A HYBRID APPROACH OF ARTIFICIAL NEURAL NETWORK TO ESTIMATE THE PADDY YIELD PREDICTION

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ABSTRACT: The impact of climate change in India, most of the agricultural crops are being badly affected in terms of their performance over a period of the last two decades. Predicting the crop yield in advance of its harvest would help the policy makers and farmers for taking appropriate measures for marketing and storage. This project will help the farmers to know the yield of their crop before cultivating onto the agricultural field and thus help them to make the appropriate decisions. It attempts to solve the issue by building a prototype of an interactive prediction system. Implementation of such a system with an easy-to-use web based graphic user interface and the machine learning algorithm will be carried out. The results of the prediction will be made available to the farmer. Thus, for such kind of data analytics in crop prediction, there are different techniques or algorithms, and with the help of those algorithms we can predict crop yield. Random forest algorithm is used. By analysing all these issues and problems like weather, temperature, humidity, rainfall, moisture, there is no proper solution and technologies to overcome the situation faced by us. In India, there are many ways to increase the economic growth in the field of agriculture. Data mining is also useful for predicting crop yield production. It provides a better accuracy than the existing model. It analyzes the given data and help the farmers in predicting a crop which in return help in gaining profits. The climatic and soil conditions of land are taken into consideration to predict a proper yield. The objective is to present a python based system that uses strategies smartly to anticipate the most productive reap in given conditions with less expenses. In this paper, SVM is executed as Machine Learning algorithm while LSTM and RNN are used as Deep Learning algorithms.

Keywords— Agriculture, Machine Learning, crop-prediction, Supervised Algorithms, Crop yield, Data Mining.

INTRODUCTION Agriculture is the backbone of the Indian economy. In India, agricultural yield primarily depends on weather conditions. Rice cultivation mainly depends on rainfall. Timely advice to predict the future crop productivity and an analysis is to be made in order to help the farmers to maximize the crop production of crops. Yield prediction is an important agricultural problem. In the past farmers used to predict their yield from previous year yield experiences. Thus, for this kind of data analytics in crop prediction, there are different techniques or algorithms, and with the help of those algorithms we can predict crop yield. Random forest algorithm is used. Using all these algorithms and with the help of inter-relation between them, there are growing range of applications and the role of Big data analytics techniques in agriculture. Since the creation of new innovative technologies and techniques the agriculture field is slowly degrading. Due to these, abundant invention people are concentrated on cultivating artificial products that are hybrid products where there leads to an unhealthy life. Nowadays, modern people don't have awareness about the cultivation of the crops at the right time and at the right place. Because of these cultivating techniques the seasonal climatic conditions are also being changed against the fundamental assets like soil, water and air which lead to insecurity of food. By analysing all these issues and problems like weather, temperature and several factors, there is no proper solution and technologies to overcome the situation faced by us. In India, there are several ways to increase the economic growth in the field of agriculture. There are multiple ways to increase and improve the crop yield and the quality of the crops. Data mining is also useful for predicting crop yield production. The main objectives are a. To use machine learning techniques to predict crop yield. b. To provide easy to use User Interface. c. To increase the accuracy of crop yield prediction. d. To analyse different climatic parameters (cloud cover, rainfall, temperature).

LITERATURE REVIEW:

