ISSN No. 0976-5697

Volume 3, No. 2, March-April 2012

International Journal of Advanced Research in Computer Science

RESEARCH PAPER

Available Online at www.ijarcs.info

Intelligent Rainfall Forecasting System Through Artificial Neural Networks Implementing Via Cloud Computing.

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Abstract: This research paper presents the implementation of Artificial Neural Networks concepts with Cloud Computing. The drawbacks of rainfall forecasting through Artificial Neural Networks can be overcome by Cloud Computing. The proposed method includes the Cloud Computing techniques for the rainfall forecasting. The procedure was implemented for the single town "Kadapa". After analyzing the error factor and accuracy of results, it has extended for large set of data items. The results are providing 96% of accuracy.

Keywords: Artificial Neural Networks, Multilayer Perception, Wind speed, Temperature, Humidity, Gradient descendent learning, Cloud computing.

I. INTRODUCTION

The existing forecasting methods include the techniques; retrieve the rainfall based on previous history/data. It will give suspected rainfall forecasting with the accuracy of 70% to 80%. There are more failure cases in the real world implementation. My proposed research work predicts the rainfall based on situation structure. This research implements techniques of Artificial Neural Networks and implemented in cloud computing for situation analysis. The situation analysis system provides accurate information for forecasting. The results provide **96%** of accuracy basing on the real data's collected from various centers. This research implements techniques of Artificial Neural Networks and implemented in cloud computing for situation analysis. The situation analysis system provides accurate information for forecasting. The results provide 96% of accuracy basing on the real data's collected from various centers and internet. The data collected from various rain gauge stations surrounding kadapa and download the data from internet .

II. MOTIVATION OF THE RESEARCH

Andhra Pradesh is an agricultural dependency state in India. Most of them are formers and they are doing agriculture. For the sake of agriculture and its benefits rainfall prediction is essential. Prediction of rainfall also helpful for preserving the rain water in the rural & urban areas.

III. BASIC CONCEPTS OF ARTIFICIAL NEURAL NETWORKS

An Artificial Neural Network is an information-processing paradigm inspired by the way the brain processes information. Artificial Neural Networks are collections of mathematical models that emulate some of the observed properties of biological nervous systems and draw on the analogies of adaptive biological learning [1]. An Artificial Neural Networks is composed of a large number of highly interconnected processing elements that are analogous to neurons and are tied together with weighted connections that are analogous to synapses.

Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of Artificial Neural Networks as well. Learning typically occurs by example through training or exposure to a truth table set of input/output data where the training algorithm iteratively adjusts the connection weights (Synapses). These connection weights store the knowledge necessary to solve the specific problems.

Artificial Neural Networks are applied to control problems where the input variables are measurements used to drive an output actuator, and the network leads the control function. The advantages of Artificial Neural Networks lie in their resilience against distortions in the input data and their capability of learning [2]. They are often good at solving problems that do not have an algorithmic solution or for which an algorithmic solution is too complex to be found [3].

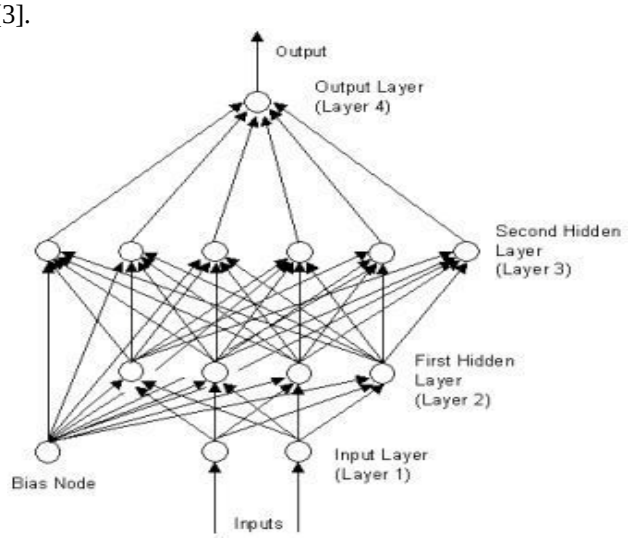

Figure: 1

IV. BASIC CONCEPTS OF CLOUD COMPUTING

The "cloud" in cloud computing can be defined as the set of hardware, networks, storage, services, and interfaces that combine to deliver aspects of computing as a service. Cloud

services include the delivery of software; infrastructure .The infrastructure refers the current situations.

Cloud computing has four essential characteristics: elasticity and the ability to scale up and down, self-service provisioning and automatic deprovisioning, application programming interfaces (APIs)[4][5].

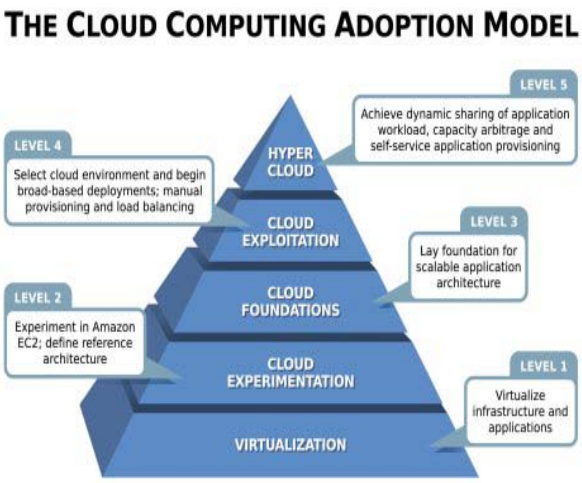

Figure: 2

V. DEVELOPMENTATION PROCESS

One of the most important natural climatic phenomena is rainfall. The rainfall prediction is challenging and demanding. The rainfall prediction is reliance to agriculture sector, which contributes significantly to the economy of the nation it is also useful for management of water resources in urban cases.

