Crop Prediction System, Crop Disease Identification and Its Solution Using Machine Learning

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Abstract: - India is agricultural land and farming is that the major source of economy. 70% of the Indian population directly relies on agriculture. The common problem existing among the Indian farmers is to settle on the proper crop supported by the soil and atmospheric requirements. thanks to this, they face a significant setback in productivity. Our work proposes to assist farmers to determine the soil quality by analyzing its various parameters and suggesting crops supported by the results obtained using a machine learning approach. The system uses the Classification algorithm of K nearest neighbor to enhance the efficiency of the Crop Recommendation System. The system maps the soil and crop data to predict the list of suitable crops for the soil and it also provides knowledge about nutrients that are deficient in soil for the actual crop. Hence it leaves upon the user to make a decision on the crop to be sown. Thus, the system helps to supply knowledge to the dilettante farmers.


I. INTRODUCTION

India is one of the oldest countries which remains practicing agriculture. But in recent times the trends in agriculture have drastically evolved thanks to globalization. Various factors have affected the health of agriculture in India. As a neighbourhood of evolution, we've come up with Crop Recommendation System to assist farmers to recommend appropriate crop supported the soil and atmospheric conditions.

In agriculture, the farmer must choose the appropriate crop to urge good yield which can generate good revenue. Predictions made using the Crop Recommendation System are accurate and precise because just in case of errors it's going to cause heavy material and financial loss. Among these various techniques that are getting used during this field, this paper proposes a system that uses machine learning algorithms to recommend the acceptable crop concerning the input parameters. Also, our project focuses on crop disease prediction, where the system is in a position to detect the disease present on the crop by analyzing the crop leaf. The condition also plays a key role in disease. Soil quality, temperature, wind, nutrition, sunlight influence plant growth. The spreading of disease is additionally influenced by environmental factors. By using image processing techniques and analyzing it with the predefined dataset, the system is in a position to work outcrops disease accurately.

II. RELATED WORK

In Paper [1], Low-cost IoT+ML design for smart farming with multiple application paper authors Fahad Kamraan Syed, Agniswar Paul, Ajay Kumar, Jaideep Cherukuri in paper [1] proposed system for water management systems and improve current irrigation methods. An IoT and ML-based farming system always keeps farmers aware of the upcoming weather possibilities and gives them the best suggestions about irrigation methods and crops thereby helping in better yield. The system provides Crop suggestion using
parameter-type of soil and the weather condition of the current season. It also provides Smart irrigation - checks for the chances of rainfall in next 24 hours using the smart weather detection system and if there is more than 70% then our system sends an alert message to the user and does not irritate the field. It also provides Smart weather using real-time data from the nearest weather station from our location. Depending on the next 24 hours precipitation probability an SMS will be sent to the user and the device will analyse about irrigation

In Paper [2] authors proposed Crop Disease Detection Using Deep Learning. In this analysis, they used some of the common data mining techniques in the field of agriculture. Using this technique, they are identifying the type of crop. It performs the different steps like 1. Collecting the dataset 2. Pre-processing the dataset 3. Training the Convolutional Neural Network (CNN) 4. CNN model to identify the type of crop 5. Training CNN model 6. Validation of model through obtained results

In Paper [3] authors proposed Crop Disease Detection Using Deep Learning. In this analysis, they used the techniques like Neural Network, SVM, CNN in the field of agriculture. Using this technique, they developed the Recommendation System based on Rules for which crop should be yield. To develop a system, they perform the different steps like 1. Dataset Collection 2. Feature Extraction using training data 3. Prepare Ensemble model using CHAID, Random Tree, K-Nearest Neighbor, Naïve Bayes 4. Recommendation System based on Rules 5. Crop to be yield.

In Paper [4] authors proposed Intelligent Decision Support System for Smart Agriculture. In this analysis, they used the various components like Temperature, Soil Moisture, Humidity, soil PH. They developed the System which is smart enough to start and stop irrigation automatically considering human expert opinion learning. They develop System which is smart enough to start and stop irrigation automatically considering human expert opinion learning.

