

Enhanced Approach for Disease Prediction in Sugarcane Crop with the support of advanced machine learning strategies

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Abstract

The paper gives method for crop yield prediction for sugarcane crop, this shows high, low, medium range for yield on the basis of rainfall. It also shows the disease concerned with that locality which will help the farmer to take preventive measures and this will improve the yield quality. The Support Vector Machine algorithms plays important role to predict the yield for sugarcane which gives more accuracy based on rainfall (98.21%). In future there is more scope to work on many different datasets and predict sugarcane yield with plot information in different linguistics and waste management of sugarcane can also be studied. Here we are using different Machine Learning algorithms with their accuracy. Here we are using Support Vector Machine (SVM) which gives better result than other algorithms. This helps the mill and farmer to analyze the profit on basis of yield. This paper focuses on Maharashtra state only. Also predict disease according to place and rainfall and give particular solution to disease.

Keywords: Crop disease, Crop yield, Machine learning, Prediction, SVM

1 Introduction:

Agriculture is being a part of economy. In India, due to increasing population there is rise in demand of food grain in country from olden days. The main and foremost culture practiced in India is agriculture. Many people cultivate on land and satisfy their basic needs. And this is been used by human beings, animals, birds. These goods are part of health and welfare lifestyle. There is always a scope for new technologies and inventions in this field.

But now-a-days the agriculture practices are being degraded due to hybrid cultivation. Due to human involving and looking only to the profit side they are not planting the crops in proper climate or season. So not considering the entire essential factor like soil, water, air which leads to shortage of food so by using new technologies we can give solution to all too all those problem.

In this paper the problem of crop yield prediction is been focused. Here restricted only to sugarcane. The solution proposed is by using a branch of Artificial Intelligence that is Machine learning. A Machine Learning is where the problems are solved relating the input variables to output variables depending on historical data. Here machine learns for structure of data. This is different from the traditional method which introduces human errors. In Machine learning there is no direct assumption it is completely based on historical data.

So ML techniques is been used for crop yield prediction. In this paper we have used supervised machine learning algorithm for crop yield prediction for sugarcane crop. In this, Support Vector Machine (SVM)

algorithm is used for prediction. Which give more accuracy than Naïve Bayes (NB). This solves the problem of many farmers and mills. It also helps us to overcome bad situation like drought and rainfall.

Discussing about crop yield, it a major concern always. But there are some factors that may degrade the quality of sugarcane and reduce the production and yield both. Sustainability in production should be done during management. So detecting the sugarcane disease is essential task on basis of rainfall and climatic condition. Detecting with manual observation is a continuous process but this is not useful for farms which are big and its risk to visit those farms inside. So here we are ML technology to detect plant disease, SVM and Random Forest (RF) give more accurate results where they are depending and using Rainfall as attribute. All the major disease is been included in this with their information.

2 Motivation

Agriculture is been center of attraction to achieve more profit economically. So yield, production, new varieties using hybridization plays important role in agriculture. Population is factor which boost agriculture to fulfill the necessity. But all these things depend on factors which includes soil type, irrigation, climatic features and type of crop to grow. So yield prediction is important with considering all aspects. In agriculture field, to satisfy farmers, the profit and as well as production prediction is important. Certain factors are also responsible like disease related to particular crop which can deduce the productivity. So in this paper we have put solution to problems which can solve problems related to yield prediction.

3 Related Work

The section gives a detailed literature survey. In this we have referred various papers related to crop yield prediction and crop disease. Many of the paper relates to our work. [1][4]In these papers Random forest is more focused which concluded with more accuracy than other algorithm.[5]In this paper KNN algorithm is been modified and compared to existing algorithm which concluded that it experimented well. [8] In this paper, Crop yield for biter crop is done using neural network. Using this crop yield prediction can be improved. [7][12]These papers mainly includes SVM algorithm for crop yield prediction which more accuracy than other algorithms. All these above papers are studied and SVM is been selected for the work. The table below describes the detailed literature survey on crop yield and crop disease. Papers [1] to [7] includes crop yield prediction and papers [8] to [13] includes papers related to crop disease.

