Using Machine Learning Technique for Recommendation of Fertilizer and Irrigation in Crops

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ABSTRACT

In the Indian subcontinent and worldwide, agriculture serves as the economy's foundation and provides most people's income. The farmer must be equipped with cutting-edge techniques to deal with today's challenges, such as weather unpredictability, water scarcity, and demand-supply volatility. More specifically, it is necessary to communicate issues such as decreased crop yields due to an unpredictable climate, inadequate irrigation resources, and decreasing soil fertility levels. As a result, it is necessary to convert abundant agricultural data into cutting-edge technologies and make them readily available to farmers. Machine learning is one method that can be used to predict crop yields. For crop growth prediction, some machine-learning techniques like clustering and classification are very helpful. Algorithms such as SVM, DT, and ANN can be used for forecasting. The wide range of available algorithms poses the dilemma of selecting the crop. This study aims to find out how various machine learning algorithms can be used to predict agricultural production and present a big data computing strategy for using machine learning techniques to predict crop yield and recommend fertilizer.

INTRODUCTION

The Indian economy relies heavily on agriculture, which encompasses agricultural production. Crops can be used for both food and profit. Various factors drastically influence the growth of crops, which includes the type of soil, fertilizer type, irrigation and nutrient content. As a result, to resolve the real prediction issue of production. By forecasting production in the early stage, farmers should take preventive measures to improve production. A large database can be used to store farmers' previous experiences, weather conditions, and other factors influencing them so that early forecasting can be done.

The input parameter typically includes humidity, pressure, temperature, wind gust, wind speed and wind direction. ML algorithms which help in early prediction of production like KNN, Naive Bayes, DT, Random Forest, and logistic regression. It is vital to forecast agro-production before yielding because it affects international trade, food availability, and global market price once the production fluctuates. Production of crops is widely affected by soil and irrigation. Farmers will also be able to use the forecast to choose alternate crops or to discard a crop early in a serious crisis. Machine-learning methods may be useful for yield prediction due to the nonlinear connection between crop-influencing factors and yield. Additionally, crop output prediction can assist farmers in better comprehending the scheduling and production of seasonal crops. Therefore, effective crop management and the desired outcomes necessitate modelling and forecasting crop output before cultivation.

METHODOLOGY

Machine learning is an Artificial Intelligence (AI) technique that enables users to feed massive amounts of data to computer algorithms. The machine learns and provides a prediction based on the input data with data assistance. The objective is to go beyond what has already occurred by utilizing historical data and predictive algorithms to ascertain the likelihood of a future event. We have used artificial neural networks and supervised machine learning in our

project to recommend fertilizers, crops, and the need for irrigation. The following learning algorithm was utilized in our study:

A. Logistic Regression

Because the dataset has multiple crop labels, we used a single VS rest to classify multiple classes. The one vs rest system is used to classify multiclass brackets using double classifiers. The logistic retrogression algorithm is a bracket system for grading double markers. After dividing the multiclass into multiple double classes, the logistic regression-grounded double classifier is trained on each double bracket problem. Vaticination is the class with the loftiest delicacy. One disadvantage of this strategy is that if there are fewer class markers, the model must be applied to each class, which takes time and memory.

B. Support Vector Machine (SVM-SVC)

The Support vector machine (SVM), also appertained to as the SVM, is a supervised machine learning algorithm that can be used to break problems with retrogression and bracket. In large or noisy data, SVM fails when the target class overlaps with the help of support vectors, which are the extreme points or vectors, a best-fit line or an aeroplane. A hyperplane is created by SVM so that the new data point can be fluently classified in the future for a bracket problem.

C. K nearest neighbour:

The lazy learner algorithm is one of the simplest supervised machine learning algorithms. It assumes that the new data point is analogous to the given dataset and places it in the order that's closest to it. KNN doesn't make any hypotheticals about the dataset that's under As a result, it doesn't use parametric algorithms.

D. The Naive Bayes Classifier

It adheres to the principle of the Bayes theorem by assuming that each feature contributes equally and independently to the outcome; Thus, it is referred to as naive. As a probabilistic classifier, it uses probability to predict the outcome. The naive Bayes method performs significantly better when applied to the extensive and categorical dataset. Its assumption of independent predictors is a limitation because it is nearly impossible to obtain a set of completely independent predictors in the real world.

RESULT

The models are tested on the test dataset after they have been trained on the training dataset. This allows the model with the highest accuracy on both the train and the test dataset to be used for recommendations.

A. Accuracy Comparison

In this instance, the random forest classifier performed better than the other classifier in both modules—the crop recommendation and the irrigation recommendation—with an accuracy of 98.37 percent for the crop recommendation and 99.31 per cent for the irrigation recommendation, respectively.

