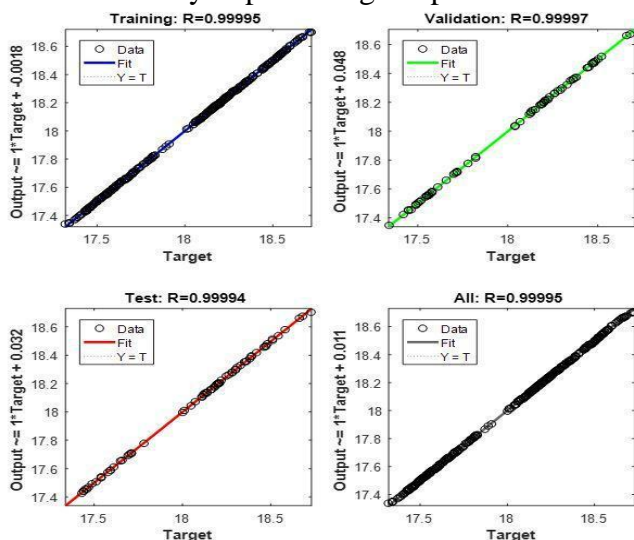


Fig: 5 Graph showing the performance of the model

The graph output shows that the MSE is very less which helps us stating that the ANN is successful in predicting the gold price close to the original price. This we can see from the graph. If you look at the Train and Validation line both are running hand to hand i.e. ANN is trained properly and the validation is up to the mark. When tested the model is working fine but, you can observe a gap in between the lines i.e. the gap is due to the variables we considered. Other than the variables we considered there are other variables that play a role in the prediction of gold prices i.e. other economic and social factors. The optimum output after 231 iterations was observed that the Mean square error is minimum i.e. 1.1×10^{-5} which is a very minute value. From this we can say that the model is working fine.

From the below graphs the result shows that the data points are lying on the regression line which helps us understand the performance of the model and its accuracy in predicting the prices.



6. CONCLUSION AND SUGGESTIONS

The main objective of this research paper is to provide reference for researchers by analysing the trend in the Gold price and build prediction models. We build prediction models for gold price for the purpose of accuracy.

There is a large scope for further research in this area of forecasting/prediction of gold price as Gold is used as an investment avenue and due to the high demand from households. Through accurate prediction of gold price an investor can make good profits by taking the advantage of time. Comparative analysis can be done using Back propagation and future more models of ANN through which we can improve the efficiency and accurate results are obtained.

7. REFERENCES

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