TABLE- III. a

Sr no	Proposed model	Merits	Demerits	Future work
[1]	Crop yield prediction using random forest algorithm	It uses minimum models with high accuracy	Crop yield is for only restricted to certain crops	Using more algorithms more accuracy can be obtain
[2]	Sugarcane yield prediction basis on plot information	Many parameters selected so achieved more accuracy	To increase more accuracy more feature extraction can be done.	Data set can be improves and increased
[3]	Model predicts the crop yield using KNN and K-means	Out of KNN and K-means, The accurate results	Data set is to be improved	Accuracy in algorithm can be done

	algorithm	are given by KNN algorithm		
[4]	By using SVM algorithm crop yield prediction is done which uses SMO classifier	Crop yield gives accurate result for rice crop	SMO classifier gives less accuracy than multilayer perceptron	Naive Bayes algorithm can be implemented to increase the accuracy
[5]	Model uses SVM algorithm to predict crop yield for sugarcane	Out of many different algorithm SVM perform 83 % accurate than others	The region is restricted to Karnataka and crop is sugarcane to be considered	Ensemble techniques can be used
[6]	Model uses certain biotic factor to predict the crop yield	Accuracy is achieved by using different algorithm	No appropriate algorithm is been used. Restricted to groundnut only	Enhancement in algorithm can improve the results
[7]	By using sensors crop yield prediction is been done	Many algorithms are been used, where GPR performs better than SVM.	Images and data set are restricted	More parameters can be included during model framework
[8]	By using deep learning to predict and classify leaf is healthy or diseased.	Accuracy is increased using CNN	High accuracy is only considered	Optimizers and learning rates can be used for increasing performance.
[9]	Statistical analysis is been done among DCM and RFM for disease prediction	RFM is more accurate	No accurate results are mentioned	Completely RFM can be used
[10]	Web based service model for recognizing pomegranate leaf disease using SVM and KNN	Prevention major and identification is done by using SVM with high accuracy	More classification can be applied	Various leaf and associated disease can be included
[11]	Detection and then classification of disease by using RGB performance.	DWT algorithm is used to improve the performance	Threshold value is considered. Only restricted to 4 disease	More automated techniques can be used
[12]	Mobile application for recommendation of best crop and disease diagnosis	Images are used for detection using SIFT	No exact model is implemented	Linguistic model can be implemented.
[13]	Analysis of different data	SVM and RF combination	No accurate model is	Results can be implemented by

	mining algorithm. Neural Network and RF perform better	gives better result	represented	hybrid results algorithms.
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4 Methodology

In this section, we have introduced machine learning approach to predict sugarcane yield. Giving an overview of model, prediction is based on input of historical data with necessary set of variables like rainfall, soil. And output generated is yield in the form of three ranges. Here methodology includes rainfall prediction, Yield prediction and disease prediction. Rainfall attribute is dependent for both crop yield and disease prediction. Here we are using Support Vector Machine for prediction of rainfall and depend on that yield is been predicted. Before going further we have used two algorithms, Support Vector Machine (Accuracy-98.21%) and Naïve Bayes (Accuracy-94.64%) out of which SVM gives more accurate results. Methodology is split into three parts. First, include proposed model, proposed flow, implementation /Results. Each part specifies detailed information of model.

A. Proposed model

a. Algorithms

The section gives idea about algorithm and proposed idea for crop disease prediction by using rainfall as a factor to that particular area. Here we are using machine learning algorithm for crop disease and rainfall prediction. Previous paper shows idea to predict the rainfall according to place and results are also represented [12]. The output expected is to predict crop yield on basis of crop disease prediction and rainfall prediction. In this paper we have introduced the crop disease prediction methodology with result.

