Transfer & deep reinforcement learning model for sustainable agrarian applications-Prediction of Crop's

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ABSTRACT:

Taking a gander at the current circumstance looked by ranchers, there is an expansion in self destruction rate throughout the long term. Primary purpose for it incorporates neediness, unusual climate, monetary issue, parental issue and regular change in Indian government standards. Training additionally assumes a significant part because because of absence of schooling they don't know about the dirt quality and the climatic change and at times rancher didn't know about the plausible harvests. Considering absence of information, they don't know about the dirt quality, soil supplements and soil creation. This paper zeroed in on expectation of harvest dependent on the current information by Artificial Neural Network. We are carrying out Artificial Neural Network which is utilized for arrangement and expectation as a large portion of serious calculation happens during preparing stage just, there is no expects of testing stage.

Key Words: Crop Yield, Machine Learning, Artificial, Sustainable agrarian applications Farmer, Prediction

I. INTRODUCTION

Agriculture is one of the important factors and it plays and important role in individual's life. Being the backbone of India,Agriculture sector has been improving by the needs of public, as the technology improves. Agriculture is the primary occupation of most of Karnataka's rural people. As per the statistics, a total of 123,100 km² of land is cultivated in Karnataka, constituting 64.60% of the total geographical area of the state. Agriculture remains the primary activity and mainsource of livelihood for the rural population in the state. It is characterized by wide crop diversification and remains highly dependent on the vagaries of the southwest monsoon. As per the statics of 2018, agriculture employed 50% of Indian work force and contribute 17 to 18% of country GDP. Suicide rate offarmer in India had ranged between 1.4 to 1.8 per 1 lakh total population over 10 years of period from 2005. However, in 2018, the farmer suicide rate is more than 10 per day. With thisincreasing suicide rate, our aim is to help farmer to get knowledge about the importance of prior crop prediction. Because of knowledge about the soil and its quality, they will be able to grow crop in huge amount.
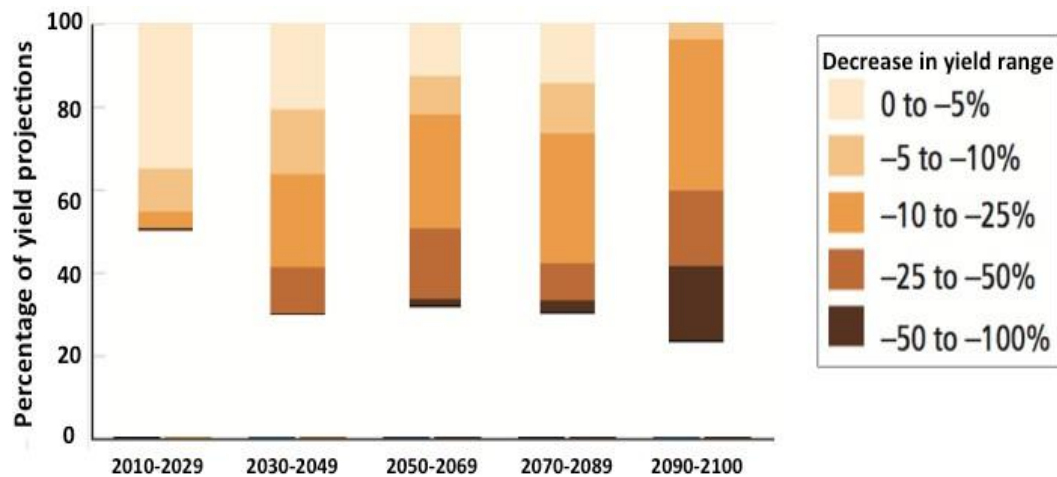
Figure 1: Decrease of Crop Yield under Global ClimateChange

II.   LITERATURE SURVEY

Agriculture plays a vital role in India's economy. 54.6% of thetotal workforce is engaged in agricultural and allied sector activities (Census 2011) and accounts for 17.1% of the country's Gross Value Added (GVA) for the year 2017-18 (at current prices). But there is continues decline in agriculture's contribution to Gross Value Added. Food is most essential element on the life which depends upon outputs of agriculture,so farmers plays an important role, Following Comparison is shown below:

