Application of Artificial Neural Networks in prediction of Yielding of Rice in Bihar

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Abstract **- Rice crop have highest share approx 40% in overall food grains in India and 46% in Bihar and Its provide food security to the region. The crop yield is reliant on favourable climate. Due to fast climate changing and growing world population crop yield prediction play an vital role in decision making and planning of food in future. In different climate conditions the prediction of crop productivity, can lend a hand to farmers and stakeholders in production decisions for agronomy and crop selection.**

ANN is used in this study to forecast rice production yielding as well as look into the factor by which the rice yield is affected for various areas of Bihar, India. All the statistics are collected from openly accessible records of Government of India and Govt of Bihar of 38 Districts of Bihar, India. The study parameters are Max, Mean, Min temperature; rainfall, rice crop evaporation and transpiration, production, vicinity and yield in Kharif season (July to December) for the years (2012-2016). WEKA tool is used for dataset processing. Multilayer Perceptron Neural Network developed and to validate statistics Cross validation process was used. The result shows that the accurateness of 94.5% with a sensitivity of 93.3% and specificity of 97.3%. For study after that relative absolute, mean absolute, Root mean Square and, root relative square error to be calculated. The act of classifier is shown pictorially briefed using ROC curve.

Index Terms - Rice Yield prediction, ANN, WEKA;.

INTRODUCTION

The principle aim of Farmers are to produce high crop. It is seen that AI method offers more useful way for estimate crop yield in different condition of cropping. The ANN offers to create models with compound parameters which can be easily interpreted.

In this research we represent the development of a forecast model for rice crop production with use of ANNs. The flexible scheme of ANNs back propagation method is used to achieve the prediction. The neural network model is the most common multilayer perceptron used in the present study. The model developed is Multilayer Perceptron Model of Neural Network to authenticate statistics fractious substantiation.

This model is to be demonstrated to predict rice crop yield in Kharif season since year 2012 to 2016 for Bihar, India, Based on various predictor variables i.e. Max, Mean, Min temperature; rainfall, rice crop evaporation and transpiration, vicinity, production and yield.

LITERATURE SURVEY

ANN Structure is from the human brain biological neural process. the interrelationship of the neurons are used to develop the process. Different study for prediction of crop yield have described the prospective for using ANN. A study for predicting rice yield with predicted climatic statistics with a maximum of 45–60 kg / ha. [1]. Another by [2] has been reported that describe simple and accurate estimation tool to predict rice yield. Rice yield prediction by the utilize of ANN model was also scrutinize meant for Nepal. During training phase, ANN gives reasonable error that explain the accurateness of a model. Then the comparision among the production, the ANN result shows the same outcome that confirmation the correctness of forecast. The predicted outcome could be used in Siraha district of Nepal for attracting the paddy yield [5]. Other current studies contain publicized the efficiency of a DSS in Phimai district, Thailand which used ANN to predict rice production [6]. Related result were details in another learning which verified the function of with ANN with feed forward back propagation for farming yield forecast. This study finished that ANN is a valuable implement used for rice yield forecast[7].

This study information lying on the utilize of ANN to forecast the rice yield for Bihar. The reason of The study is to

(1) ensure the usefulness of forecast rice yield using ANN used for Bihar

(2) compute the feat of ANN

OBJECTIVE

To forecast Rice Yielding in Bihar Zone I according to Max, Mean, Min temperature; precipitation, rice crop evapotranspiration, area, production using back propagation technique.

RESEARCH METHODOLOGY

The study includes learning area, statistics set and method.

Learning Area- The learning region for this study is Bihar, India. Bihar amid 94.2 thousand square km geographical area and is situated in the eastern part of India located between latitude 24°-20'-10"N ~ 27°-31'-15"N and longitude 83°-19'-50"E ~ 88°-17'-40"E. In area Bihar is thirteenth largest state and In Population third biggest [8]. Bihar main source of income is Agriculture for the food and trade purpose. The primary food produced in Bihar exist rice, wheat, maize, and pulses [9]. The state have nine divisions, which division into 38 districts, 101 subdivision and 534 talukas [10].

Holy river Ganges divide the land of two parts, the north Bihar having area of 53.3 thousand square km and the south Bihar with an area of 40.9 thousand square km. Based on rainfall, soil classification, land and temperature, Bihar has been divided into four main agro-climatic zones each have its own unique prospects. Zone-I North Alluvial Plain, Zone-II north East Alluvial Plain, Zone-III A South East Alluvial Plain and Zone-III B South West Alluvial Plain. Zone I and II is in north of Ganges whereas the Zone III is located in the south of Ganges. Zone I is located in the north western part of the state whereas zone II is located in the north eastern part. The flood prone areas are Zone I and whereas drought prone area is zone III. Potential wise Bihar have vast unused potential for growing the production of food grain crops [11].

