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Weather Forecast Using Artificial Neural Network

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ABSTRACT

Weather warnings are important because they are used to protect life and property. Weather forecasts are made by collecting data about the current state of the atmosphere. In our proposed system, for prediction of weather information the Artificial Neural Network-based learning algorithm is used. . The Neural Networks package supports different types of training or learning algorithms. The multilayer perceptrons with back propagation algorithm is use to train the neural network computational model. The weather parameters like maximum temperature, minimum temperature and relative humidity, wind speed are predicted for a specific time. After a thorough training and test procedure, neural net with back propagation algorithm is found to be the best predictive model.

Keywords : Weather forecasting, Time series features, Feed forward ANNs, Multilayer perceptrons, Back propagation

Introduction
Agriculture sector and several industrial areas are depend on the weather conditions, so it is necessary to forecast the weather to indicate the various climate conditions like rain fall, temperature, humidity. Weather prediction is useful to warn about natural disaster that cause by sudden change in climate conditions.

II. Weather Forecast Using ANN
The weather forecast is basically done with the help of remote satellite. But the satellite need very high cost of investment. A artificial neural network is a powerful tool which capture and represent complex input / output data and their relationship . The aim of developing of neural network technology is to develop an artificial system that could perform intelligent tasks similar to human brain. Neural network act like a human brain in it acquires knowledge through learning and knowledge is stored within interneuron connection strengths known as synaptic weights. Neural network has a large number of interconnected neurons which is used for learning of system model which involves adjustment to the synaptic connections between the neurons.

Backpropagation neural network is the one which is used to train the system model and predict the desire output. It consist of at least three layer (Multilayer perceptrons) i.e. input layer, hidden layer, and output layer. Input layer neurons are connected to hidden layer and hidden layer is connected to output layer. The input data is pass to the model is feed-forward fashion i.e. from input layer to hidden layer and from hidden layer to output layer.

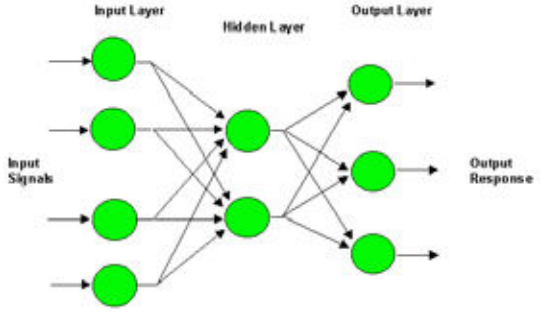

Fig 1: Multilayer Neural Network

III. Phases in Backpropagation Technique
The back propagation learning algorithm can be divided into two phases: propagation and weight update.

Phase 1: Propagation
Each propagation involves the following steps:

1. Forward propagation of a training pattern's input is given through the neural network in order to generate the propagation's output activations.

2. Back propagation of the output activations propagation through the neural network using the training pattern's target in order to generate the deltas of all output and hidden neurons.

Phase 2: Weight Update
For each weight-synapse:

1. Multiply its input activation and output delta to get the gradient of the weight.

2. Bring the weight in the direction of the gradient by adding a ratio of it from the weight.

This ratio impacts on the speed and quality of learning; it is called the learning rate. The sign of the gradient of a weight designates where the error is increasing; this is why the weight must be updated in the opposite direction.

The phase 1 and 2 is repeated until the performance of the network is satisfactory.

Learning with Backpropagation Algorithm
Backpropagation is also known as generalized delta rule and it is supervised learning algorithm for multilayer neural network. Error data is back propagated to the earlier stage to update the incoming weight of the layer .At the output layer this error is easily calculated i.e. difference between actual output and desired output.

The training session of the neural network has the pair of parameters (Xi, Ti) where Xi is input elements and Ti is target or desired elements. The Xi causes the output responses Oi at output layer. At the output layer the difference between actual and target output is yield an error signal.

where : E is the error due to a single pattern P at the last layer n; is the target output at the last layer(i.e., the desired output at the last layer) and is the actual value of the output at the last layer. This error is minimized and during this the weights are updated.

new = old – eta.

where eta is the “learning rate”, typically a small number like 0.0005 and will be decreased gradually during training. The speed and accuracy of the learning process that is, the process of updating the weights also depends on a factor, learning rate.

IV. Methodology

A. Data collection

The observations of atmospheric pressure, temperature, wind speed, wind direction, humidity, and precipitation are made near the earth’s surface by trained observers.

B. Weather Prediction

Weather Prediction uses the power of computers to make a forecast. Complex computer programs, also known as forecast Models run on supercomputers and provide predictions on many atmospheric variables such as temperature, pressure, wind, and rainfall. The network “learns” by adjusting the interconnections (called weights) between layers. When the network is adequately trained, it is able to generalize relevant output for a set of input data. A valuable property of neural networks is that of generalization, whereby a trained neural network is able to provide a correct matching in the form of output data for a set of previously unseen input data. Backpropagation is one of the most famous training algorithms for multilayer perceptrons..

V. Conclusion

In this paper, back propagation neural network is used for predicting the temperature based on the training set provided to the neural network. This approach is able to determine the non-linear relationship that exists between the historical data (temperature, wind speed, humidity, etc.,) supplied to the system during the training phase and on that basis, make a prediction of what the climate would be in future.

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