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Enhancing Back Propagation Neural N/w Algorithm for crop prediction

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Abstract: ***The aim of this research is to develop a farmer prediction system to identify crop suitable for particular soil. To attain this Neural Network should be trained to perform correct prediction for farmers. After the network has been properly trained, it can be used to categorize the crop suitable for particular type of soil. Artificial neural networks are non-linear mapping structures based on the function of the human brain and are mathematical modeling tools that are especially useful in the field of prediction. We can predict the type of crop that may be grown on a particular land based upon physical and chemical properties of soil using artificial neural network, a data mining technique. Neural networks provide a very general way of approaching problems. The cut off value of mean square error is used to avoid the overtraining of neural network.***

Keywords— Back Propagation, Training, Pattern, Processing Element, Feed-Forward, Neural Network.

I. INTRODUCTION

Diverse management strategies could be used to increase and sustain crop production and, at the same time, enhance soil quality. Effective and worldwide recognized strategies that meet production and conservation goals include reduced tillage, legume- or forage-based crop rotation, crop residues incorporation, organic manuring. On the other hand some farming practices, e.g. irrigations and fertilization, have a direct and well known positive effect on crop productivity, but, if not properly managed, may cause negative impacts on environment. For example high fertilizers levels could produce nutrient runoff and leaching, hence within this context fertilizers use and management is a specific concern [1]. Information packaged in considerable databases about all kinds of individuality and facets are available these days. Extracting new and interesting information through interpreting the composed data is cumbersome since more data potentially contains more information. In particular for a developing country like India, where the majority of the population depends primarily on agriculture for livelihood. Main Focus is to improve the optimal utilization of innate characteristics in a soil through cultivation of appropriate crops, which will help in growing the volume and excellence of yield. By Studying various properties of soil, to determine the types of crops suitable for a particular region can increase the yield to greater extent, which reduces the expenditures involved in irrigation and application of fertilizers. With the available tested techniques for calibrating the quality of soil and the crops suitable for cultivation in the soil, it is possible to determine the exact crop, irrigation patterns and smooth the cycle and quantity of fertilizer application. To analyze the patterns of soils distributed across huge geographical area and identify the suitable types of crops for the particular soil. Evaluation of correct crop(s) suitable for a particular region can help stave off redundant maintenance and the inherent expenditures that would occur due to over irrigation and over usage of fertilizers, to fulfill the natural deficiencies [2]. Artificial neural networks are non-linear mapping structures based on the function of the human brain. They are mathematical modeling tools that are especially useful in the field of prediction and
forecasting in complex settings. ANN use a large number of highly interconnected processing neurons, working in unison to solve specific problems, such as pattern recognition and forecasting. Each neuron is associated to assured of its neighbors with changeable coefficients or weights, which represent the relative control of the different neuron inputs to other neurons. ANN have been generally used in the agricultural field [7]. Training a neural network model essentially means selecting one model from the set of allowed models (or, in a Bayesian framework, determining a distribution over the set of allowed models) that minimizes the cost criterion. There are several algorithms available for training neural network models; most of them can be viewed as a simple application of optimization theory and estimation. Mainly algorithms used in training artificial neural networks consume some form of gradient descent. This is done by basically taking the derivative of the cost function with respect to the network parameters and then changing those parameters in a gradient-related route [8]. There are various types of learning algorithms in the literature. Back propagation: The back propagation (BP) neural network algorithm is a multi-layer feed forward network trained according to error back propagation algorithm and is one of the most widely applied neural network models. BP network can be used to learn and accumulate a great deal of mapping relations of input-output model, and no need to reveal in proceed the mathematical equation that describes these mapping relations. Its learning rule is to accept the

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steepest descent method in which the back propagation is used to regulate the weight value and threshold value of the network to achieve the minimum error sum of square.

The application of the generalized delta rule thus involves two phases: During the first phase the input is presented and propagated forward through the network to compute the output values for all output unit. This output is compared with its preferred value do, resulting in an error signal for each output unit. The subsequent phase involves a backward pass through the network during which the error signal is passed to each unit in the network and appropriate weight changes are calculated [9].