1. Random forest algorithm

Random forest is one of powerful supervised machine learning algorithm which tends to perform both regression and classification. This is used to construct the decision tress during the training set and gives the output in the form of class which is used for classification or for regression which is used for mean prediction. It also used to overfit in the training sets. Advantage of Random Forest algorithms is that is requires less over fitting and no need of pruning [1]

2. K- nearest neighbor

It is the algorithm which is based on proximity. By selecting nearest point, KNN classifier predicts the class. They do not require training. Every point it computes the nearby distance from all data points and selects the nearest point. KNN uses hyper parameter 'K' which is selected using different values of K [12]. The K value is selected according to its minimum error and high accuracy.

3. Naïve Bayes

It is classifier which works in probabilistic manner to predict the points using prior knowledge which is calculated from training dataset. During learning the class and variables learns the probabilistic relation which is used to predict the class labels. In this variables are treated independent. We can also keep the variables default and get the output.

4. Support vector machine

SVM is used to predict the crop yield in this proposed model. SVM uses a hyper plane or hyper plane sets in dimensional space which used regression or classification. Depending on model for learning linear function. In other situation for nonlinear, it uses kernel method to draw the data point into a dimensional space using features where it uses linear function. SVM, main advantage is about its simplicity where it uses only less features to fit in the model. This SVM is mostly applied in application like time series, weather prediction and agriculture field for prediction .In our case we have used SVM for rainfall prediction and crop yield prediction. SVM easily fit in the model and always capable to map the functions to the hyper plane [16]. The problem with SVM is to determine the hyper parameters, kernel functions and coefficient used.

b. Proposed flow

In this section, the model for prediction the crop yield with rainfall and prediction of sugarcane crop disease is been proposed. It consists of different modules. The proposed model is web based which has certain flow to get the results. Every model uses machine learning algorithms to predict the results. Accuracy of every algorithm is been discuses in further section. Figure shows system architecture and its flow.

- Model consist of various modules
 1. Rainfall Prediction
 2. Crop yield Prediction
 3. Disease prediction
- Flow of model
 - a. Login of new user
 - b. Filling of required information
 - c. Rainfall prediction.
 - d. Result with rainfall and disease prediction
 - e. Crop yield prediction

