e-Krishi - A one stop portal for Farmers

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Abstract: Agriculture being the most important occupation of our country, making it easy for functioning in terms of marketing agricultural goods and letting farmers understand what crops are best suited based on soil nutrients, geographical and weather conditions has become very important. To sell the crops, an online mandi(market) would be very beneficial to the farmer. The use of various techniques like ML algorithms and deep learning are recognised as they are capable of dealing with complex data handling problems and accuracy. These techniques are mostly used for various pattern recognition and several classification problems. The main objective of this project is to help farmers understand what plants are best suited depending on various factors and also what additives can be put into soil for growth of a particular crop of their interest.

Keywords: agriculture, crop recommendation, e-commerce, farming, krishi, machine learning, random forest classification

1. INTRODUCTION

e-Krishi is a website made especially for farmer's profit in every possible way. The website serves multiple purposes such as crop recommendation and an e-commerce platform. Crop prediction for farmers gives them a helping hand in deciding the crop best suitable for them at a given time based on N, P, K (Nitrogen, Phosphorous, Potassium) values, temperature, humidity, and rainfall in a certain geographic location. The values such as temperature, humidity and rainfall are fetched by an API to which we have to input the name of the city.

2. LITERATURE SURVEY

The following papers were studied which were relevant to agriculture and inference drawn from each is mentioned below.

The suggestion of the best crop has been provided to the farmers which depends on various factors like district and weather. The model helps in predicting the rate of success for the crops according to input that has been provided .The model then analyzes and provides farmers with the suggestion of best crop with respect to the highest success rate. A non-linear technique is also being used to understand the relation to learn about connections between different parameters which are in any way affecting the crop yield..By adding more layers the accuracy of the prediction could be improved[1].

Simple, one step process for a farmer to sell the crops, price prediction option helps the farmer in prediction for a commodity based on market history. For those who are disabled with respect to sight, voice translations cannot be provided for each product entry which takes the input and gives output for the user. This process is complicated and not user-friendly[2].

Developing Agriculture Market Information System(AMIS) using ICT and low cost IOT devices which is suitable for low scale and rural farmers where there are electricity problems. Availability and Affordability of Sensors and several IOT devices is a major drawback in this system[3].

Combining investigation data and remote sensing image data, we verify the feasibility of the algorithm and realize the rapid classification of typical plant communities of high resolution remote sensing images, extending the application range of the projection pursuit algorithm. Complex Mathematical equations and not easy to understand algorithms were encountered, which is a drawback of this system[4].

A multilayer convolutional neural network(CNN) was used for diseased plant images classification. The proposed model achieved higher classification accuracy when compared with other models. The described model can also be integrated and further be used for detection of various diseases based on plant leaves[5].

This paper proposes a new method based on projection pursuit learning algorithm, which optimizes the projection pursuit algorithm, accelerates the selection of projection index, realizes the global optimization of projection, improves Community classification accuracy and makes better extraction effect in details. Through the combination of investigation data and remote sensing image data, we verify the feasibility of the algorithm and realize the rapid classification of the typical plant community of high resolution remote sensing images, extending the application range of the projection pursuit algorithm. The method has been applied to the special investigation project of the basic ecological control line in Shenzhen and served for ecological protection and urban planning, and the classification of typical plant communities of plantations and natural forests in Shenzhen has been realized[6].

3. SYSTEM ARCHITECTURE

The proposed system focuses on the availability of access and features available to different users and also focuses on classifiers used for prediction. The overall system structure can be depicted as follows:-

