

Intelligent Crop Recommendation System Using Machine Learning

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Abstract - Agriculture has a utmost part in the socioeconomic structure of India. In a country where about 58 percent of the populace works in agriculture, selecting the right crop for the soil using conventional and non-scientific approaches is a serious challenge. Farmers occasionally made the wrong crop choices based on the properties of the soil, the planting season, and the location. This results in tone- murder, quitting the husbandry field, moving towards communal areas for livelihood. To overcome this issue, this disquisition work has proposed a system to help the farmers in crop selection by considering all the factors like sowing season, soil, and geographical position. likewise, In emerging nations, perfection husbandry, which focuses on point-specific crop operation, is also being carried out using current agricultural technologies.[1]

Keywords- Agriculture, Crop Management, Soil, Farmers, Socioeconomic.

I. INTRODUCTION

Almost 58 percent of the populace of our country relies on agriculture for their primary source of income[1]. According to the 2016–17 Economic Survey, the typical monthly wage of a farmer in 17 states is Rs. 1700, which resulting in farmer suicide and agricultural land conversion for non-agricultural uses. Wrong crop selection will always result in less yield. If the family is fully dependent on this income, then it's very difficult to survive. In the suggested system the environmental characteristics like temperature and rainfall, temperature, and geographical location in terms of the state along with soil characteristics such as soil type, pH value, and nutrients concentration are being considered to recommend a suitable crop to the consumer. The proposed system is implemented using machine learning which is among the programmers of Machine Learning (AI) that empowers allows the systems to learn and evolve automatically without explicitly programmed by programmer. Before planting, the crops were graded using the neighbour's regression and Artificial Neural Networks were used to select the crop with the highest yield rate. Based on the random forest technique and Big ML, crop features were examined [3]. In order to mitigate the effects of water stress on plants, algorithms for machine learning were developed. These algorithms also provided a set of decision criteria that were used to anticipate the state of the plants. Smart technologies were employed to offer real-time advice, and machine learning techniques were applied to anticipate crop costs[4]. In this work, surveys on

various uses of algorithms for machine learning in agriculture output systems were conducted. Additional AI-enabled tools were used to provide crop management advice. Crop cultivation can be more productive with the use of deep learning algorithms.[1]

II. AIMS AND OBJECTIVE

a) Aim

The aim is estimating crop yield and provide accurate recommendations to the end user regarding the necessary fertilizer ratio dependent on soil factors. employing machine learning to recommend the crop price as well.

b) Objective

- Build a robust model to give a correct and accurate prediction of crop sustainability in a given state for particular soil type and climatic conditions.
- To make the best recommendations for the best crops in the area so that the farmer does not lose money.
- Provide profit analysis of various crops based on the previous year's data.

III. LITERATURE SURVEY

Paper 1: Crop Selection System To Maximize Crop Yield Rate Using ML:

Planning for agriculture is important for a country with an agricultural economy and for ensuring food security. Crop

choice is essential. Using statistical approaches or machine learning techniques, many studies looked at crop production rate prediction, weather prediction, soil classification, and crop classification for agricultural planning. The choice of crop becomes difficult if there are multiple ways to plant a crop at once while only having a limited amount of land available. In order to deal with the crop selection issue, maximize net yield rates across seasons, and subsequently achieve optimum economic growth for the nation, this research suggested the Crop Selection Procedure. The suggested approach might increase crop net yield rates.[6]

Paper 2: Crop recommendation system for precision agriculture:

Data mining in agriculture is used for research of various biotic and abiotic factors. The a widespread issue affecting Indian farmers they don't select the appropriate crop depending on their soil needs. As a result, they experience a major setback in productivity. The farmers' issue has been handled through precision agriculture. Precision Agriculture is a modern farming method that makes use of research data on soil types, traits, and crop yields to recommend the best crop to farmers based on site-specific factors. As a result, crop choosing errors are minimized, and productivity is increased. This issue is addressed in this study by suggesting a recommendation system employing an ensemble model and a majority voting method. using Random tree, CHAID, K-Nearest Neighbor and Naive Bayes as learners to suggest a crop for the particular parameters with high accuracy and efficiency.[5]

Paper 3: Smart Farming Using Machine Learning:

In India's economy Agriculture is a significant but fundamental change in Indian culture is currently taking place, which is causing a disaster. Making agriculture a successful business and enticing farmers to continue crop producing activities are the only ways to end the crisis. This study paper will assist farmers in using machine learning to make informed judgements about their cultivations as part of an endeavor in that direction. Using historical data, this paper employs supervised machine learning methods to estimate an suitable crop depending on weather conditions and crop yield. A web application has also been created.[2]

IV. EXISTING SYSTEM

In our nation, 58% of the community makes their living mostly from agriculture. According to the 2016–17 Economic Survey, the average monthly salary of of a farmer in 17 states is Rs. 1700, which contributes to farmer suicides and the repurposing of agricultural land. Moreover, 48% of farmers choose to relocate to urban areas over passing on their harvests to future generations. The reason behind this is that the farmers often take wrong decision about the crop selection for example selecting a crop that won't give much yield for the particular soil, planting in the wrong season, and so on. The farmer might have purchased the land from others so without previous experience the decision might have been taken. Wrong crop selection will always result in less yield. If the family is fully dependent on this income then it's very difficult to survive. in existing system random forest algorithm is used but it cannot predict exact recommended crop.