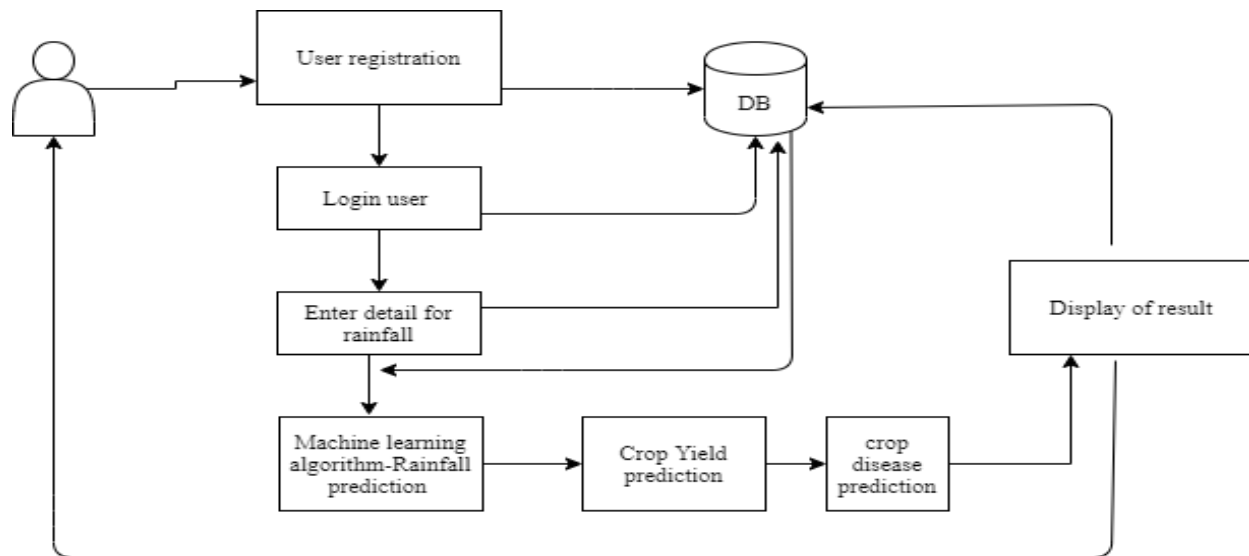


Fig. IV.B. a

c. Implementation

In this paper, we have presented machine learning methodology to predict sugarcane yield. In this as input we have taken data set for rainfall for particularly for Maharashtra where sugarcane is grown on large scale. The predictive model is been developed for Rainfall in which SVM algorithm is been used , on basis of that yield is been predicted.

Note that, before moving forward we have investigated by studying and implementing two algorithms which include Naive Bayes and Support Vector Machine. The analysis is been discuss in next section below.

Work includes:

Step 1: Home login

This section gives user to login with the detail of user and then the OTP is been generated to the mail id provided. This completes the login procedure.

Step2: Rainfall prediction

Rainfall prediction module includes predicting rainfall on the basis of input. User need to select the amount of rainfall for the year and basis on that the module calculates the rainfall prediction using SVM and Naïve Bayes out of both SVM gives higher accuracy algorithms. Dataset considered from previous few years for prediction of rainfall for next year. Selecting district, city and soil type we are getting result.

Crop Disease Prediction

HOME

To Select Below Field For Prediction

Please Enter Correct Details, give

State: Maharashtra, District: Amravati, City: Methal

Jan-Feb: 250-300, March-Apr: 400-450, May-Jun: 400-450, July-Aug: 400-450, Sep-Oct: 200-400, Nov-Dec: 400-450

Submit

Fig. IV. C. a

Crop Disease Prediction

HOME

GROWER SOLUTIONS

State: Maharashtra, District: Methal, City: Amravati, Prediction Result: Low_Rain

SUBMIT

Fig. IV.C. b

Step 3: Yield prediction

Using SVM, dependent attribute is rainfall. On basis of that yield is been categorize in three way High, Low, Medium range. Average value is also been calculated. This gives prediction for the yield for next year. Only Maharashtra state is been considered



Fig. IV. C. c

Step 4: Crop disease prediction

In this module crop disease prediction is done on basis of rainfall. Here Maharashtra state is been considered according to that all the disease are been included. SVM and KNN performs better for prediction. According to disease information related to disease is also provided so that preventive measures can be taken.

