CROP RECOMMENDATION SYSTEM USING MACHINE LEARNING

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Abstract **- Agriculture plays a major role in the Indian economy and employment sector. Half of the population is employed in agriculture. However, challenges such as poor crop quality and lack of knowledge in crop selection hinder productivity. Precision agriculture, aided by technologies like machine learning, can address these issues. This paper proposes a crop recommendation system using machine learning algorithm- ANN, based on soil and climate parameters collected from Kaggle.com. The system helps lower soil degradation, maintain crop health, and make appropriate crop recommendations considering factors like weather conditions, moisture, and season.**

Key Words**: *Recommendation, Machine Learning, Dataset, Artificial Neural Networks(ANN).***

1. INTRODUCTION:

Agriculture holds a pivotal position in India, serving as the backbone of its economy. With over 60% of the land dedicated to agricultural activities, it plays a crucial role in feeding the country's vast population of 1.3 billion people. However, the current state of Indian farmers is challenging, necessitating improvements to enhance their productivity and profitability. This is where technology can play a transformative role, exerting a substantial impact on the agricultural sector.

Machine learning techniques offer a promising avenue for recommending crops based on various parameters. The process begins with collecting and processing data, which is then employed as training data for the machine learning system. The system is trained to recognize patterns and make predictions. In the context of crop recommendation, parameters such as nitrogen, potassium, phosphorus, rainfall, temperature, and humidity are computed and utilized to determine the most suitable crop for a given soil type. Factors like accuracy and percentage of nitrogen, phosphorus, and potassium are considered in recommending the appropriate crop for a specific soil type.

In our paper we aim to address the challenges faced by farmers by utilizing machine learning techniques to offer accurate crop recommendations. By providing effective solutions, we strive to guide farmers in selecting appropriate crops, thereby avoiding unfavourable outcomes and maximizing their agricultural potential.

2. LITERATURE SURVEY:

1. Priyadharshini A., Swapneel Chakraborty, Aayush Kumar, Omen Rajendra Pooniwala conducted a study on machine learning algorithms in her research article. This technology reduces crop failure and decreases productivity by supporting farmers in choosing the proper crop and provide the data that regular farmers do not maintain. A variety of machine learning algorithms were applied. The neural network was the most accurate of the bunch. [1]

2. Mayank Champaneri, Chaitanya Chandvidkar, Darpan Chachpara and Mansing Rathod conducted research on crop yield prediction using a data mining technique. They used a random forest classifier because it can perform classification and regression tasks. The user-friendly website built that can be used by anyone to predict crop yield for their choice of crop by giving climate data for that area. [3]

3. Reddy, D. Anantha, Bhagyashri Dadore, and Aarti Watekar.'s paper presents the methodology used in developing the system, including the collection and preprocessing of data, as well as the implementation of machine learning algorithms like Decision Trees and Random Forests. The performance of the system is evaluated based on metrics such as accuracy and precision.[12]

4. Mamata Garanayak, Goutam Sahu, Sachi Nandan Mohanty, and Alok Kumar Jagadev in their paper focused on the development of an agricultural recommendation system that utilizes various machine learning regression methods such as Linear Regression,

Decision Tree Regression, Random Forest Regression, and Support Vector Regression, aiming to assist farmers in making informed decisions regarding crop selection based on specific agricultural parameters. [14]

3. PROPOSED SYSTEM:

The proposed system is a recommendation system that utilizes machine learning, specifically Artificial Neural Networks (ANN), to provide farmers with crop recommendations based on soil properties. By collecting data on soil parameters, temperature, humidity, and rainfall, the system aims to help farmers increase productivity and reduce losses by suggesting the most suitable crops for their specific area. The system also considers seed data for different crops to ensure successful crop growth. The research prioritizes real-world conditions and actual requirements, rather than making assumptions. The system is designed to be visual and user-friendly, catering to uneducated farmers. The results of the research hold potential benefits for agricultural farmers, and further evaluation will incorporate additional factors that influence crop selection for specific fields and locations.

Advantages:

- This system suggests the most suitable crops for a specific region or field leading to improved yield as farmers can make informed decisions based on data-driven recommendations.
- The system enables precision farming practices by providing tailored recommendations that understand the unique requirements of each area.
- This system can help mitigate risks associated with crop failure due to unpredictable weather conditions, thus enabling farmers to respond to challenges and reduce losses
- These systems can support sustainable farming practices by optimizing the use of resources
- These systems enable farmers to make informed decisions based on data analysis rather than relying solely on intuition or traditional practices.

4. SYSTEM ARCHITECTURE:

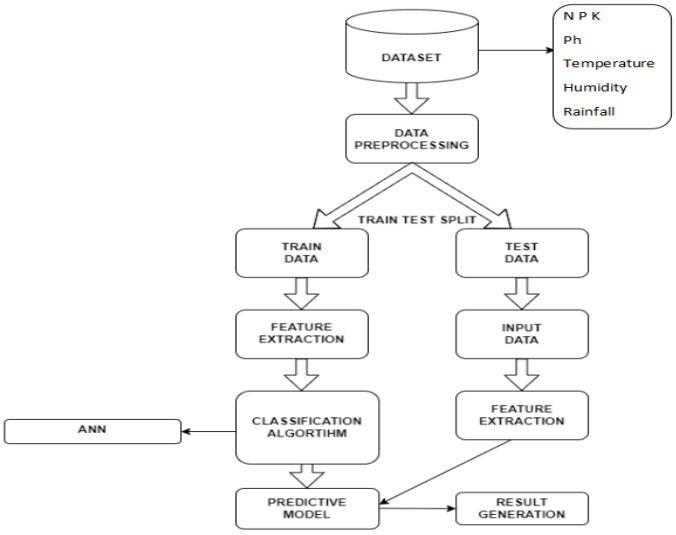


Figure 4.1 : System Architecture

4.1 Data Collection: The framework collects significant information from the dataset (taken from kaggle), soil parameters (N ,P, K, Ph), climate factors (temperature, humidity, rainfall).