V. COMPARATIVE STUDY

Sr. No	Paper Name	Author/ Publication	Technology	Purpose	Advantages
1.	Crop Selection system to maximize crop yield rate using machine literacy fashion.	Rakesh Kumar, MP. Singh, Prabhat Kumar.	Machine Learning.	To propose a technique called crop selection strategy to address the issue of crop selection	The system recommends best crop to be grown in particular region.
2	Crop recommendation system for precision agriculture	S Pudumalar, E. ramanujam, R.harine Rajashree,C Kavya,T.Kiruthika, J.Nisha	Data Mining.	To asses new data mining techniques and apply them to various variables.	The system can be customized based on the specific needs of farmers.
3.	Smart farming using machine learning.	Dr.Shubham Pawar, Sumit Dere,Ashitosh Akangire,Harshvardhan Kamble	Machine Learning.	To Predict appropriate crop according to the climatic circumstances and yield of the crop.	The system uses ML algorithms to automate and optimize farming practices.
4	Soil data analysis using classification techniques and soil attribute prediction	Jay gholap,Anu rag Ingole,Jaye sh ghoil	Data Mining	It focuses on classification of soil using Various data mining techniques.Ano ther important purpose is to predict predict untested	The proposed system can provide a more accurate and detailed analysis of soil data.

Table no.01: Comparative Analysis

VI. PROBLEM STATEMENT

There are veritably many platforms that help growers with their husbandry strategy. Suspicion grounded opinion may

not prove salutary in the long term. growers frequently undervalued the fertility of soil of their own farms. They frequently find it delicate to notice factory conditions that directly affect the product rate. Using applicable parameters

like rain patterns, temperature patterns, soil structures, and other factors similar as a crop condition makes it possible to yield accurate crop vaticination results. A lot of current systems have numerous excrescencies and make them non intuitive to use.[1]

VII. PROPOSED SYSTEM

The proposed system is implemented using machine learning which is among he programme of Machine Intelligence (AI) that empowers the systems to learn and evolve automatically without explicitly programmed by a programmer. Followed by that, the accuracy of the program will be improved without human intervention. Numerous researchers are working in this area to aid farmers in selecting the crops they should use given the numerous considerations discussed as follows, various factors like physical, environmental, and economic factors were taken into consideration. In this project, a computer-aided neural network is used to select the crop with the highest yield rate, and real-time monthly atmospheric conditions are used to create an efficient yield forecasting mechanism. A non-parametric statistical model along with nonparametric regression methods was being used to implement the above-said forecasting mechanism. In this project collect Various datasets from government website and Kaggle are fed into the system. After the pre-processing step, the data-set is used to train different machine learning models like neural network and linear regression to attain accuracy as high as possible.

VIII. ALGORITHM

The Algorithm for Intelligent Crop Recommendation System:

```

1: Initialize with data loading
2: def build_naive_model(xtrain, ytrain, xtest, ytest,
   features, target, acc, model): Create a Gaussian naive Bayes
   classifier and fit it to the training data
   nb = GaussianNB()
   nb.fit(xtrain, ytrain)
   Make predictions on the test set
   ypred = nb.predict(xtest)
3 : Compute performance metrics on the test set
   accuracy=metrics.accuracy_score(ytest, ypred)
   precision=metrics.precision_score(ytest, ypred,
   average='weighted')
   f1_score=metrics.f1_score(ytest, ypred,
   average='weighted')
   recall=metrics.recall_score(ytest, ypred,
   average='weighted')
4: Append the accuracy and model name to global lists
   acc.append(accuracy)
   model.append('NaiveBayes')
   Perform cross-validation on the whole dataset
   cv_scores=cross_val_score(nb, features, target, cv=6,
   scoring='accuracy')
5: Print the performance metrics and cross-validation
   scores

```

```

print("Naive_Bayes: ", accuracy, precision, f1_score, recall,
cv_scores)
Return the performance metrics on the test set
return accuracy, precision, f1_score, recall

```

IX. MATHEMATICAL MODEL

1.Naive Bayes:

The Bayes theorem is used to create a simple probabilistic classifier called Naive Bayes. Naive Bayes classifiers make the assumption that, given the class variable, the value of one feature is independent of the value of any other feature..

$$P(C|D) = (P(D|C) * P(C))/P(D)$$

2. Decision Tree:

Decision trees are classified as supervised learning for classification and regression. A tree representation is used to solve the problem, with each leaf node representing a class label. and the tree's interior node represents attributes.

