COMPARISON OF TRAINING ALGORITHMS ON THE NEURAL NETWORK AIDED TIME SERIES ANALYSIS FOR THE PREDICTION OF ISMR

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ABSTRACT

We can do prediction of of Indian summer monsoon rainfall by finding the patterns in past time series of all Indian rainfall data. ANN model are widely used these days in solving many problems due to their simple way of training and analyse performance .In this paper we will see that how we can do batter prediction of ISMR by comparing different neural network training algorithm .We will use 10 years data of ISMR and will do statiscal prediction based on the correlation analysis .By choosing appropriate training algorithm we can minimize the RMSE and also see how can we reduce time in training and increase performance ,so that we can easily and accurately forecast the ISMR .We will use matlab neural network tool for analysis of different training algorithm. Different training algorithms were used to training a ann model containing a single hidden layer with 5 nodes. we will do training using ANN on the data paints of 12 month of 140 years .we will take data paint as an array of months and year and will do training until we minimize the RMSE value between the output value and target value.

General Terms

Artificial neural network

Keywords

artificial neural network (ANN),Indian summer monsoon rainfall(ISMR)

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1. INTRODUCTION

India is an agriculture based country, so it's very important to do the exact prediction of Indian summer monsoon rainfall otherwise many crises will happen. There are many methods to find patterns in the statiscal data like ann model, regression model etc. Here we will use ann model as it can easily do prediction by finding the trends in already existing prior data .model like regression model may be good in calculation but at the time of prediction when we see pattern are not in a regular manners they found very difficulty because they are either based on some function or are based on formula.In this paper we will see how different training algorithm will affect our prediction performance of ismr.As we see different training algorithm results in different performance so we will see which algorithm is batter on which parameter. After doing comparative study we can easily say that which training algorithm is batter for our specific purpose .As we see different traing algorithms give different performance in diferent situations, So it is necessary to do comparative study for our specific problem.

2. Artificial Neural Networks

In the perspective of Artificial Intelligence ,ANN can be considered as a part of it .It works on the same way as human brain works In the ANN we see things like connectionism(as we see connection among neurons), parallel distributed processing(as all neurons concurrently work for producing output), neuro-computing, machine learning , and at last we say it artificial neural networks.

The ANN today we seeing is a result of past many years of improvement, in the beginning it don't attract much attention but later modifications make it popular among the people. the reason behind the growing popularity of ANN was that it includes many user friendly techniques and also lots of improvements in personal computers .though ANN is inspired by the working of biological human brain working system ,it is not necessary that we always work in the same manner ,a different approach can be followed inside ANN. processing inside the ANN happen in the same manner as we see in our human brain ,it process like an hardware and has a design that fully resembles with human brain..

2.1 Inside ANN

ANN is different from other mathematical techniques due to its design. In the ANN we see a network that has many processing units called neurons that hold their individual local memory. We see connection between these units that carry numeric data..The neurons receive input from the connections and work on their individual data. The high parallelism in ANN found because computation units are independent to each other as in biological neural networks .In the neural networks we see training rules in which weights of connection are adjusted on the basis of patterns. As we see children learn from example ,neural networks also learn from examples and show ability of generalization.. ANN gives the abstract view to solve the real world problems. They learns from the past experience and do improvements to adapt according to changing environment.When we don't have full information or data containing noise then ANN will be useful as we cant define the rules or steps for solving our problem. after training when ANN found similar input pattern it can now able to predict the output pattern.

2.2 ANN Architecture

In the ANN architecture we see many artificial neurones connected together to form a particular network. Our objective is to found some meaning patterns from the input. Neurones are arranged in layers.The working of neurons held by processing information from one to other.Neurons work by processing information. Spike are the way by which neurons provide information. We provide one or more input to the artificial neuron that works in the same manner as dendrites works in the human brain. Inputs have weights that update the strengths of input and add them together.

The activation function or transfer function got the sum of each neuron and produce a output (representing a biological neuron's axon.

2.3 Training

Sequential manner

in it updation of weights held by applying the delta rule after doing forward and backward computations

For each training pair, weights and biases adjustments are done.

In one epoch, N times the adjustments are applied. The same continue for next epoch

Batch mode

in it we first present all the training examples and then go for weight updation.The cost function is an as average squared error

$$\mathscr{E}_{av} = \frac{1}{2N} \sum_{n=1}^{N} \sum_{j \in C} e_j^2(n)$$

as we reach the stopping criteria our learning process that happening epoch by epoch terminates. If we want batter performance then we should choose randomized samples in our training examples.

2.4 Stopping criterions

Average squared error change:

when we see change in average squared error for each epoch small in the range of (0.1,0.01) then we say that our back propagation is converged.

Generalization based criterion:

if we test NN after each epoch and found generalization performance adequate then stop.

Early stopping method of training

For cross-validation, the training data is divided into an estimation subset and a validation subset. After a period of training, the validation error is measured, when validation phase is over, the training is resumed and this process is repeated.

3. Neural networks training algorithms

We use neural network so that we can learn to solve problem like pattern recognition, time series prediction etc.