For present study, Agro- climatic zone I -North Western part is chosen in particular which lies in the district of West Champaran, East Champaran, Siwan, Saran, Sitamarhi, Sheohar, Muzaffarpur, Vaishali, Madhubani, Darbhanga, Samastipur, Gopalganj, Begusarai.

Learning area Used: All the learning area utilize in the study were taken from the openly obtainable files at Govt of India and Govt of Bihar meant for since 2012-2016. The factor meant for learning are:

- Max, Mean, Min Temperature (Degree Celsius): The Development of plant is influenced by the temperature. The Max Temperatures along with environmental change will affect productivity of plant. Thus the present study considered the Max, Mean, Min temp of 2012-2016 of all district.
- Rainfall (mm): Rainfall is remarkable part of irrigate series, and is conscientious for saving fresh water. From monthly mean Rainfall the aggregate Rainfall of Kharif every year all district be calculate since year 2012-2016 for a specific district.
- Reference Crop Evaporation and Transpiration (mm): Addition of evaporation, plant transpiration of Earth's area and sea surface to atmosphere is Evapotranspiration. Monthly mean of 2012-2016 for all district reference crop evapotranspiration was calculated.
- Area (Hectares): In Bihar Cultivated region of rice during Kharif season (July- December) since year 2012-2016 be measured for the study.
- Production (Tonnes): Production of rice in Kharif season (July- December) be considered for the study.
- Yield (Tonnes/Hectare): The total produced rice in addition to the rice area cultivated in Kharif season since year 2012-2016, in all of the chosen district, the yield be considered for the study.

Methodology

To include the entire statistics sets are attain for the learning MS Excel be used. Steps trail for dealing out and organize the data for affect multilayer perceptron technique be:

Step1: Each Parameter (Obtain each parameter (min, mean, max temperature, Rainfall, and evapotranspiration of mention crop) mean monthly records of every district since 2012-2016 Govt of India records.

Step2: Scheming total Rainfall for every district for every year through Kharif season (July-December).

Step3: Scheming average temp in Kharif season used for min, mean, max temperature for every district for every year.

Step4: Scheming average evapotranspiration of mention crop for every district for every year of Bihar in Kharif season.

Step5: Obtain every districts production from publicly available record of 2012-2016.

Step6: The unrefined statistics set be gathered in particular sheet which consist the data in MS Excel: Serial. No, State Name, District Name, Year, Min Temp, Avg Temp, Max Temp, Rainfall, Soil, Region, Crop Production and, yield.

Step7: The statistics were omitted for district's whose climatic information or production information not available. Serial number was included for every record set.

Step8: To apply multilayer perceptron method, unrequited data were removed. These are Serial. No, Year and, District Name.

Step9: The statistics set arrange area wise and the data set which have area less the 100 hectares are omitted from study so removed from the dataset

Step 10: The statistics set arrange yield wise to categorize the information in high, moderate and low production of rice yield. Low group have series 0.15 to 0.50 tonnes/hectare, group moderate have series 0.51 to 1.00 tonnes/hectare and group high with the series 1.00 to 3.16 tonnes/hectare.

Step11: The date set omitted the production and area columns as yield has been calculated on the basis of them.

Step12: The statistics set be saved in .csv file used for advance affect multilayer perceptron method in Weka.

RESULT ANALYSIS

Running the Multi Level Perceptron method on yield of rice crop statistics set of Bihar, we obtained the results for prediction of crop yield. India. WEKA has been used to design the algorithms. Multi Layer Perceptron Methods parameter set are as shown:
GUI=true; autoBuild=true; decay=false; debug=false; momentum=0.2; learningRate=0.3; normalizeAttributes=True; hiddenLayers=a; normalizeNumericClass=True; reset=True; nominalToBinaryFilter=True; trainingTime=500; seed=0; validationThreshold=20; validationSetSize=0;.

The precision of 94.5%, sensitivity of 93.3% and specificity of 97.3% is achieved by using the algorithm. To illustrate the forecast yield when high, moderate and low in output level a 3 level neural network using feed-forward back propagation method has been used successively with Input layer having 6 neurons in, the hidden layer having 4 neurons and output layer having 3 neurons as shown below in Figure 1.