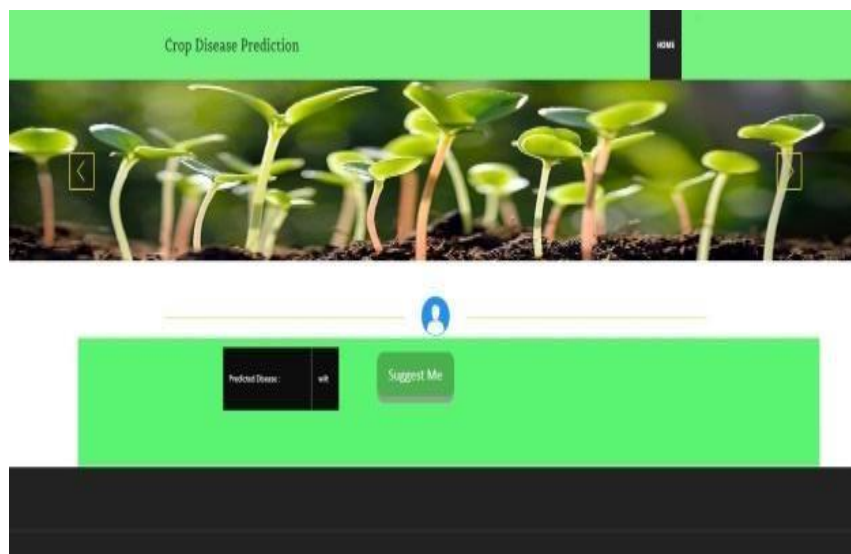


Fig. IV.C. d

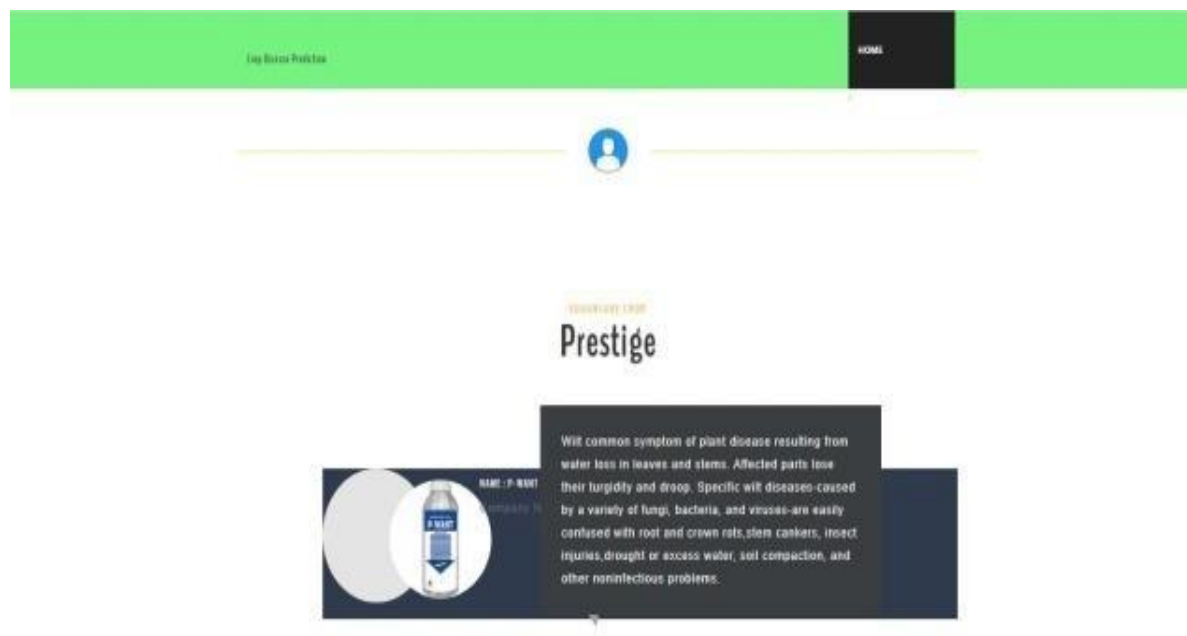


Fig. IV.C. e

5 Analysis Of Results

In this, we have analyzed different algorithms to get the accuracy of different algorithms and select best out of it. The data set consider is only restricted to Maharashtra for rainfall and crop disease. The test data and training dataset is consider is 70% and 30%. Here for Rainfall we have used SVM and Naïve Bayes. The SVM gives accuracy of 98.21% and Naïve Bayes gives accuracy of 94.64%. A For Crop disease prediction we have verified four algorithms Naïve Bayes (Accuracy=61.21%), KNN (Accuracy=83.64%) , SVM(Accuracy=83.64) and RF (82.42%) .

6 Conclusion

Indian economic growth is completely based on agriculture. It shares major percentage in economy. In field of agriculture main threats are climatic changes and temperature. Secondary threats like soil type, nutrients, type of crop. All this plays an important role. One of the essential ways to solve the problem is using branch of Artificial Intelligence (AI) that is Machine Learning (ML). By using machine learning algorithm one can identify the crop yield prediction. In this paper we have proposed solution for crop yield prediction which uses rainfall attributes. Model is web-based which uses previous data for prediction. In this we have focused on sugarcane crop and disease related to sugarcane for obtaining results.

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