II. RELATED STUDY

Armenise [1] Nowadays, due to the overall attention developed on environmental topics, the challenge for soil scientists is to identify eco-compatible farming techniques that, at the same time, do not leave out crop productivity. In this paper some wheat production parameters and soil quality indicators were estimated jointly, as affected by different management strategies (cropping systems, crop residues management, fertilizer levels), on a long-term field trial.For the productivity aspect, different quantity and quality parameters of wheat production were analyzed: number of spikes m-2, grain yield (Gy), grain specific weight (Sw), 1000 kernel weight (Kw). These yield components were also used to develop a set of coefficients for determining the C in wheat crop (NPP). In order to estimate the potentiality of the soil management strategies compared in preserving soil quality, soil texture, water extractable organic C (WEOC) and N (WEN) were considered. The results from single d.f. contrast method allowed to obtain comparisons among the wheat based cropping systems. Overall analysis of variance pointed out statistically significant differences in only two parameters in relation to the treatments under study: WEN and Kw. Dr. P. Thangaraj [2] Study on characteristics of soil, to decide the types of crops suitable for cultivation in a particular region can increase the yield to greater point, which minimizes the expenditures involved in irrigation and application of fertilizers. With the experienced techniques available for calibrating the quality of soil and the crops suitable for cultivation in it, it is possible to decide the exact crop, irrigation patterns and smooth the cycle and quantity of fertilizer application. This dealt with the application of SOM based clustering and Artificial Intelligence techniques, to examine the patterns of soils distributed across huge geographical area and identify the suitable types of crops for the particular soil. Estimation of exact crop(s) appropriate for a particular region can help stave off redundant maintenance and the inherent expenditures that would occur due to over irrigation and over usage of fertilizers, to accomplish the natural deficiencies. Our Focus is to improve the most favorable utilization of innate characteristics in a soil through cultivation of appropriate crops, which will boost the volume and quality of yield, in particular for a developing country resembling India, where the enormous majority of the population depends primarily on agriculture for livelihood. Parag.P.Kadu [3] This paper utilizes artificial neural networks for temperature forecasting. The study based on back propagation neural network which is trained and tested based on dataset provided. Three-layer network has been constructed in formulating the ANN-based predictive model. Appropriate air temperature predictions can provide farmers and producers with valuable information when they face decisions regarding the use of mitigating technologies such as orchard heaters or irrigation. The research presented in this developed artificial neural networks models for the prediction of air temperature. In this back propagation neural network is used for temperature forecasting. The procedural milestones, that have been achieved by the researchers in this field has been presented and reviewed. The back propagation algorithm and artificial neural networks and used for temperature forecasting in general are explained. Gill [4] Accurate weather forecasting is important in today's world as agricultural and industrial sectors are largely dependent on the weather conditions. Secondly, it is used to notify about natural disasters. Outstanding to non-linearity in climatic physics, neural networks are appropriate to predict these meteorological processes. BP algorithm using gradient descent method is the most important algorithm to train a neural network for weather forecasting and this algorithm suffers from several problems. In order to overcome some of these harms, an integrated back propagation based genetic algorithm technique to train artificial neural networks is planned. In the proposed technique, back propagation is combined with genetic algorithm in such a way that the pitfalls of the algorithm get converted to benefits.

Hui Li [5] This paper addresses the questions of improving convergence performance for back propagation (BP) neural network. For usual BP neural network algorithm, the learning rate choice is depended on experience and examination. It is based on Taylor formula the function relationship between the total quadratic training error change and association weights and biases changes is obtained, and united with weights and biases changes in batch BP learning algorithm, the method for self-adaptive learning rate is given. Contrasting presented algorithm, the self-adaptive learning rate depends on only neural network topology, training samples, error curve surface gradient and average quadratic error but not artificial selection. Simulation results demonstrate iteration times is significant less than that of traditional batch BP learning algorithm with constant learning rate.

