

## CROP RECOMMENDATION SYSTEM USING MACHINE LEARNING

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### ABSTRACT

Approximately 17% of India's GDP derives from the agricultural sector, which even employs more than 60% of the country's workforce. This field has seen some changes with new technologies like vertical farming and so on. However, many Indian farmers still follow traditional ways and beliefs to use their land. For example, they wait for the weather to match their farming practices, rather than adjusting to the weather changes. Our research goal is to help farmers pick the best crops for their situation and environment by predicting which crops fit well with the factors that influence crop growth, such as soil nutrients, soil pH, humidity and rainfall. We use different machine learning models, such as Decision Tree (DT), Support Vector Machine (SVM), Logistic Regression (LR), and Gaussian Naïve Bayes (GNB).

**Keywords** Crop suggestion, Nitrogen-PhosphorusPotassium (NPK), Humidity, Rainfall, pH, Machine Learning (ML), Decision Tree (DT), Support Vector Machine (SVM), Logistic Regression (LR), and Gaussian Naïve Bayes (GNB).

### 1. INTRODUCTION

Agriculture is a significant area for the Indian economy and human survival. It is one of the primary occupations which is essential for human life. It likewise contributes a huge part to our day-to-day life [1]. In most cases, Farmers commit suicide due to production loss because they are not able to pay the bank loans taking for farming purposes[12]. We have noticed in present times that the climate is changing persistently which is harmful to the crops and leading farmers towards debts and suicide [18]. These risks can be minimized when various mathematical or statistical methods are applied to data and by using these methods, we can recommend the best crop to the farmer for his Agricultural land so that it helps him to get maximum profit [12].

1. In India today, agriculture has made significant advancements. Precision farming's secret weapon is "areaspecific" cultivation. Although improvements have been made, there are still some problems with precision cultivation. Crop recommendations are significantly influenced by precision agriculture. Crop recommendations are determined by a variety of factors.
2. Precision agriculture focuses on identifying these parameters in an area-specific way to identify issues. Not all the results given by precision agriculture are accurate to result but in agriculture, it is significant to have accurate and precise recommendations because in case of errors it may lead to heavy material and capital loss. Many research works are being carried out, to attain an accurate and more efficient model for crop prediction [11].
3. Machine Learning focuses on the algorithm like supervised, unsupervised, and Reinforcement learning and each of them has its advantages and disadvantages. Supervised learning the algorithm assembles a mathematical model from a set of data that contains both the inputs and the desired outputs. An unsupervised learning-the algorithm constructs a mathematical model from a set of data that contains only inputs and no desired output labels. Semi-supervised learning- algorithms expand mathematical models from incomplete training data, where a portion of the sample input doesn't have labels [8].

### 2. PROPOSED SYSTEM

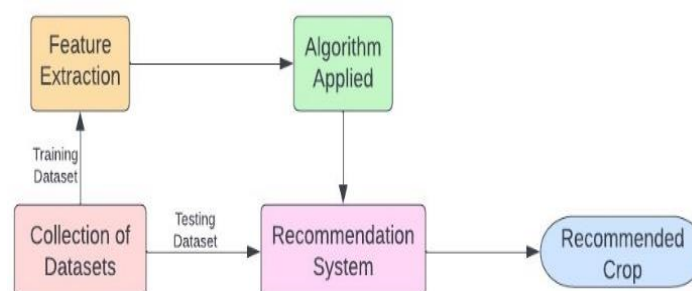


Fig 1: Block Diagram of Overall Methodology of Proposed System

In our framework, we have proposed a procedure that is separated into various stages as appeared in Figure 1.

The five phases are as per the following:

- 1) Collection of Datasets
- 2) Pre-processing (Noise Removal)
- 3) Feature Extraction
- 4) Applied Machine Learning Algorithm
- 5) Recommendation System
- 6) Recommended Crop

Flow of the Proposed System

As demonstrated in the figure, the methodology to extract the sentiment contains the several steps that are described below:

## 2.1 Data Collection

The dataset [27] consists of parameters like Nitrogen (N), Phosphorous (P), Potassium (K), PH value of soil, Humidity, Temperature and Rainfall. The datasets have been obtained from the Kaggle website. The data set has 2200 instance or data that have taken from the past historic data. This dataset include twenty two different crops such as rice, maize, chickpea, kidneybeans, pigeonpeas, mothbeans, mungbean, blackgram, lentil, pomegranate, banana, mango, grapes, watermelon, muskmelon, apple, orange, papaya, coconut, cotton, jute, and coffee.