A) Block Diagram

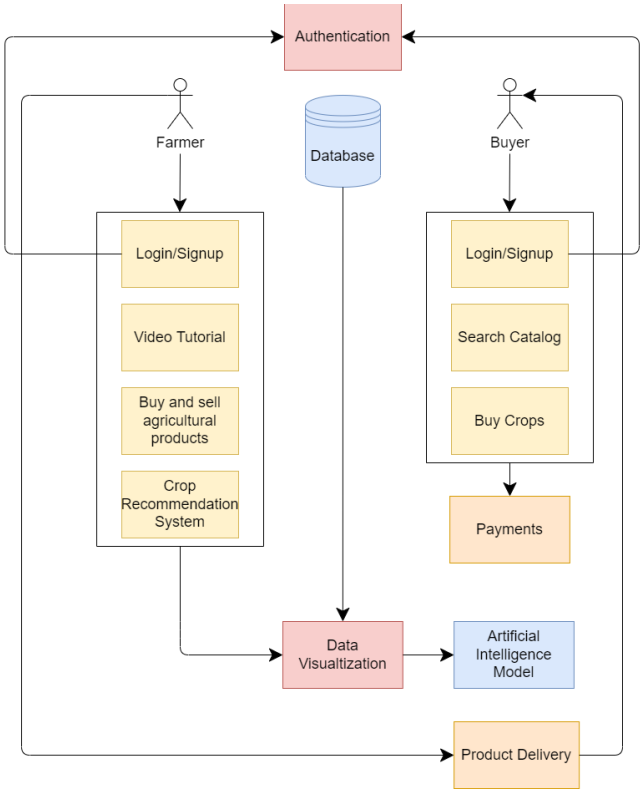

Figure 1: Block diagram

As seen in the diagram - figure 1, the design of website is such that it has 2 sides i.e. Farmer side and Customer side. On the farmer portal, farmers can get various information related to crops and agricultural techniques. The system generates recommendations and predicts which crop is best suitable for the prevailing soil and weather conditions. The farmer can even look out for the current value of their crops and can accordingly decide the selling price. To access an individual farmer's information related to their farm and crops, the farmer can login to our portal. On the Customer side, the customer can search and view products. To buy any product from the mandi, he/she needs to register and sign up. After buying the product payment is made and the customer can track his/her order and can even rate the products they have brought.

B) Modular Diagram

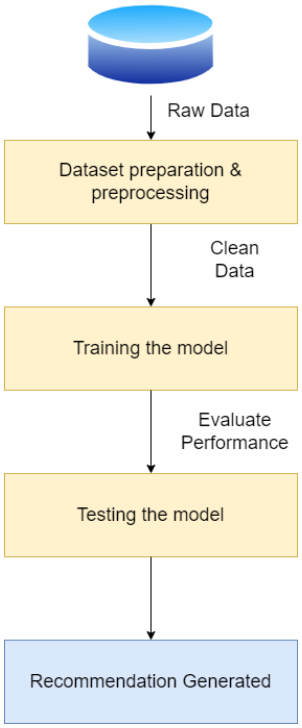

Figure 2: Modular Diagram

The raw data was collected from Kaggle. Once the dataset was available, data preprocessing and cleaning has been performed so as to avoid null values and remove duplicate data. The dataset was then split in the ratio of 3:1 for training and testing sets.
After a thorough study of various relevant algorithms, the model has been trained over the cleaned dataset and further tested. The accuracy scores are compared for all the implemented algorithms and the best one (Random forest classifier) has been chosen for the crop recommendation module.

1) Data Preprocessing:

The output of our model is a crop recommendation based on variable factors which are provided as input by the farmers. Before feeding the data into the Machine Learning Algorithm, all the redundant data such as null values or irrelevant data should be removed.This is known as preprocessing of data which can be done with the help of label encoding. For handling categorical variables one can use Label Encoding which is a popular encoding technique. In supervised learning, preprocessing is one of the most important steps for a structured dataset. With the help of preprocessing a unique integer is assigned to each variable. The assigned integer is based on the alphabetical ordering of the labels.

2) Classification Algorithms used:

1. Random Forest Classifier:
   Random Forest Classifier is a group of decision trees, trained with the bootstrap aggregation method. The bootstrap aggregation method is also known as bagging method. This method uses a combination of various learning models. With the help of the bagging method it is ensured that the overall result is increased.

2. Decision Tree Classifier:
   One of the algorithms in supervised learning is the decision tree algorithm. Unlike other similar algorithms, the decision tree algorithm can also be utilized for classification or regression problems. The main aim to use decision trees is for developing a training model which is used for the

prediction of value of the target variable. While using Decision Trees, we begin from the root of the tree to predict a class label for a specific record. In the Decision Tree classifier, a comparison is done between the root attribute and record's attribute values. The branch that is closer to root attribute value is chosen and followed.