Saman Razavi [6] Feed forward neural network is one of the most commonly used function approximation techniques and has been applied to a wide variety of problems arising from various disciplines. Conversely, neural networks are black-box models having multiple challenges/difficulties associated with training and generalization. It initially looks into the internal behavior of neural networks and develops a detailed interpretation of the neural network functional geometry. Based on this geometrical analysis, a new set of variables relating neural networks is proposed as a more effective and geometrically interpretable alternative to the traditional set of network weights and biases. It develops a new formulation for neural networks with respect to the newly defined variables; this reformulated neural network (ReNN) is equivalent to the common feed forward neural network but has a less complex error response surface. To demonstrate the learning capacity of ReNN,

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two training methods involving a derivative-based (a variation of back propagation) and a derivative-free optimization algorithms are in use. Furthermore, a new measure of regularization on the basis of the developed geometrical interpretation is proposed to estimate and improve the generalization ability of neural networks..

II. PROBLEM STATEMENT

Farmers face lot of problems in agriculture, one of which is what type of crop must be grown on a given field which yields maximum productivity. Study on characteristics of soil to determine the types of crops suitable for cultivation in a particular region can increase the yield to greater degree, which minimizes the expenditures involved in irrigation and application of fertilizers.

A Dataset of n crops,
D= {c1, c2, c3...ck}
Where C are various crops
S= {s1, s2, s3…sm}
Where sm € S are various types of Soils
PP= {p1, p2, p3…pr}
Where pr € PP is Physical properties of soil
CP= {c1, c2, c3 …cq}
Where cq € CP is chemical properties of soil
Where cq € CP is chemical properties of soil

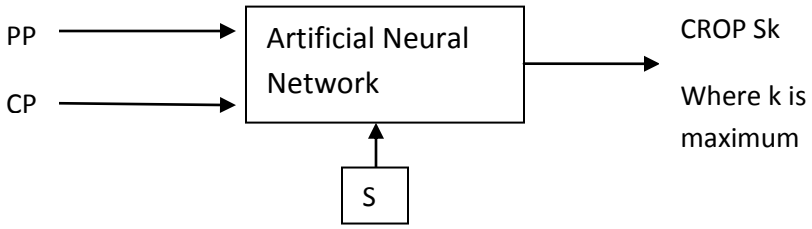

Fig. 3.1: An Older ANN with Inputs & Output

III. RESULT & DISCUSSION

4.1 MSE computation for first 20 iterations

Mean square error (MSE) is the difference between the actual and predicted output. Once the network is trained with the given set of input and output values, it is able to predict the type of crop and gives predicted output. The difference between the actual output and predicted output gives the value of MSE. MSE computation for first 20 iterations is shown in fig:4.1.