In Paper [5] authors proposed Review of image processing approaches for detecting plant diseases. In this analysis, they used the various techniques like CNN, Fuzzy-Logic. They developed the System Using the extracted features and techniques for identification of the area of interest, region of interest. The system extracted the features and techniques for identification of the area of interest, region of interest.

In Paper [6] authors proposed Crop hand-an android based crop and fertilizer advisor. In this analysis, they used the various techniques like Random Forest Algorithm, Clustering application, Association Rule Mining, Apriori Algorithm. They observed the Crop Recommendation using soil type, the system provides for Users can open their accounts to view recommended crops and fertilizers and also purchase them. Crop Recommendation using soil type. The system provide for Users can open their accounts to view recommended crops and fertilizers and also purchase them.

### III. CROP PREDICTION SYSTEM

**DataSet:** -The data used in existing system is made up of by combining the parameters like Nitrogen, Phosphorous, Potassium and pH values of the soil. It also contains the temperature, humidity and rainfall required for a particular crop. This data is predefined data and using those data system will recommend the crop but it work on only predefined data value. Now, Current System takes the real time data contains temperature, humidity, pH and moisture of soil using DTH11 sensor and soil moisture sensor. After taking those data values then store it on firebase. System will work on real time data values so that it will beneficial to farmers to choose correct crop.

**Proposed System Of Crop Prediction System:**

![Proposed System Of Crop Prediction System](image)

Above architecture depicts crop recommendation system using machine learning algorithms. This proposed system worked on real time data which is fetch via IOT sensors. All soil moisture real values are taken through soil moisture sensor, soil pH values via Soil pH level sensor, temperature and humidity are taken via DTH11 sensor. After getting all values that store on firebase in real database. Then, those data will divide into two datasets one is training dataset and another testing dataset. Next step is applied the machine learning algorithm decision tree classifier to recommend the best crop based on real data values.

**Algorithm Used Crop Prediction System:**

The goal of this algorithm is to predicts the value of a target variable, for which the decision tree
uses the tree representation to solve the problem. In
which the leaf node corresponds to a category label
and attributes are represented on the interior node of
the tree. In a decision tree, for predicting the class of
the given dataset, the algorithm starts from the root
node of the tree. This algorithm compares the values
of root attribute with the real dataset values and, based
on the comparison, follows the branch and jumps to
the next node.
We have applied Decision tree approach in our model
as:
(i) Importing library DecisionTreeClassifier from
sklearn. tree Class
(ii) Now we create DecisionTreeClassifier object
(iii) In the last we fit our data
# Importing Decision Tree classifier
from sklearn.tree import DecisionTreeClassifier
clf = DecisionTreeClassifier()
# Fitting the classifier into training set
clf.fit(X_train, y_train)
pred = clf.predict(X_test)

IV. CROP DISEASE IDENTIFICATION
AND ITS SOLUTION

Dataset: - We have used the plant Village dataset. This
dataset includes the healthy and infected leaves of
various plants. The dataset consist the various plants
like tomato, potato, Pepper_Bell etc. We have spilt
dataset into training dataset, testing dataset and
validation dataset. There is total 38 classes, 54,305
images belong from training set, 43444images belongs
from test set, 10861 images belong from validation set.
The images cover 14 species of crops, including:
apple, blueberry, cherry, grape, orange, peach, pepper,
potato, raspberry, soy, squash, strawberry and tomato.
It contains images of 17 basic diseases, 4 bacterial
diseases, 2 diseases caused by mold (oomycete), 2
viral diseases and 1 disease caused by a mite. 12 crop
species also have healthy leaf images that are not
visibly affected by disease

Architecture:-

![Diagram](diagram.png)

Figure 2. Proposed System Of Crop Disease
Identification
Take the picture or choose it from mobile gallery of an
infected leaf. Then that user input get to convolutional
neural network for doing the processing like image
processing, feature extraction. After that it will divides
the dataset into test and train set. And then it will gives
us a predicted crop disease.