3. Support Vector Machine:
The Support Vector Machine, or SVM, is a type of Supervised Learning technique that can help us to solve multiple classification issues along with that problems with respect to regression. The main purpose of using SVM is for classification in machine learning. The SVM algorithm's purpose is to find the difference and create a decision for categorizing variable spaces into classes so that additional spaces can be utilized by data points if it requires more space in future. Optimal choice boundary which is also referred to as hyperplane. The points on hyperplanes are decided by SVM which are generally assisted by extreme vectors.

4. Logistic Regression:
In this method a set of independent variables is used to predict a categorical dependent variable. Categorical dependent variable's output is hence predicted. Therefore the result must be a discrete or categorical value. It can be 0 or 1, Yes or No, true or false, and so on. It delivers probabilistic values that are somewhere between 0 and 1 instead of giving values like 0 and 1. Logistic Regression is very similar to Linear Regression. Regression problems are solved using Linear Regression.

5. Naive Bayes Classifier:
In Naive Bayes classification the algorithms are highly expandable, they need a huge number of parameters that are linear in the number of variables that includes features and predictions in the learning of a machine learning problem. Accordingly, the training is done by the evaluation of a finite number of standard operations which take linear time, opposed to using iterative approximation. This method is also used in many other types of classifiers.

4. IMPLEMENTATION DETAILS

Precision agriculture is in trend nowadays. It helps the farmers to get informed decisions about the farming strategy. Here, we present to you a dataset which would allow the users to build a model for recommendation of the most suitable crops to grow in a particular area while considering various aspects. The dataset was split into training and testing datasets.

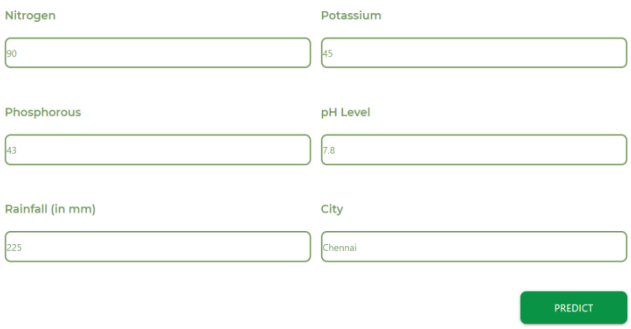

Figure 3: Input for Crop Recommendation

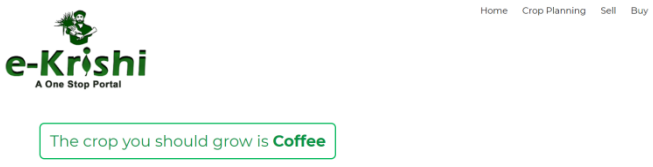

Figure 4: Output

sPreprocessing was done on the dataset and the cleaned data was then trained. The accuracy score of the training dataset was further improved and we achieved a 98.77% accuracy score with the help of Random Forest Classification Algorithm. Figure 4 represents the text fields where the farmer provides input values. These values are fed to the machine learning algorithm and the output - Crop Recommendation is displayed as shown in Figure 5.

5. RESULT AND DISCUSSION

Various algorithms of machine learning such as Random Forest Classifier, Decision Tree Algorithm, Support Vector Machine, Guassian Naive Bayes Classifier and Logistic Regression were implemented on our dataset and accuracy obtained by these algorithms is as follows.

Table 1 Performance Analysis of algorithms

Algorithms Used	Accuracy [%]
Random Forest Classifier	98.77
Decision Tree Classifier	97.05
Logistic Regression	96.6
Simple Vector Machine Classifier	95.02
Gausian Naive Bayes Classifier	94.54

6. CONCLUSION

Our aim for this project is to overcome and tackle the problem of the crop recommendation system. The user interface(UI) will be easy to navigate and would also comprise of translation as well as some tutorial videos for better understanding. The portal will be online so that the farmers won't require anything except a device and internet.
"Thus, our proposed system, e-Krishi will literally act as a one-stop portal that will satisfy all the needs and requirements of farmers and will thus help them in their business."

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