

## A REVIEW: ANALYSIS AND FORECASTING OF GDP BY USING ANN

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### ABSTRACT

Gross Domestic Product is one of the most economic factors. Importance of GDP forecasting needed because during the period of 2007 to 2009 Indian Economy was suffering from Recession and GDP growth rate also affected by Recession. By observing past experiences it has been seen that the variances in the GDP economy got up and down. Simulated annealing is one of the crucial algorithms which can be used to optimize the weight value of the Artificial Neural Network. Back Propagation algorithm processes the weight values from back to forth, but here simulated annealing algorithm considers all the weight values together and processes all these weights to find optimal weights. SA algorithm here improves the performance over the BPN. SA technique can be applied on a specific application by knowing the input and output parameter. Forecasting is helpful to decrease the uncertainty in the economy.

**Keywords:** BPN; SA; GDP; Forecasting; optimize

### INTRODUCTION

Neural Network is the network which is made up by parallel, distributed, non linear and interconnected neurons (these neurons are artificial) which process the information. Artificial Neural Network has proved as a crucial research work tool in many domains of engineering and economic aspects also. ANN is the better choice as compared to the traditional time series forecasting models which have been used for prediction [1]. ANN is used in many economic and business applications. Superior performance of the forecast and simulation of the network can be achieved by regulating the ANN [2].

There are two types of forecasting techniques namely artificial Intelligence and Statistical Techniques. Genetic algorithm, Artificial Neural Network and Fuzzy Logic are Artificial Intelligence based techniques. And Multiple Regression and ARIMA fall in the Statistical techniques. Neural Networks are used for Non Linear data while Statistical methods compromise with linear data. One of the big limitations of Statistical Methods is that these methods have to fit

the data with the available data and these have prior knowledge about the relationship between input and output.

#### A. *Description of the Gross Domestic Product*

GDP has three separate words G stands for Gross; D stands for Domestic and P stands for Product which refers to the production of all goods and their services of a country or nation within a period of time. Basically, GDP is to be measures annually. It is one of the crucial factors of the economy. GDP impact on the growth of the Economy. GDP can be calculated by using following formula:

$$\text{GDP} = \text{Consumption} + \text{Investment} + \text{Government Expenditure} + \text{Balance of trade}$$

GDP prediction is a crucial job in the economy and business analysis. It is provides the way to set up future business plan and take timely decision about the financial market and economy.

### LITERATURE SURVEY

**Steven Gonzalez (2000):** Author conducted a research got that the neural network has smaller error as compare to the linear regression model. Author concluded that the performance of the ANN according to the error of the predicted Output is better as compare to the linear regression model.

**Pengyi Shi, Zhuo Chen, Guangming Xie (2006):** Authors conducted a survey and found that Artificial Neural Networks which are trained by Genetic algorithms these performs better and more effectively as compare to the Artificial Neural Networks trained by back propagation algorithm. In this paper Author developed a new Hybrid Model by the combination of ANN and GA based on Overlapping Generations model. This model performs better than Standard ANN and Error ANN when predicted the GDP of China.

**ADNAN HAIDER , MUHAMMAD NADEEM HANIF (2007) :** In this Research Paper Authors found that ANN performs better prediction than AR (1) And ARIMA models.

**Dominique Guegan, Patrick Rakotomarahy (2010):** In this Paper Author found less error in this paper by worked with Multivariate k-NN method. In this paper comparison between both of k-NN method is done. And multivariate proved better than single variant k-NN method.

**Liliana, Togar Alam Napitupulu (2010):** According to the final output results, the authors have concluded that the ANN model is the better model in the forecasting for the macroeconomic indicators. And Results of this Research of GDP Forecasting were better than the forecast by government. .

**Kunwar Singh Vaisla, Dr. Ashutosh Kumar Bhatt (2010):** In this Paper Final Result of this research shows that error of the forecasting by NN is less than Regression and proved that performance of the forecasting of stock market by NN is better than the Regression.

**Li Ge, Bo Cui (2011):** In this Paper Authors concluded Results that PNN Model is better enough as compare to Traditional Neural Network due to less error rate. And Performance of the PNN model is best as compare to Traditional Neural Network.

**Karaatli Meltem, Göçmen Yağcılar Gamze, Karacadal Hüseyin, Sezer Firat Suleyman (2012):** In this research Researchers found the final conclusion that was ANN is an efficient tool of the prediction of Neural Network Models which improves the performance of the GDP.