Entropy:

$$E(S) = -\sum P_i(S) \log_2 P_i(S)$$

Information Gain:

$$IG(S, A) = H(S) - \sum_{v \in Values(A)} (S_v|/S) H(S_v)$$

3.Random Forest:

The random forest algorithm induce decision trees from different data samples, forecasts data from each division, and then votes to determine the winner. system is a better solution RF uses the bagging method for data training, which improves the outcome's correctness.

$$f(y) = mode(f1(y), f2(y), \dots, fN(y))$$

X. SYSTEM ARCHITECTURE

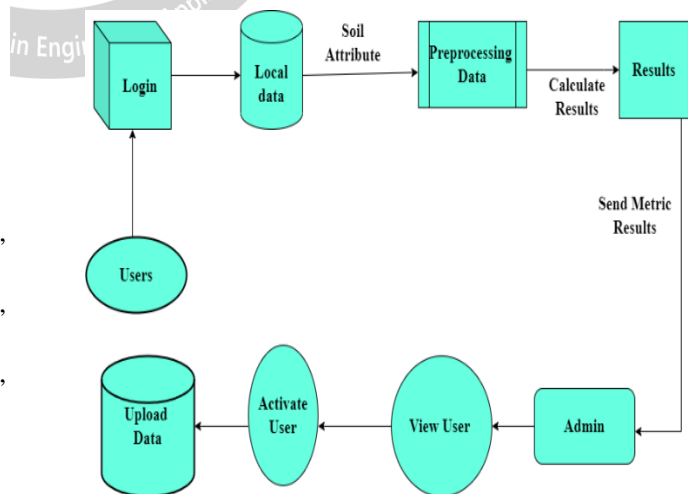


Fig.1: System Architecture

Description:

- 1)The user will login in to the system
- 2)User authentication will be done by admin.

- 3)The user will load the all data like attributes of soil.
- 4)Then system will use trained models and algorithms for preprocessing data.
- 5)The system will calculate the results and system will display the recommended crop to user.

XI. ADVANTAGES

- Crop recommendation systems assist farmers in making decisions by using numerous characteristics such as temperature, precipitation, seasons, and agro-ecological circumstances.
- Crop recommendation system will improve productivity of farmers.
- It will increase profit of farmers.
- This application will assisting farmers to predict the yield.

XII. DESIGN DETAILS

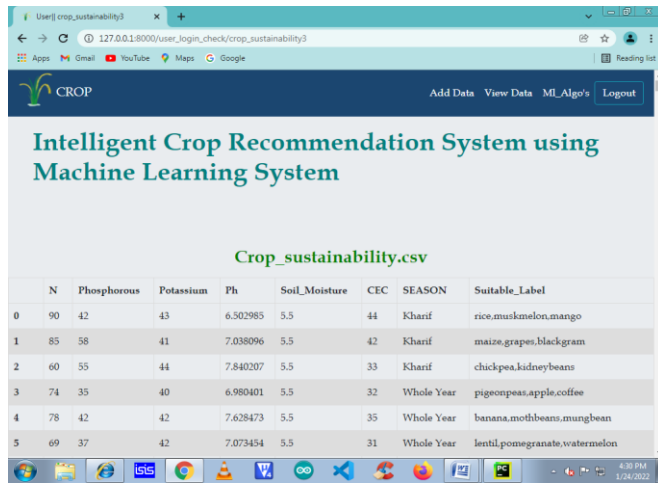


Fig 2: Result

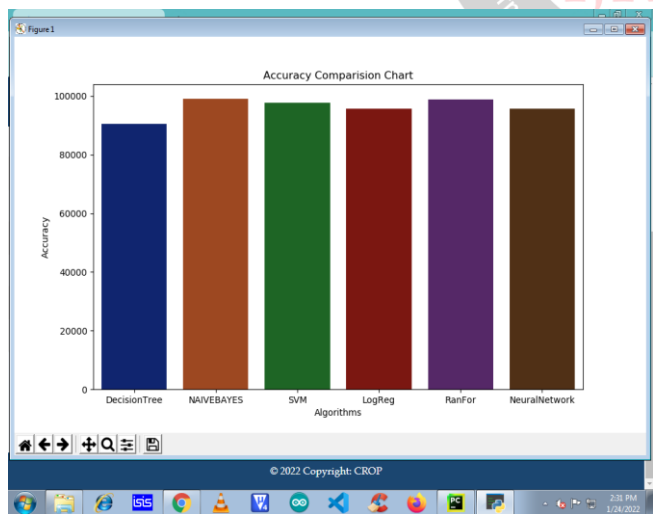


Fig 3: Accuracy

Result Analysis:

Soil parameters and a crop database are used in the proposed model. The ideal crop for the specific soil is recommended

using a machine learning algorithms. Naive Bayes was the most accurate of the algorithm we tested.

XIII. CONCLUSION

Thus, we have tried to implement the paper “Intelligent Crop Recommendation System Using Machine learning.”, Priyadarshini A; Swapneel Chakraborty; Aayush Kumar; Omen Rajendra Pooniwalla IEEE 2021 and the conclusion is as follows: Intelligent crop recommendation system helps the farmers By offering information that most farmers don't consider, it help farmers to pick the best crop, lowering crop failure risk and rasing output. Also, it stops them from suffering losses.The research study demonstrates the potential of machine learning algorithms in the field of agriculture. The system can be further improved by integrating additional data sources such as market prices, fertilizer availability, and pest infestations to provide more comprehensive recommendations. Hence the above project was successfully implemented.

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