The study in [1] used Kohonen's SOM (Self-Organizing Map)and Multilayer perception feed-forward neural network for analysis of crop. In the multilayer perception feed-forward neural network, the neurons of the first layer direct the output to the second layer, in a unidirectional manner so that the neurons are not received from the reverse order. Incorporatingthe three layers- input, output and hidden, the feed-forward neural network designates distinct roles for each. The output layer comprises a number of neurons equal to the used numberof quantities computed from the input and made accessible theperceptron responses. The hidden layer takes care of approximating non-linear problems. Input layer maintains equal number of neurons corresponding to that of the variablesin the problem. The input and output layer are only required forprocessing linear. The risk of overfitting occurs in feed-forwardneural network if we want to create the database of huge data based on deep learning strategies. The main drawback of the SOM is that it requires neuron weights be necessary and sufficient to cluster inputs. When a SOM is provided too little information or too much extraneous information in the weights,the groupings found in the map may not be entirely accurate orinformative.

The study in [2] used Random Forest Classifier for analysis ofcrop. Decision tree classifier uses greedy approach which mayreduce the value of important data. The result are accurate andaccuracy ranges from 0 to 100%. Class assignment was made by the number of votes from all the trees and for regression theaverage of result was used. Random forest Classifier is only applicable for the collection of decision tree. Due to the collection of decision tree, the complexity arises and they are much harder and time-consuming method. It's fairly good for training even small samples and can be easily parallelized in R/python/other software. However, it fails when there are rare predictors or outcomes, as algorithm is based on bootstrap sampling.

The study in [3] used Multiple Linear Regression (MLR) technique for analysis of crop. [5] Multiple linear regression (MLR), also known simply as multiple regression, is a statistical technique that uses several explanatory variables to predict the outcome of a response variable. The goal of multiplelinear regression (MLR) is to model the linear relationship between the explanatory (independent) variables and response (dependent) variable. ID3 algorithm and Classification is usedto analyze 362 dataset and gives the output. Training dataset was classified according as organic, inorganic and real estate for predicting soil's type. The output computed from this system were accurate and reliable.

In [4], 2 regression supervised machine learning methods are used: Relevance vector Machine (RVM) and Support Vector Machine (SVM) to show the effectiveness in predicting soil quality. Here a smart wireless device is used for sensing moisture of the soil and other soil's factor. The wireless deviceused didn't give the accurate reading which results error. However, the device is not tested with real time data. And, alsoagricultural system which deals with so many factors affectingthe crop yield needs a non-linear method to interpret the relationships between these factors and crop performances [5].Thus, regression is insufficient to show the interactions of the factors and crop yield.

III. PROPOSED SYSTEM

Crop prediction analysis is used for predicting the suitable cropby considering various parameter of the soil such as nitrogen, fertility, pH, Phosphate, Potassium, and some atmospheric parameter such as sunshine, rainfall and humidity. Above factors have direct impact on crop yield. Complexity arises as agriculture system deals with large amount of data that comes from number of factors. Lots of technique have been used for predicting the crop's yield using different algorithm. The proposed system aims to help the farmer to predict the crop's yield based on various factor such as temperature, rainfall, humidity, soil nutrients, etc. It can be achieved using ArtificialNeural Network algorithm which is based on the human brain'sbiological neural network The ANN is based on human brain'sneural process and used to solve complex problems. Artificial Neural Network Consist of three different layer such as Input Layer, Hidden Layer, Output Layer. Input layer is very beginning layer of neural networks that takes the input and serves that input to the subsequent layer of neural network. Input layer feeds the output to input of the hidden layer, and theoutput of which is connected to the output layer.
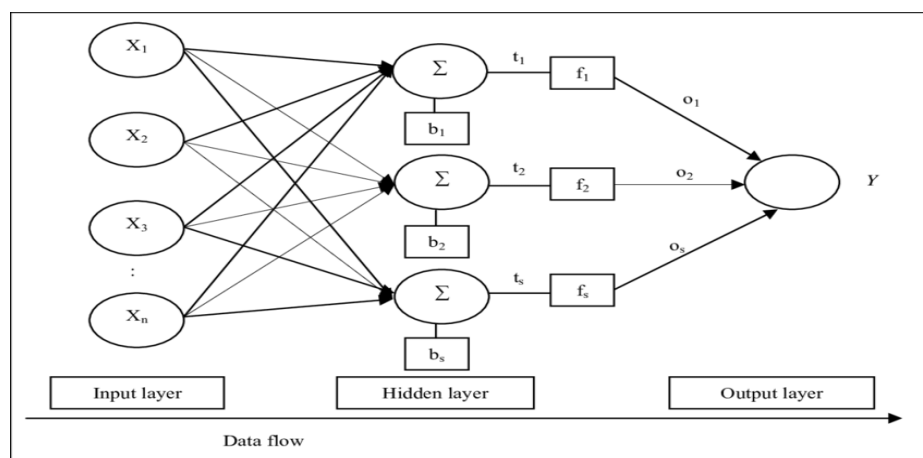