4.2 Data Preprocessing: The collected data is preprocessed to handle noise, lost values, exceptions, and irregularities. It may include data cleaning, normalization, and include building to plan the data for preparing the ANN model.

4.3 ANN Model Training: The preprocessed information is utilized to prepare the ANN model. The design of the ANN can change, but in this case it comprises of an input layer, one or more hidden layers, and an output layer. The number of neurons in each layer and the activation functions utilized can be customized based on the particular requirements.

4.4 Feature Extraction: Feature extraction techniques may be utilized based on the data complexity and model characteristics to identify the most significant features that contribute to precise crop recommendations. This process aids in reducing dimensionality and enhancing the model's efficiency.

4.5 Model Evaluation: The trained ANN model is evaluated using appropriate evaluation metrics such as accuracy, precision, recall, or mean squared error, depending on the specific problem formulation (classification or regression).

4.6 Recommendation Generation: Once the model is trained and evaluated, it can generate recommendations for suitable crops based on input parameters such as soil properties, climate conditions, and other relevant factors. The ANN model utilizes its learned patterns and relationships to predict the best crops for a given set of inputs.

4.7 User Interface: The crop recommendation system incorporates a user-friendly interface that permits users or clients to input their parameters and get suitable recommendations.

5. MODULES:

Phase 1:

- Give Training Dataset and Testing Dataset.
- Take as an input.
- Data Preprocessing step contains the data cleaning process.

Phase 2:

- Divide dataset is two parts
- Dataset for training.
- Dataset for testing.
- Training of data contains feature extraction and algorithm work.
- Testing phase contains predictions of Crop and accuracy check.
- Show Result.

5. ALGORITHM USED:

Artificial Neural Networks (ANNs):

They are computational models inspired by biological neural networks. They are widely used in machine learning and have achieved success in various applications. ANNs consist of interconnected nodes that receive inputs, perform computations, and pass outputs to other nodes.
The weights in ANNs determine the strength of connections between nodes and are adjusted during the learning process. ANNs typically learn from labeled data through supervised learning, where the network adjusts its weights based on the error between predicted and desired outputs.
ANNs are popular because they can learn and generalize from large datasets. They excel in tasks such as pattern recognition, classification, regression, natural language processing, and image recognition. They have found successful applications in agriculture sector, computer vision, speech recognition, recommendation systems, finance, and other fields.

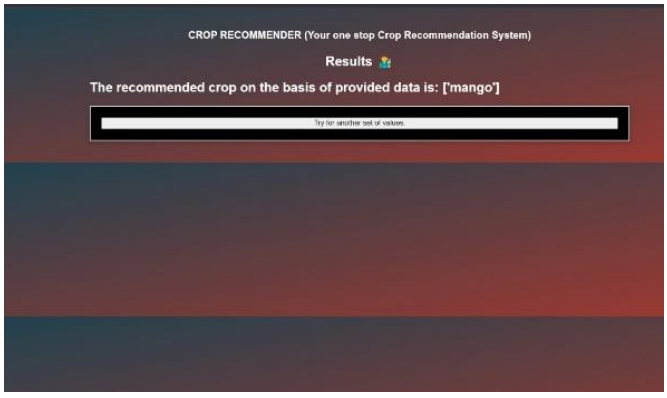
7. RESULT:

The recommended crop is displayed after processing the input data given by the user.

1. The snapshot below represents the main web page:

(Figure 7.1 : Values taken as input)

2. The snapshot below shows the result page:



(Figure 7.2 : Output- Recommended Crop)

8. CONCLUSION:

In conclusion, by considering various data sources such as soil characteristics, and weather patterns, crop recommendation systems empower farmers to make informed decisions and optimize their farming practices. The advantages of these systems include improved yield, precision farming, risk mitigation, sustainability, and data-driven decision-making.

However, it is important to acknowledge the limitations and challenges of crop recommendation systems, such as data availability and quality, local variability, interpretability, and the dynamic nature of agriculture. Addressing these limitations and ensuring continuous learning, adaptation, and collaboration with farmers and stakeholders are crucial for the future success of these systems.

Overall, crop recommendation systems have the potential to transform agriculture by optimizing resource usage, mitigating risks, increasing productivity, and promoting sustainable farming practices. As technology continues to advance and more data becomes available, these systems will play a crucial role in supporting farmers in making informed decisions and achieving better outcomes in crop production.

9. FUTURE SCOPE:

Looking ahead, the future scope for crop recommendation systems involves integrating advanced technologies, such as remote sensing and IoT, advancements in ML and deep learning algorithms, personalization and context-aware recommendations, blockchain for data security and traceability, and real-time decision support. Additionally, the adoption of explainable AI and the creation of collaborative platforms for knowledge sharing can further enhance the effectiveness and acceptance of crop recommendation systems.

The future scope for crop recommendation systems lies in leveraging advanced technologies, integrating diverse data sources, personalizing recommendations, ensuring data security and traceability, and providing real-time decision support to farmers. These advancements can contribute to improved agricultural productivity, resource efficiency, and sustainable farming practices.

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