AI-Based Crop Rotation for Sustainable Agriculture

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Abstract. The crop recommendation system employing machine learning methods will be covered in this study. For sustainable agricultural practices to be followed and to increase crop yields, crop advice is crucial. Based on several factors, including nitrogen (N), phosphorus (P), potassium (K), and humidity, we will advise the best crop for the given site. We analyzed various algorithms like KNN, Decision Tree, Random Forest, SVM etc. But based on various accuracy levels we committed to random forest implementation. Means in this paper we are going to implement a crop recommendation system using random forest algorithm. The model is allowed to train upon a large dataset and the Performance of the recommendation system is measured using accuracy score. Finally, Using the trained model we are going to predict suitable crops for land according to the given parameters. Our proposed approach can be helpful for farmers, researchers, and policymakers in making informed decisions regarding crop management and planning.

Keywords. Artificial Intelligence, Crop, Agriculture, KNN, Decision Tree, Random Forest, SVM.

1. INTRODUCTION

Modern advanced technologies in the field of computer science are rapidly expanding around the world. The versatility of machine learning and data science has led to their application in a wide range of human needs. In order to keep agriculture as the cornerstone of our nation and make sure it is robust enough, we must use these modern technological advancements. A variety of issues in the world of agriculture can be resolved using machine learning techniques and data science.

Based on our research, we identified several common and critical difficulties in

agriculture, and we used the previously mentioned technologies to assist farmers in

identifying the best solutions. Agriculture is a large-scale operation with several processes and numerous challenges to overcome.

The first and foremost stage is to choose a crop type that is appropriate for the land's quality. To do this, we employed a machine learning tool known as Random Forest to forecast the crop type while considering other aspects like the kind of soil, its nitrogen concentration, etc. We will talk about a random forest-based crop recommendation algorithm in this paper. One of the techniques for categorization and regression is random forest. It is an ensemble learning technique that generates the class that is the mode of the classes (classification) or the mean forecast (regression) of the individual trees. Many decision trees are built during the training phase.

Similarly, we are going to analyze various performance metrics of random

forest. Overall, we are going to make a random forest to train upon the dataset. Once the random forest model is trained with enough data, we finally test with some of the samples and analyze the results. Our proposed approach can be helpful for farmers, researchers, and policymakers in making informed decisions regarding crop management and planning.

1.1 PROJECT SCOPE

This project is titled "Crop prediction based on characteristics of the Agricultural Environment Using Various Feature Selection Techniques and Classifiers". Crop prediction in agriculture is a complicated process and multiple models have been proposed and tested to this end.

1.2 PROJECT FEATURES

This project primarily focuses on address classification. It aims to analyze various factors that can potentially impact crop yields. These factors encompass the potential for yield fluctuations, the emergence of internal and shape defects, and alterations in the chemical composition of crop yields. The growth and quality of plants, as well as the environmental conditions, are influenced by both abiotic and biotic factors. To accomplish this analysis, the project employs a range of Machine Learning approaches, including:

1. Random Forest (RF)
2. K Nearest Neighbour (KNN)
3. Support Vector Machine (SVM)
4. Decision Tree (DT)
5. Naïve Bayes (NB)

These methods contribute to the effective classification of addresses and the comprehensive understanding of crop yield-related factors.

1.3 PROJECT PURPOSE

The primary objective of this project is to employ machine learning techniques for the identification of various methods. This is particularly pertinent due to the complex nature of the problem, which involves an assortment of datasets. Crop cultivation is intricately linked with both biotic and abiotic factors. Biotic factors pertain to environmental elements influenced by the direct or indirect impact of living organisms on other living organisms. This encompasses a wide range of factors, including those resulting from human activities, known as anthropogenic factors. The project aims to effectively analyze and address these interconnected elements for improved agricultural outcomes.

2 CONCLUSION

In conclusion, the method proposed in this study, utilizing the Random Forest Implementation for crop recommendation, represents a significant advancement in the field of agriculture. This system offers the capability to forecast the most suitable crop based on the specific soil and meteorological conditions of a given area. Such proactive and data-driven recommendations empower farmers to make informed decisions about crop selection, resulting in improved yield and overall productivity.

This approach serves as a vital solution to mitigate the persistent issue of crop failure, ensuring that the choice of crop aligns perfectly with the environmental conditions of the land. By reducing the risk of crop losses, it not only benefits individual farmers but also contributes to the overall stability and sustainability of the agricultural sector.

3 FUTURE SCOPE

The future scope of this model is promising and multifaceted. By implementing this approach, we can minimize the wastage of agricultural plots, ensuring that crops are selected based on efficiency and suitability for the specific conditions. This model holds great potential to pique the interest of both researchers and entrepreneurs, as it addresses a critical issue in agriculture and offers practical solutions.Furthermore, this technology can facilitate global knowledge sharing among farmers. It allows farmers in one region to gain insights into the prospect of farming in distant parts of the world, thereby promoting the exchange of best practices and crop selection strategies on a global scale. In our future endeavors, we plan to expand the model's capabilities by incorporating unsupervised and reinforced learning techniques. These advancements can enhance the model's predictive accuracy and adaptability to changing conditions.

In summary, the future of this model is not only about improving crop recommendations but also about fostering global agricultural knowledge sharing and embracing emerging technologies to make farming more efficient, sustainable, and technologically advanced.

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