The existing system predicts the rainfall based on geographical objects in the setup environment in the prediction centers. Most of the cases there is a chance of failure [6].

Figure: 3 Cloudy environment

Case 1: As shown in the figure cloud environment, on the day of 5-9-11 the environment is cloudy due to this rainfall, one can assume that rainfall may be there, but the rainfall on that day is 0.

Figure: 4 Dry Environment

Case 2: on the day of 21-10-11, the environment is fully dry. But there is a sudden change in it and the recorded rainfall is 3.62cm. The gap of prediction and actual may be filled with cloud computing techniques [7].

The cloud computing accept the current data values and capable to predict new values basing on current situations. New prediction values may have more accurate than the existing one. The accuracy is 96%.

VI. STEPS FOR DEVELOPMENT PROCESS

a. Accept Non Linear processing elements [PES]. [8].
b. The multilayer perception is trained with error-correction learning. It will work based on the response at PE_i at iteration n, $d_i(n)$ and the desired response $Y_i(n)$.
c. Using theory of gradient descent learning, each weight in the network can adopted with current value.
   $W_{ij}(n+1)=W_{ij}(n)+n@i(n)x_j(n)$
d. compute the output if the neurons through
   Neti= ∑ijxi+θi
e. For getting the accuracy implement K-Means algorithm.
f. K-Means algorithm.

Randomly initialize the forecasting values and current input values.

Iterate:
For each point p
Find the nearest point(p)
Add p to the C(p)
C(p) update the results.

Non Linear Items which effect rainfall.

a) Wind speed
b) Temperature
c) Humidity
d) Pressure
e) Wind Direction

The data values are collected from the meteorological department [9][10]. The interval time consider as 2 minutes and the data collected, if there is a change in the existing values.

VII. EXPERIMENTAL RESULTS

Table 1.1 The recorded data values.

Time	Temperature	Humidity	Wind speed	Wind direction
0.2	18.66	112.8	0	WNE
0.4	18.78	110.7	0	NNE
0.633	18.69	111.3	0	NNE
0.85	18.75	111	0	ESE
1.066	18.38	112.1	0	NNE
1.283	18.19	113.3	0	NNE
1.5	18.19	114.2	0	WNW
1.71	18.22	114.5	0	S
1.933	18.28	114.6	0	NE
2.15	18.03	114.5	0	WNW

In our study, for computational purposes, values as in table are assigned to the various directions. The data values are implemented to the algorithm in order to predict the rainfall.The predicted rainfall as follows.

Table 1.1The recorded rainfall as follows.

Time	Temperature	Humidity	Wind speed	Wind direction	Rain fall
0.2	18.66	112.8	0	WNE	0.76
0.4	18.78	110.7	0	NNE	0.76
0.633	18.69	111.3	0	NNE	0.741
0.85	18.75	111	0	ESE	0.62
1.066	18.38	112.1	0	NNE	0.68
1.283	18.19	113.3	0	NNE	0.682
1.5	18.19	114.2	0	WNW	0.7
1.71	18.22	114.5	0	S	0.76
1.933	18.28	114.6	0	NE	0.77
2.15	18.03	114.5	0	WNW	0.78

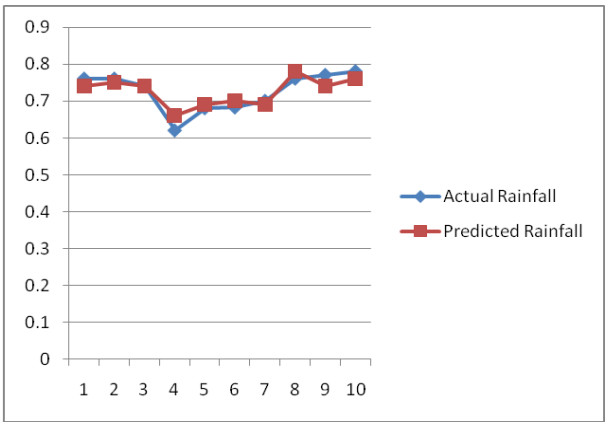

Figure: 5

The graph represents the comparison between the actual and predicted values.

Table 1.3 The comparison between the actual and prediction values is as follows.

Time	Rainfall (Recorded)	Rainfall (predicted)	Error
0.2	0.76	0.74	-0.02
0.4	0.76	0.75	-0.01
0.633	0.741	0.74	-0.001
0.85	0.62	0.66	+0.04
1.066	0.68	0.69	+0.01
1.283	0.682	0.7	+0.18
1.5	0.7	0.69	-0.01
1.71	0.76	0.78	+0.02
1.933	0.77	0.74	-0.03
2.15	0.78	0.76	-0.02

VIII. CONCLUSION

This research paper adopt the techniques of Artificial Neural Networks and implemented with Cloud computing to reduce the error , with the help of current parameters rainfall will be predicted with minimal error factor. The data collected from various rainfall stations and meteorological departments to run real time rainfall.

This study is very robust, characterized by fast computation capable of handling the current situations and data that are typical in rainfall forecasting. The minimal of error has been discovered with this model.

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