In [1] Predicting yield of the crop using machine learning algorithm. International Journal of Engineering Science Research Technology. This paper focuses on predicting the yield of the crop based on the existing data by using Random Forest algorithm. Real data of Tamil Nadu were used for building the models and the models were tested with samples. Random Forest Algorithm can be used for accurate crop yield prediction. In [2] Random forests for global and regional crop yield prediction. PLoS ONE Journal. Our generated outputs show that RF is an effective and adaptable machine-learning method for crop yield predictions at regional and global scales for its high accuracy and precision, ease of use, and utility in data analysis. Random Forest is the most efficient strategy and it outperforms multiple linear regression (MLR). In [3]. Crop production Ensemble Machine Learning model for prediction. International Journal of Computer Science and Software Engineering (IJCSSE). In this paper, AdaNaive and AdaSVM are the proposed ensemble model used to project the crop production over a time period. Implementation done using AdaSVM and AdaNaive. AdaBoost increases efficiency of SVM and Naive Bayes algorithm. In [4]. Machine learning approach for forecasting crop yield based on parameters of climate. The paper provided in International Conference on Computer Communication and Informatics (ICCCI). In the current research a software tool named Crop Advisor has been developed as a user friendly web page for predicting the influence of climatic parameters on the crop yields.C4.5 algorithm is used to produce the most influencing climatic parameter on the crop yields of selected crops in selected districts of Madhya Pradesh. The paper is implemented using Decision Tree. In[5]. Prediction On Crop Cultivation. International Journal of Advanced Research in Computer Science and Electronics Engineering (IJARCSEE) Volume 5, Issue 10, October 2016. Presently, soil analysis and interpretation of soil test results is paper based. This in one way or another has contributed to poor interpretation of soil test results which has resulted into poor recommendation of crops, soil amendments and fertilizers to farmers thus leading to poor crop yields, micro-nutrient deficiencies in soil and excessive or less application of fertilizers. Formulae to Match Crops with Soil, Fertilizer Recommendation. In [6]. Analysis of Crop Yield Prediction by making Use Data Mining Methods. The paper provided in International Journal of Research in Engineering and Technology. In this paper the main aim is to create a user-friendly interface for farmers, which gives the analysis of rice production based on the available data. For maximizing the crop productivity various Data mining techniques were used to predict the crop yield. Such as K-Means algorithm to forecast the pollution factor in the atmosphere. In [7] From GPS based colour images is provided as an intensified indistinct cluster analysis for classifying plants, soil and residue regions of interest. The paper includes various parameters which can help the crop yield for better enhancement and ratio of the yield can be increased during cultivation. In [8] In this paper, we present a comprehensive review of research dedicated to the application of machine learning in agricultural production systems. Machine learning (ML) has emerged together with big data technologies, techniques, methods and high-performance computing to generate new opportunities to unravel, quantify, and analyse data intensive processes in agricultural operational sectors. By using Support Vector Machines (SVP) the Paper is Implemented. In [9]. A Study to Determine Yield for Crop Insurance using Precision Agriculture on an Aerial Platform. Symbiosis Institute of Geoinformatics Symbiosis International University 5th & 6th Floor, Artur Centre, Gokhale Cross Road, Model Colony, Pune – 411016. Precision agriculture (PA) is the application of geospatial methodologies and remote sensors to identify variations in the field and to deal with them using different strategies. The causes of variability of crop growth in an agricultural field might be due to crop stress, irrigation practices, incidence of pest and disease etc. The Paper is Implemented using Ensemble Learning (EL). In [10]. Random Forests for Global and Regional Crop Yield Predictions. institute on the Environment, University of Minnesota, St. Paul, MN 55108, United States of America. The generated outputs show that RF is an effective and different machine-learning method for crop yield predictions at regional and global scales for its high accuracy. The Paper is Implemented using k-nearest neighbour, Support Vector Regression (SVG).

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PROPOSED METHOD:

In the proposed framework, the machine learning and deep learning techniques are executed in order to predict the best crop production. An experiment is done on a crop dataset by the proposed model. The crop is chosen on the basis of the current atmosphere, the soil along with its constituents as the climatic and soil parameters are taken into consideration. Deep learning is used to achieve numerous successful calculations as it is used to get the best suitable crop in case a number of options available. By using this technique, crops are predicted accurately. The SVM algorithm is implemented under machine learning while LSTM and RNN are executed under deep learning technique as shown in figure 1.

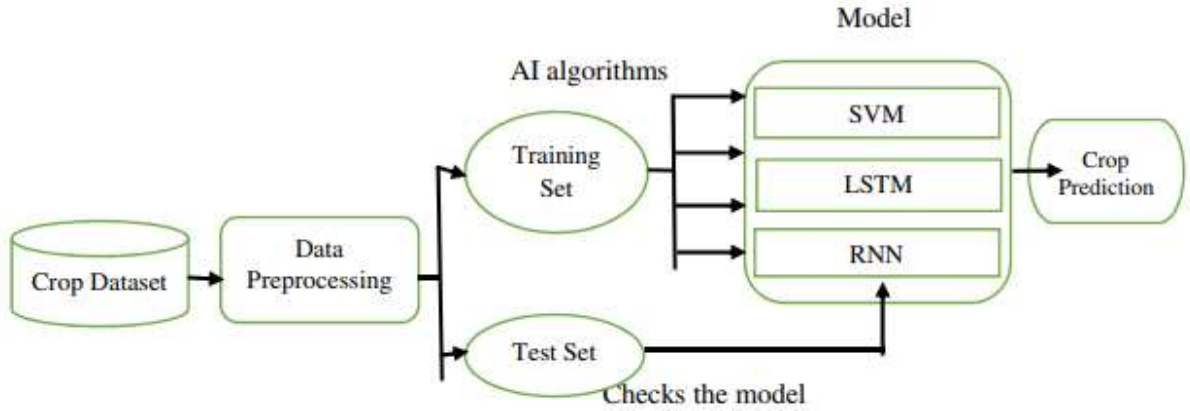

Figure 1. Architecture of proposed model used to predict crops

Steps of implementation

Step 1: Load the crop dataset containing a number of parameters.