## 2.2 Pre-Processing (Noise Removal):

For the successful application pre-processing is required. The data which is acquired from different resources are sometime in raw form. It may contain some incomplete, redundant, inconsistent data. Therefore in this step such redundant data should be filtered. Data should be normalized [5]. We also use Power BI to remove peak/downfall, local min-max, outliers, and junk values.

## 2.3 Feature Extraction:

This step is focus on identifying and using most relevant attribute from the dataset. Through this process irrelevant and redundant information is removed for the application of classifiers [5].

## 3. METHODOLOGY

In this proposed system applied different Machine Learning algorithms like Decision Tree, Support Vector Machine (SVM), Logistic Regression (LR), and GaussianNB.

## 4. MODELING AND ANALYSIS

The confusion matrix used to determine the performance of the classification models for a given set of test data. It can only be determined if the true values for test data are known.

The matrix itself can be easily understood, but the related terminologies may be confusing

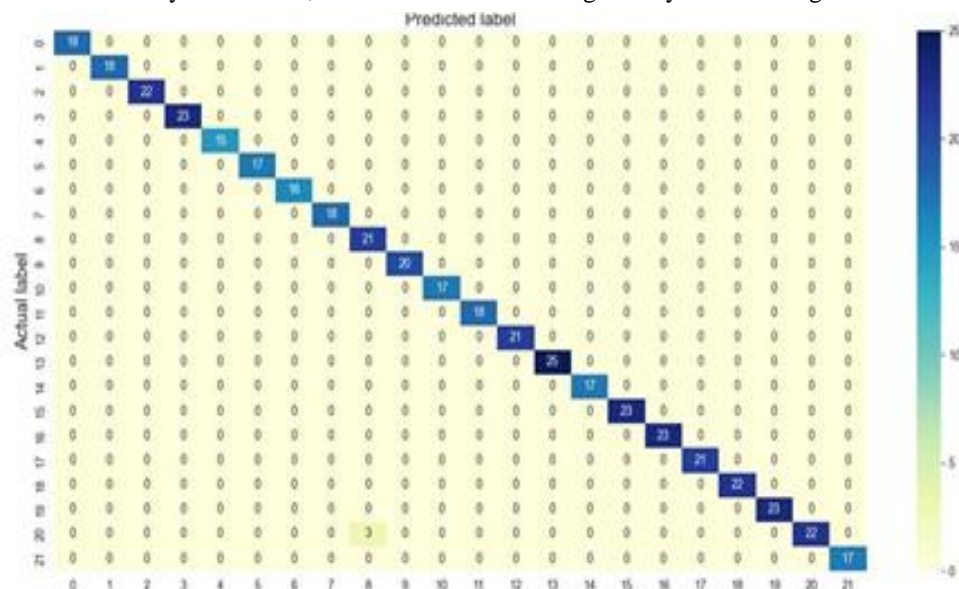


Figure 1 Accuracy Comparison.

**Table 1:** Algorithm vice Accuracy Result in Percentage

Training Accuracy Score	99.5%
Validation Accuracy Score	99.3%

Based on the results provided, we can see that the model performs great with 99.3% accuracy.

## 5. CONCLUSION

We have developed and applied a smart system that can suggest suitable crops for farmers across India. This system would help the farmers choose the best crop based on factors like Nitrogen, Phosphorous, Potassium, PH Value, Humidity, Temperature, and Rainfall. By using this research we can increase productivity of the country and produce profit out of such a technique. This research can enhance the country's productivity and profitability by using this technique. This way, farmers can grow the right crop and increase their income and the country's overall earnings. We have evaluated machine learning algorithms and discovered that Decision Tree and Gaussian NB had the best accuracy among them.

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