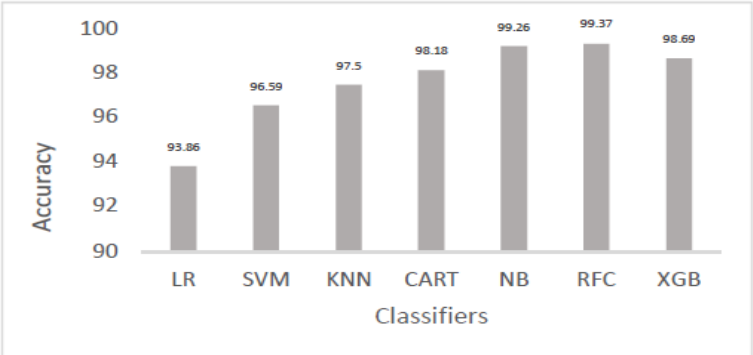


Figure 1 Accuracy of classifiers on crop dataset

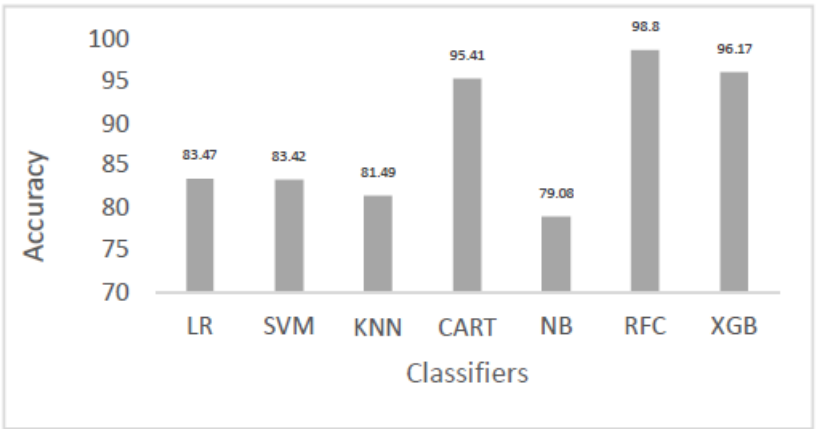


Figure 2 Accuracy of classifiers on irrigation dataset

B. Evaluation Matrix

1) Confusion Matrix

The confusion matrix is an N*N matrix that summarizes the prediction results for a classification problem, with N representing the classes of the dependent variable.