Figure 2: Layers and connection of a feed-forward backpropagation ANN

ANN has become most popular technique in predicting in caseof biological science. ANN model produces more accurate andprecise result in crop prediction technique because ANN require no explicit mathematical equation and assumptions. InANN most of the intense computation take place during training process. Since there are huge amount of factor which influence crop prediction, ANN technique uses the major factorwith influence the prediction directly or indirectly. Some of factors are:

- Environmental Factor
- Soil Factor

ANN in Environmental Factor

The Environmental Factor such as temperature, humidity, rainfall was the most important factor that control crop yields. Crops like barley, rice, maize, etc. is highly influenced by the environmental factor. Due to global climate change, every yearthere is decrease in crop's yield. Using ANN one can take the specific factor and feeds to the input layer based on the types of crops. For maize, rainfall is most important factor. So, we can consider the maximum rainfall, minimum rainfall andoptimal rainfall and feed that input to the ANN to show the relation between output and input factor.

ANN in Soil Factor

Based on the types of soil, one can grow the crops. Consideringthe soil factor (such as fertility, pests), we can predict with types of crop should be grown using the technique of back- propagation method. Based on the previous data of the soil, ANN technique can predict which crop should be grown in thatland.

In ANN, Backpropagation algorithm attempts to find the minimum of the error function in the weight space using methods based on gradient descent which sends their signal forward and error are propagated backwards.
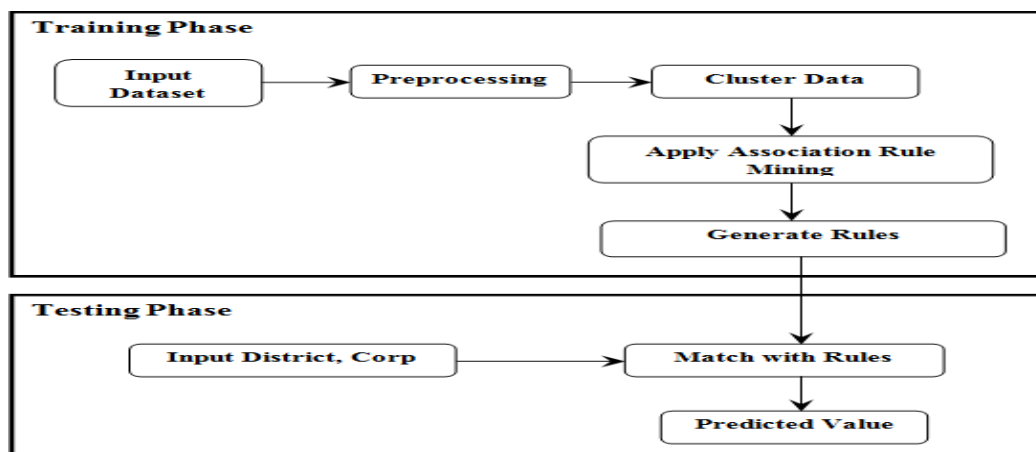

Figure 3: Workflow Model

Figure 3, show the workflow model which consist of two phases i.e. Training phase and Testing phase. In training phase,the input data is feed to the input layer and preprocessing is done using the hidden layer. Hidden layer takes the cluster of data and then it processes the data and feeds the output to the input of the output layer. Training phase comprises of Input layer, Hidden layer which Testing phase only contain output layer. Training data is always greater than testing data. All the major functionality is included in training phase (such as preprocessing of data, clustering). Preprocessing of data includes redundancy check, data filtering, outlier detected, correlation testing, feature extraction and so on. Clustering means group the data with similar characteristics. After the completion of the training phase, the data is feed to the testingphase. Training phase