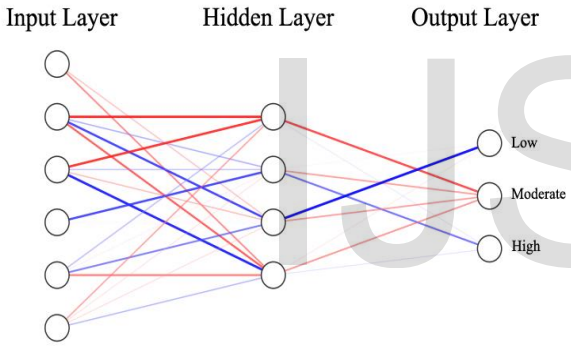

Fig1 Diagram of Neural Network

To test and train the ANN cross validation with 10-fold has been used for subset of the statistics. The subset of statistics has been divided in 10 components arbitrarily of which one of the components has been employ for testing and the outstanding parts are employ for training data. the step was repeated 10 times continuously by changing the subset of data and the average result found. To train the neural network using feed-forward back propagation the back propagation algorithm has been applied.

On the evaluation of the model, the following parameters are computed and the result illustrate a 12% of qualified absolute inaccuracy, a relative qualified inaccuracy of 33%, root mean square inaccuracy of 0.1522 and mean absolute error of 0.0502. It gives MCC of 0.92 and F1 score of 0.94

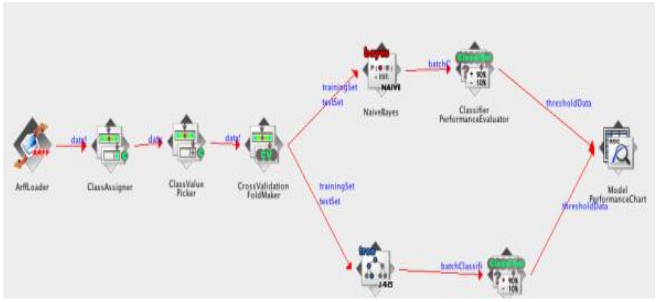

Fig2 Layout of Knowledge Flow

Fig2 represents the Layout of Knowledge Flow of the present dataset. ArffLoader is used for the loading dataset and TextViewer shows the result generated from the data set.

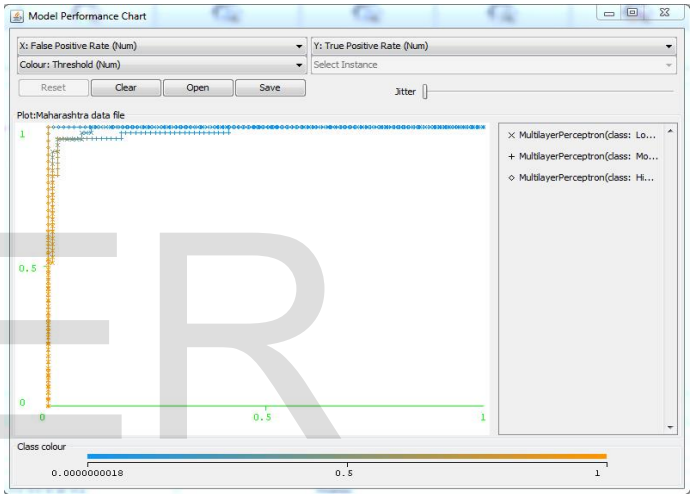

Fig3 Model Performance Chart

Beyond it Fig3 shows the ROC curve is shown used for 3 classes High, Moderate, Low with the Model Performance Chart for representing the specificity and sensitivity of the classes. The curve which is generated shows continuation that represent 100% specificity means no artificial positives and 100% sensitivity means no artificial negatives. The curve created is a isolated form which bring artificial positive and artificial negatives values that misses 100% specificity and sensitivity.

CONCLUSIONS

A non-linear system is required to understand the correlation and to illustrate the interaction between the thing affecting the rice yield. The complication of the thing affecting the rice yield Linear methods like linear regression considered deficient to illustrate the interaction between the thing and rice yield. For predicting crop production Neural Networks

has been considered as an substitute to conventional linear regression methods.

To forecast the rice yield for Bihar in addition flood-prone areas of India these models show the potential as well as accuracy for the prediction. In the current study area, other data mining techniques are less truthful balance to the current Neural Networks model [3,4]. By allowing for other parameters to facilitate affect the production of rice crop in Bihar, the model may be widened for more improvement and effectiveness for prediction credentials of the Neural Networks based crop prediction of rice yield.

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