Various steps have to be considered:

1. Define the type of training set examples,
2. Choose a training data set by which we fully describe the problem.,
3. After that we have to go for validation on the test to see the performance of ANN
4. we use fresh data in test that is not used prior in training..

if we think in the term of convergence speed and accuracy for a given problem we can follow many traing algorithms but it will be difficult to choose the best one.

we have to focus on so many factors like complexity of the

problem, the number of datasets used in training, the number of weights and biases in the network, the error goal, and whether the NN is used for function approximation or classification, etc., seem to have influence (Coskun and Yildrim 2003).

4. Comparison among main training algorithms

Though we can see so many training algorithms to train our data ,here i will discuss only three main training algorithms .we will see how these three algorithms are giving output in our AIR data.

Gradient Descent Back propagation training (GD)

In this back propagation training algorithm we focus minimizing the mean square error between the network's output and the desired output.for batter convergence of network we decreased the error to a specified threshold level and out network is said to be trained.in it we update the weights and biases along the negative gradient of error energy function..

Resilient Back propagation training (RP)

In it we do local weight updation according to error function. as other algorithms are effected by the size of derivative it only effected by the sign that leads to an efficient adaptation process..it is much faster then the other algorithm though only requires only little increase in memory.

Levenberg-Marquardt Backpropagation training (LM)

This technique has advantages of both Gauss–Newton and steepest descent algorithms. This method has better convergence properties than the conventional back propagation method. LM training algorithm is effective only when we have only few hundred weights. in it we see much

calculation takes place in every iteration but it has very high efficiencey.so it works good when we need high precision.

training algorithms outputs in matlab on AIR data.

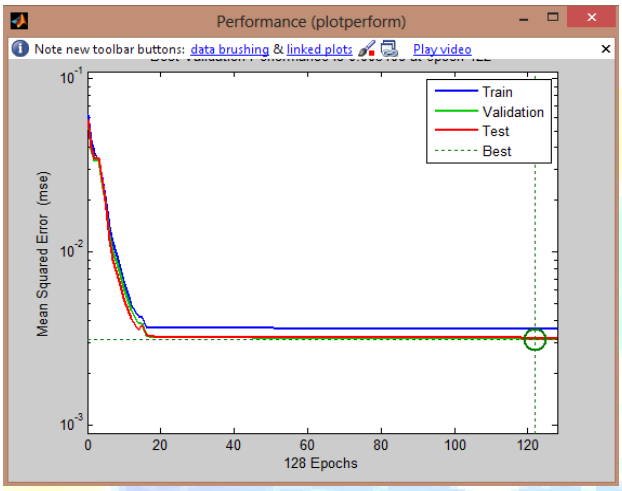

Fig 1: Levenberg-Marquardt Backpropagation (LM

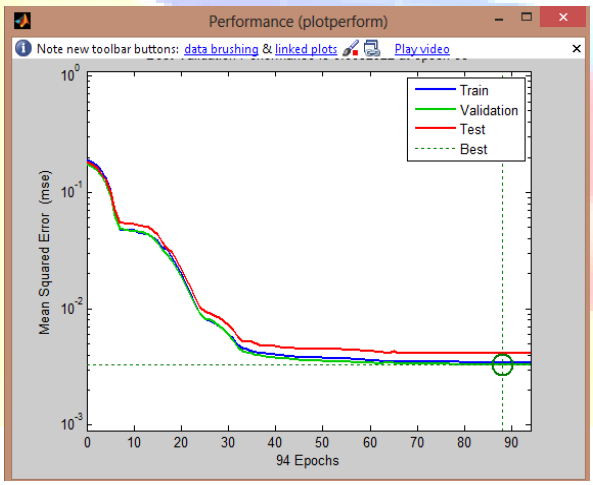

Fig 2: Resilient Backpropagation (RP)

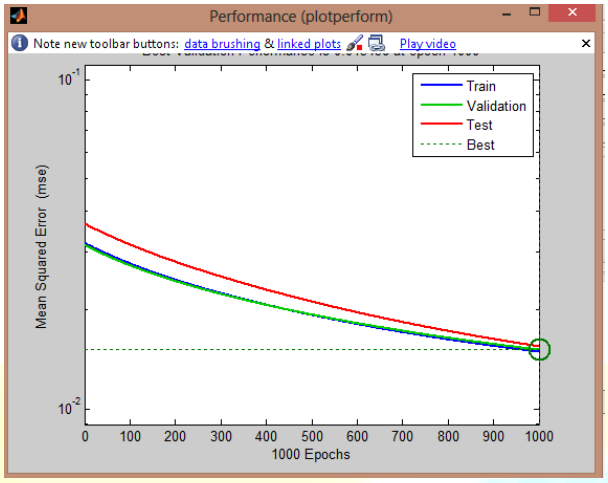

Fig 3: Gradient Descent Backpropagation (GD)

5. Conclusion

In this paper we see that how different training algorithms are giving different result on our AIR(all india rainfall) data. The result shows that LM algorithm is faster than others as it minimize the error in early stage than other two algorithms. The study also indicated that the appropriate input vector to the ANN could be simply determined using the correlation analysis.

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