## SUMMARY OF THE USED ALGORITHMS

### A. *Back Propagation Description:*

*Stages of the Back Propagation in the training algorithm:*

1. First of all initialize the weight values from input to hidden layer and hidden to output layer.
2. Feed Forward Network containing input, hidden and output layers.
3. In the third step calculates the errors and Back Propagation errors of the Network.
4. In the fourth step update weights and bias values.

*Update weights and bias of BPN:*

1. For each output unit ( $y_k, k=1, \dots, m$ ) have to update its bias and weights ( $j=0, \dots, p$ ). The weight correction term is given by

$$\Delta W_{jk} = \alpha \delta_k Z_j$$

Bias Correction term is showing by

$$\Delta b_{0k} = \alpha \delta_k$$

Therefore

$$W_{jk}(\text{new}) = W_{jk}(\text{old}) + \Delta W_{jk}$$

$$b_{0k}(\text{new}) = b_{0k}(\text{old}) + \Delta b_{0k}$$

2. For each hidden unit ( $Z_i, i=1, \dots, p$ ) updates its bias and weights ( $j=0, \dots, n$ ) weight correction term

$$\Delta W'_{ij} = \alpha \delta_j X_i$$

And bias correction term

$$\Delta b'_{0j} = \alpha \delta_j$$

So

$$W'_{ij}(\text{new}) = W'_{ij}(\text{old}) + \Delta W'_{ij}$$

$$b'_{0j} = b'_{0j}(\text{old}) + \Delta b'_{0j}$$

### B. *Simulated Annealing Technique:*

Simulated annealing is a technique in which heating of the material and sudden cooling provides a way to increase its crystals size and decrease the defects of the material. Simulated annealing is one of the crucial algorithm which can be use to optimize the weight values of the ANN. SA

algorithm here improves the performance of the BPN.SA technique can be apply on a specific application by knowing the input and output parameters.

Value of the Function  $f(X)$  is to be minimize.  $T_0$  is the initial Temperature and  $X_i$  is the set of weights.  $V$  is taking for step length of values  $X_i$ .  $X$  and  $V$  are of length  $n$ .  $v$  and  $x$  are elements of the vectors  $V$  and  $X$ .  $f(X)$  is sum of squared errors which produced by  $X$ . Candidate  $X'$  is chosen by varying each  $x_i$  and  $r$  is random number fetch from the uniform distribution between  $[-1,1]$ .

$$X_i' = x_i + v_i * r \quad (1)$$

From the new  $X_i'$  function value  $f'$  is then computes.

If  $f' < f$ ,  $X'$  is accepted as the new  $X$ .

If this new  $f$  is the smallest then solution is so far.

And if  $f' >= f$  then test for acceptance.

From (2) the value of  $p$  is computed and compared with  $p'$ . If  $p > p'$  then new point is accepted and  $X$  is updated with the value  $X'$  else  $X'$  is rejected.

$$P = e^{-(f-f')/T} \quad (2)$$

This Process repeats for a specified number of steps.

Reduction in  $T$  is calculated by the formula

$$T_1 = T_0 * r_T \quad (3)$$

Here  $r_T$  is also user defined value between  $[0, 1]$ . Reduction of the Temperature ( $T$ ) gives current optimal results. By the decreasing of the temperature number of rejections will increase .and step length will get decline.

Step1: Assume Initial Temperature is  $T$  and Initial Solution State is  $S'$ , for every  $T$  performs iterations up to  $n$ .

Step2: In step 2,  $i=1, \dots, n$  perform step 3 to step number 6

Step3: evaluate  $S''$  for data processing.

Step4: Now find out the Incremental Calculation  $\Delta t' = C(S'') - C(S')$

Here  $C(S')$  is evaluating function.

Step5: Now check the condition

If  $\Delta t' < 0$  then  $S''$  is current solution

Step6: Now check if there is termination condition, the output will be current solution and will optimal then stop the process.

Step7:  $T$  decreases gradually and  $T \rightarrow 0$  then move to step no 2.

Evaluate the error rate of the Network by using RMSE (Root Mean Square Error).algorithms

Continue runs on the training set until RMSE tends to increase the validation set.

## CONCLUSION

Simulated annealing technique can be used as an effective algorithm to improve the performance of the forecast GDP results. Simulated Annealing optimize the weight values and gives optimize results. In this paper it is trying to analyze the performance of the BPN and Simulated Annealing

to forecast GDP. GDP is one of the crucial factors of the Economy and growth rate of the GDP affect to the Economy and Market Value. So it is important to predict the future GDP. By this prediction Investors, Businessman, Industry Owners and Government can get help in business and economy to gain profit.

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