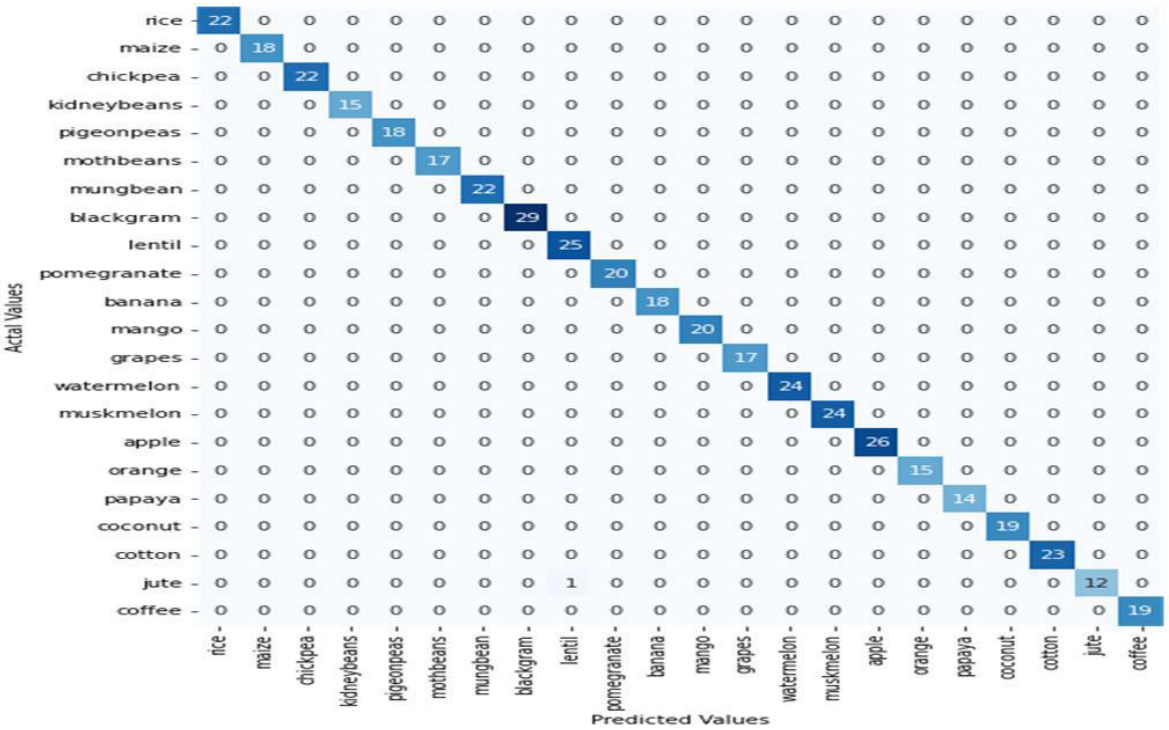
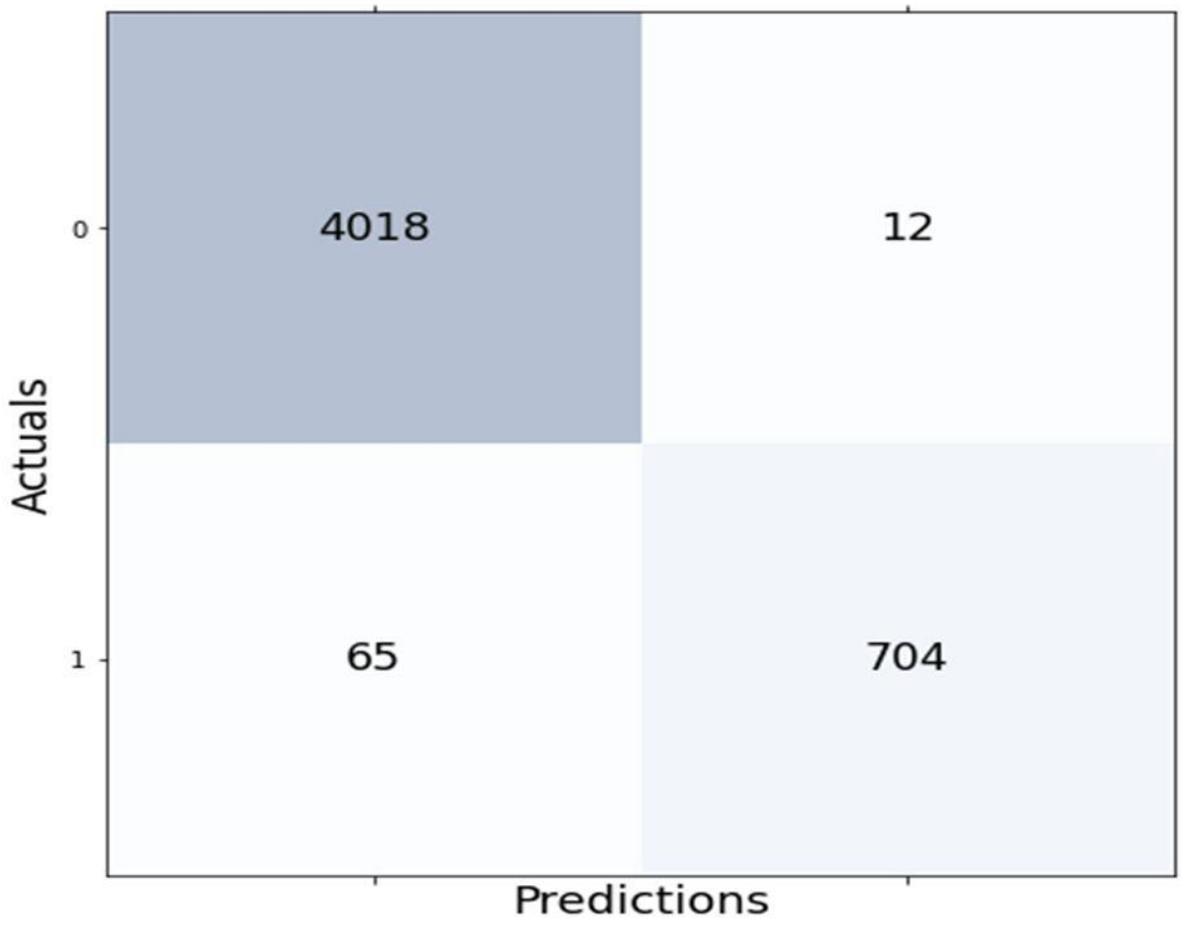


Figure 3 Confusion Matrix for Crop Prediction



CONCLUSION

Based on geospatial data and other parameters, crop and fertilizer input recommendations have shown that high yield rates are possible. High yields can also be achieved by recommending irrigation at the right times.

With 99.37 per cent accuracy, we conclude that crop recommendation is most effective with Random Forest. With an accuracy of 98.80%, Random Forest delivers the best recommendations for irrigation.

Work in the agriculture sector with high technology integration can be extended further by developing a user-friendly mobile application that allows farmers to upload images to identify crop diseases.Agri-tech has a lot of potential for humanity, and significant advancements can be made in this field with a lot of work.

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