WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Crop Recommendation using Machine Learning

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ABSTRACT

In India, where agriculture constitutes a significant portion of our economy and sustains livelihoods, a prevalent challenge among farmers is the inadequate selection of crops aligned with their soil requirements. This oversight adversely impacts the soil's yield potential. Addressing this concern, precision agriculture emerges as a transformative solution—a smart farming approach harnessing soil data and characteristics to empower farmers in decision-making. This methodology revolves around three crucial elements: understanding the farm's soil composition, recognizing diverse soil types, and leveraging data on crop yields associated with these factors. By synthesizing this information, tailored crop recommendations are generated, enabling a substantial boost in productivity and the avoidance of inappropriate crop choices. Precision agriculture facilitates resource optimization, ensuring farmers utilize their land more efficiently. To operationalize this approach, we have developed a system employing machine learning models, including Naive Bayes and Decision Tree algorithms. These models analyze comprehensive datasets to determine the most suitable crops for specific plots of land. The integration of machine learning empowers farmers to make informed choices, potentially leading to increased profitability. This project signifies a pivotal step towards sustainable and efficient agriculture in India, offering a technologically advanced solution to enhance the decision-making capabilities of our farmers.

Keywords: *Machine Learning, Supervised learning, Heart disease, Decision tree, Random forest, Health care services.*

INTRODUCTION

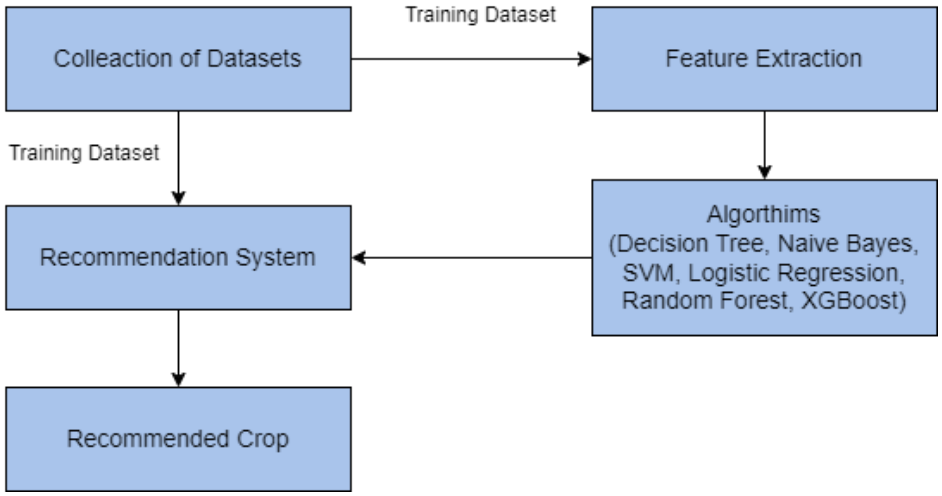
Agriculture serves as the backbone of the Indian economy, providing sustenance and livelihoods for millions, yet farmers grapple with the challenge of selecting optimal crops for their fields, impacting yields and income. Precision agriculture emerges as a solution, leveraging data on soil conditions, crop yields, and diverse factors to empower farmers with informed decisions. This paper advocates for a machine learning-based crop recommendation system designed to guide farmers in choosing the most suitable crops. Employing various machine learning models such as Naive Bayes and Decision Trees, the system meticulously analyzes soil and crop yield data to identify the ideal crops for specific lands. By embracing this innovative approach, farmers stand to enhance their decision-making processes, potentially boosting income. Furthermore, the system fosters resource efficiency, aiding farmers in optimizing their agricultural practices while concurrently minimizing environmental impact. In essence, the proposed machine learning-based crop recommendation system represents a pivotal stride towards a sustainable and prosperous future for Indian agriculture.

RESEARCH APPROACH

This research paper introduces an innovative system that harnesses the synergy of Internet of Things (IoT) and machine learning to provide crop recommendations based on soil testing facilitated by sensors. The study employs various sensors, such as those measuring soil temperature, moisture, pH, and NPK levels, to continuously monitor and analyze soil conditions. Utilizing machine learning algorithms, including Decision Tree, Naïve Bayes, Support Vector Machine (SVM), Random Forest, and XGBoost, the paper compares their performance in recommending suitable crops. Among the algorithms assessed, the XGBoost algorithm emerges as the most accurate, demonstrating its efficacy in crop recommendation systems. The research extends its focus to the development of a model for classifying crop leaves as either healthy or diseased, with the added capability of identifying specific diseases when present.

In an effort to make these advanced technologies accessible to farmers, the paper proposes the creation of a user-friendly website and mobile app. This digital interface is designed for easy access and utilization of the developed model, providing farmers with a practical tool to enhance decision-making in crop selection and disease management. The integration of IoT and machine learning, as presented in this research, holds the promise of revolutionizing agricultural practices and contributing to sustainable and efficient crop production.

METHODOLOGY:



Data collection:

The data collection step is essential for building a crop recommendation system. The data should be collected from a variety of sources to ensure that it is representative of the real world. It is also important to collect data from different regions to account for regional variations in climate and soil conditions.

Data pre-processing:

The data pre-processing step is important for ensuring that the data is in a format that can be used by the machine learning algorithm. This may involve cleaning the data to remove any errors or inconsistencies, imputing missing values, and converting the data to a consistent format.

Feature extraction:

The feature extraction step is important for converting the data into a format that can be used by the machine learning algorithm. The features should be chosen carefully to ensure that they are relevant to the problem of crop recommendation.

Model training:

The model training step is where the machine learning algorithm learns to predict the crop yield for a given set of features. The algorithm is trained on the pre-processed data and learns to identify patterns in the data. These patterns are then used to predict the crop yield for new data.

Model evaluation:

The model evaluation step is important for assessing the performance of the machine learning model. The model is evaluated on a held-out test set, which is a set of data that was not used to train the model. The performance of the model on the test set gives an indication of how well the model will generalize to new data.

Crop recommendation:

The crop recommendation step is the final step in the crop recommendation system. The farmer simply needs to provide the model with information about their specific needs and conditions, such as the climate and soil type. The model will then recommend the crop that is most likely to be successful.

RESULTS

Classifier	**Accuracy**
Linear Regression (LR)	95.22%
Decision Tree (DT)	90%
Naïve Bayes (NB)	99%
Support Vector machine (SVM)	10.86%
XGBoost	99%
Random Forest (RF)	95.22%

CONCLUSION

In conclusion, our research introduces a practical solution to a common challenge faced by Indian farmers in choosing suitable crops for their fields. The implementation of a machine learning-based crop recommendation system, incorporating Naive Bayes and Decision Tree models, proves to be a

promising approach. By leveraging soil data and crop yield information, this system assists farmers in making informed decisions, thereby enhancing agricultural productivity. Through this proposed system, farmers can overcome the hurdle of selecting inappropriate crops, leading to improved yields and potentially increased income. The simplicity and accessibility of our system make it a valuable tool for farmers, offering user-friendly insights based on data analysis. As we strive to bridge the gap between traditional farming practices and technological advancements, our research envisions a future where farmers can confidently choose the right crops, thereby fostering economic growth. Ultimately, the adoption of our machine learning-based approach holds the potential to transform the way farmers engage with their land, promoting prosperity and responsible agricultural practices.

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