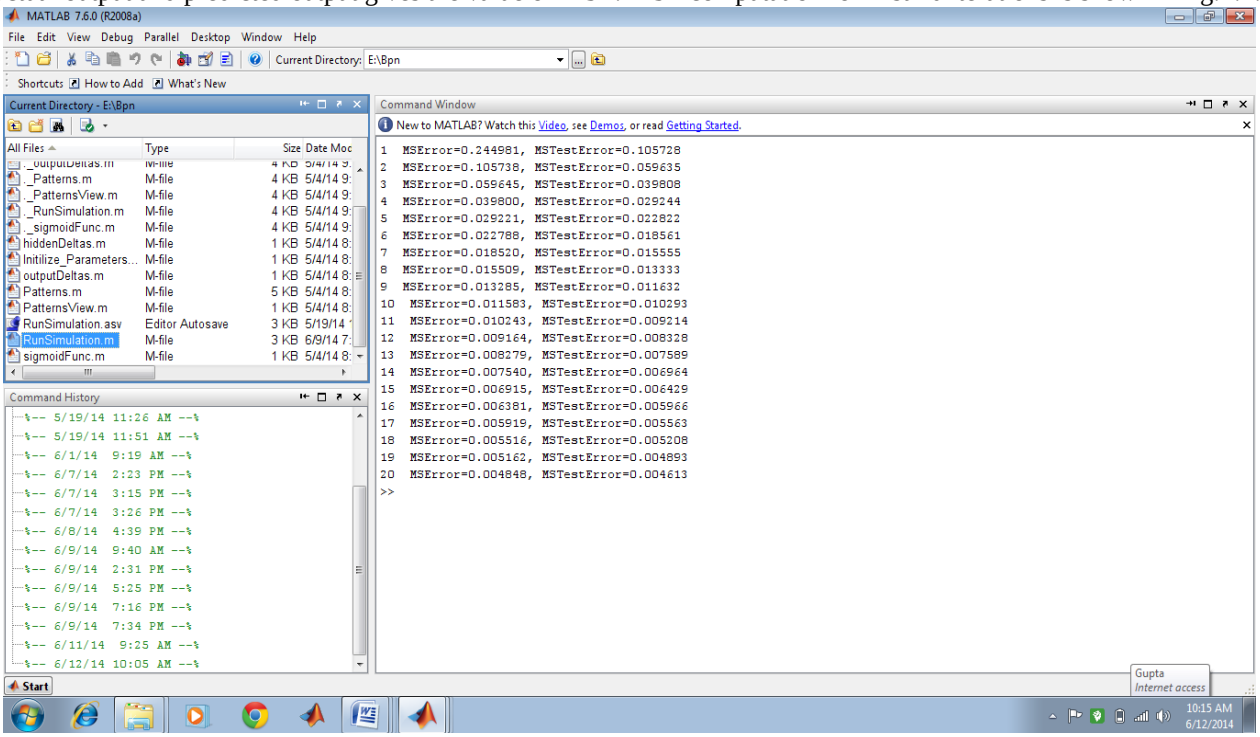

Fig 4.1: MSE computations for 20 iterations

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4.2 Graph between MSE and Learning Epoch

This graph is plotted between MSE and Learning Epoch.MSE gives error for testing and training.