mainly consist of classification and prediction of data. Classification classify the data based on the related algorithm and prediction is used to predict the value present in the data.
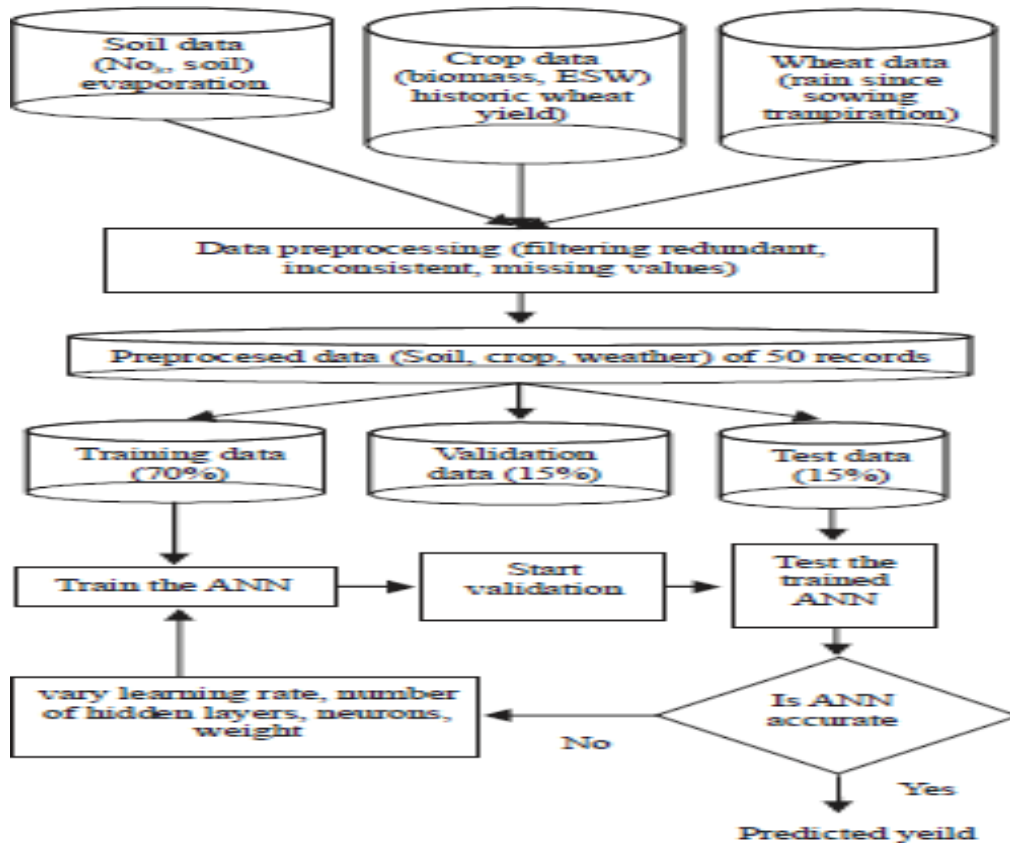
VI. SYSTEM ARCHITECTURE

Figure 4: System Architecture

Figure 4, shows the flow diagram of Artificial Neural Network for crop prediction. In ANN technique, Input layer is feed with three datasets i.e. soil data (such as soil fertility, soil evaporation, soil moisture), crop data (such as biomass, previous year crop yield) and the specific grain data (to be planted). After preprocessing the data, the input layer sends the preprocessed data to the hidden layer. After collection the dataset by input layer, ANN performs Exploratory Data Analysis (EDA) and filter redundant for inconsistent and missing values. Data preprocessing is the major step in building model. Redundant and missing value in dataset affects the learning rates of the model and that is the accuracy of the model.

After preprocessing of dataset, ANN divide the dataset into testing data and training data with 70 percent training data and 15 percent testing data and 15 percent validation data. After that the model is built with ANN and then the model was trained using training set. When training completes, Data should be classified and tested using testing set to test the learning rate/accuracy of the model. In between validation dataset will validate the predicted ANN is accurate or not.

If the result is accurate, we can predict the sample of crop to be yield and it will give us the list of the suitable crop to be grown

in the given condition. But, if the result is not accurate, we have to reshape the ANN model with varying learning

rate, numberof hidden layers, neurons, data, weight and the specific crop data. We will repeat the process until we can an accurate result.

IV. CONCLUSION

The proposed system takes into consideration the data related to environmental factor, soil factor, weather, fertility of soil andpast year production and suggests the best profitable crops thatcan be cultivated in the given environment condition. ANN technique lists out all the possible crops so that the farmer has option to choose the profitable one. The combination of artificial intelligence and the agriculture will help most of the farmers in near future. In comparison with other, Neural Network is best solution for agriculture problems (such as prediction of crop yields). The application of ANN plays and important role in prediction of the agriculture based on the certain important factors and it also plays a major role in futureevaluation of crop yields based on the present/past data.

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