Algorithm Used In Crop Identification:-

1. Firstly, the input image is subjected to two
convolution layers having 32 filters each and filter size
of 2 2. The ReLU activation function is applied
internally in the convolution layer. Parallelly, we apply
the batch normalization to the convolution layer to
reduce the training size. After that, we use a max-
pooling layer of size 2 2 to reduce the size of the
convolution matrix further. Again, we used two
convolution layers with 64 filters and size 2 2 along
with ReLU activation function and batch normalization.
This is followed by one more max-
pooling layer with size 2 2, we applied two more
convolution layer with 128 filters and filter size 2-2
with ReLU and batch normalization. This is followed
by two more convolution layers with 256 filters and
filter size 2 2 with ReLU and batch normalization.
After all this, a flattening layer is used to get a vector
of neurons which uses ReLU function. Then two dense
layers are used: one uses ReLU, while the other uses the
SoftMax function and depicts the output class.

V. EXPERIMENTAL RESULTS

1. We have applied DecisionTreeClassifier from
sklearn. tree Class
2. In the last we fit our data
3. One-Hot Encode the categorical column
4. Build a sequential model architecture using dense
layers
5. Train the model and make the predictions,
We have applied CNN algorithm in our model as:
(i) Importing library from keras. preprocessing.image
from keras Class
(ii) In the last we fit our data
# Model building to get trained with parameters
BATCH_SIZE = 64
# Model building to get trained with parameters
opt = keras.optimizers.Adam(lr=0.001)
model.compile(optimizer=opt, loss='categorical_crossentropy', metrics=['accuracy'])
train = model.fit(train_generator, epochs=20, steps_per_epoch=train_generator.samples, validation_data=val_generator, validation_steps=val_generator.samples, verbose=1, callbacks=[early_stopping]).

Figure 3: Input given to algorithm
ii. We applied CNN algorithm on crop disease identification and we got 89% accuracy on that model.

![Figure 4: accuracy and loss at each epoch](image.jpg)

We collected sensor through raspberry pi then stored in firebase database that value given to the trained crop prediction model then performs the necessary operations and gives it to the crop suggestion GUI. The suggestion GUI suggests about the crop that can be chosen for cultivation. Hence precision decision is made by the farmers with the help of the predicted result.

![Figure 6.: Predicated Crop Disease](image.jpg)

iii. Here we applied Decision tree algorithm on crop prediction system we got 90% accuracy on model and after that get predicted crop for suitable crop.

![Figure 5: Accuracy and Output Of Crop Prediction System](image.jpg)

VI. SCREENSHOTS OF SYSTEM

Here we upload an image from the android app then the trained crop disease model performs an algorithm on given that input and gives it to the crop disease name and its solution.

![Figure 7. Crop Recommended](image.jpg)

Here We show the present weather details of that user region in our android app.
CONCLUSION

Agriculture being an important a neighbourhood of our economy, it's essential to form sure that even the tiniest investment exhausted the agriculture sector should be taken care of when it involves farming and crop seeds are one of them. So, it's essential to ascertain if the proper crop has been chosen for suitable soil that matches its requirements to profit the farmer. this technique would assist the farmers in making an informed decision about which crop to grow relying on a selection of environmental and geographical factors. The IoT and ML based suggestions will help to educate the farmers and help them to minimize the cost for cultivation this enables for a scalable, reliable solution to an important problem affecting many of us. Our future work aims at developing this model with more soil attributes and with a much bigger data set.

FUTURE SCOPE

Currently, we are worked on the 9 crops and 30 diseases and the system has also provides the solutions for crops based on its causes , in future the system will works on more crops and diseases and also provide the solutions for crops based on its causes. Informing the farmers about the latest news and government schemes related to agriculture sector. System will also provide the regional language support The system will also provide fertilizers and its cost based on recommended crop.

REFERENCES