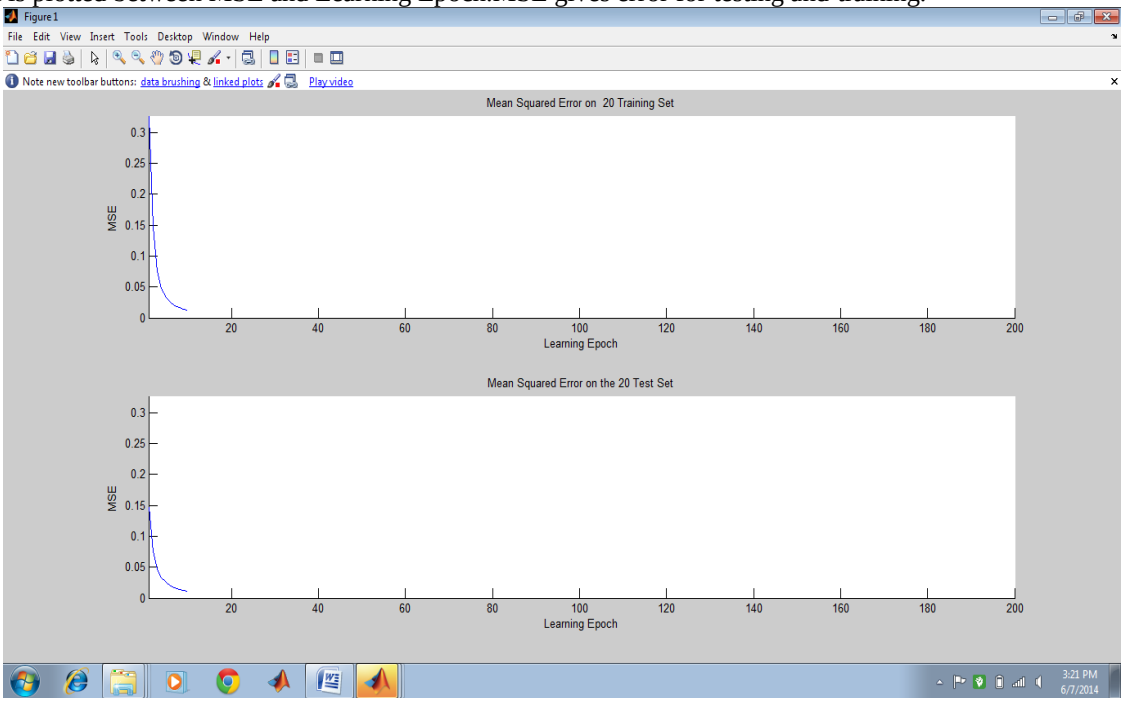

Fig. 4.2: Graph between MSE and Learning Epoch

4.3 MSE Convergence Graph for training and prediction data

This shows graph between MSE and number of patterns. The value of MSE computed by the network is the difference between actual and predicted output. These values are plotted graphically and the graph shows how the neural network mean square error (MSE) decreases as number of patterns proceed as shown in figure. Figure 4.3 represents the MSE for training and prediction where x-axis of graph represents the no. of iterations and y-axis of graph represents the mean square error.

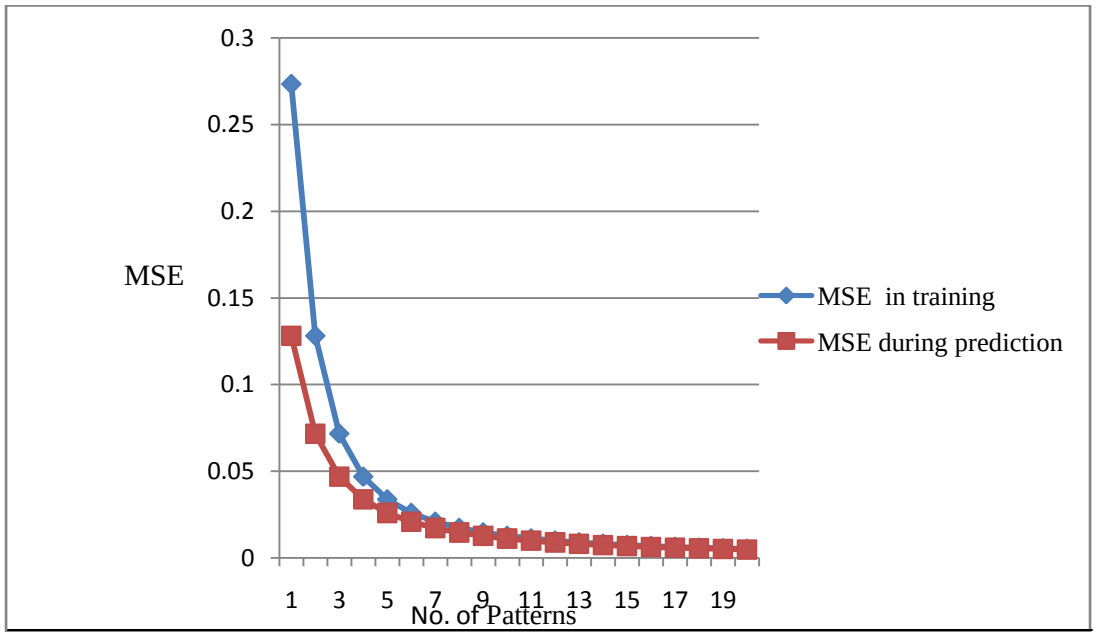

Fig 4.3 Convergence Graph for training and prediction data

V. CONCLUSION

Our proposed system will facilitate farmers to know the crop which may give best production in the given land It can be applied in a generic manner for any network size that uses a back propagation algorithm by controlling network training time based on mean square error. The proposed algorithm for the training of multilayer neural Networks is the enhanced

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version of the Back propagation BP algorithm. Performance of the system may be improved and further various data mining algorithms may be applied by studying climatic conditions affecting soil.

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