Step 2: Load the useful libraries and packages.

Step 3: Data preprocessing is performed.

Step 4: To prepare dataset, the data is divided in training set and testing set.

Step 5: After this, a model is constructed by applying machine learning (SVM algorithm) and deep learning (LSTM, RNN) techniques which in turn predicts the best suitable crop that needs to be grown.

Step 6: The test set checks the performance of model. If any garbage value is given as input, the model throws an error, 'value mismatch or wrong prediction'.

A huge generic crop dataset containing agricultural parameters is taken to feed the model. Another dataset is taken as feature dataset. The datasets are collected from a website, named, kaggle.com. The size of the crop dataset is 7841 kb. The prediction parameters in this dataset includes temperature, rainfall, pH value, relative humidity, and area. There are a number of crops taken in this dataset like, wheat, rice, maize, millet, pea, pigeon pea, sugarcane, green gram, etc. A number of values are available for each and every prediction parameter for single crop. For instance, when taking crop as wheat, any value can be given to the prediction parameters among a set of values available in the dataset, for wheat. It is same for the entire crops available in the dataset.

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Crop	pH	Temperature	Rainfall	Relative H	Value
Wheat	5.5	13	49	40	0
Wheat	5.5	13	49	41	0
Wheat	5.5	13	49	42	0
Wheat	5.5	13	49	43	0
Wheat	5.5	13	49	44	0
Wheat	5.5	13	49	45	0
Wheat	5.5	13	49	46	0
Wheat	5.5	13	49	47	0
Wheat	5.5	13	49	48	0
Wheat	5.5	13	49	49	0
Wheat	5.5	13	51	40	0
Wheat	5.5	13	51	41	0
Wheat	5.5	13	51	42	0
Wheat	5.5	13	51	43	0
Wheat	5.5	13	51	44	0
Wheat	5.5	13	51	45	0
Wheat	5.5	13	51	46	0
Wheat	5.5	13	51	47	0
Wheat	5.5	13	51	48	0
Wheat	5.5	13	51	49	0
Wheat	5.5	13	53	40	0
Wheat	5.5	13	53	41	0
Wheat	5.5	13	53	42	0
Wheat	5.5	13	53	43	0

Figure 2. Crop Dataset. In figure 2, a small part of the crop dataset is displayed. In this, crop is wheat, the pH value of soil is 5.5, the temperature contains a value of 13, the rainfall and relative humidity contain a number of values according to the weather conditions on different days, and a target value is assigned to every crop to label it.

3.3. Algorithms Used

3.3.1. Support Vector Machine (SVM)

Step 1: Import the required packages. Step 2: Load input data. Step 3: Choose the required number of features from the dataset. Step 4: Plot SVM boundaries with the help of original data. Step 5: Define a value for the regularization parameter. Step 6: Finally, the object of SVM classifier is generated.

3.3.2. Long-Short Term Memory (LSTM) Step 1: Define a neural network in Keras in the form of sequence of layers. Step 2: Compile the network that requires various specified parameters. Step 3: Fit the network that requires the specified training data, both an input patterns matrix X and a matching output patterns array y. Step 4: Evaluate the network on the training data. Evaluation of the model on a test or validation set is done rarely. Step 5: Make required predictions which can be achieved in a format given by the network's output layer.

3.3.3. Recurrent Neural Network (RNN) Step 1: The network is provided with single time step of input. Step 2: With the help of the previous state and the current input, compute the current state. Step 3: The current state ht turns out to be ht-1 for the next time step. Step 4: any number of time steps can be made depending on the problem. The information is joined from the entire previous states. Step 5: After the completion of the entire time steps, the final current state is utilized which computes the output. Step 6: In order for updation in the weights, the error is back-propagated towards the network. Hence, RNN is trained.

Conclusion and Future Scope:

The proposed model is constructed by using AI algorithms to reduce the farmers' problems of getting losses in their farms due to lack of knowledge of cultivation in different soil and weather conditions. The model is created by using machine learning (SVM) and deep learning (LSTM, RNN) techniques. The model predicts best crops that should be grown on land with less expenses among a number of crops available after analyzing the prediction parameters. To the best of studies, there is no such work in existence that uses the same techniques in predicting the crops. Hence, it is concluded that there is an enhancement in the accuracy of this research work when compared to the existing work that used another techniques for prediction of crops. The accuracy is calculated as 97%. It has a vast extension in future and can be actualized and interfaced with a flexible and multi-skilled application. The farmers need to be educated and hence, will get a clear information regarding best crop yield on their mobiles. With this, even if the rancher is at home, the work can be managed at that particular instant of time, without facing any kind of loss ahead. The progress in the agribusiness field will be extremely appreciable which will further result in helping the farmers in production of crops.

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