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# SMART AGRICULTURE : CROP PREDICTION AND RECOMMENDATION USING ARTIFICIAL NEURAL NETWORKS

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**ABSTRACT**

As a coastal state, Tamil Nadu faces uncertainty in agriculture which decreases its production. With more population and area, more productivity should be achieved but it cannot be reached. Farmers have words-of-mouth in past decades but now it cannot be used due to climatic factors. Agricultural factors and parameters make the data to get insights about the Agri-facts. Growth of IT world drives some highlights in Agriculture Sciences to help farmers with good agricultural information. Intelligence of applying modern technological methods in the field of agriculture is desirable in this current scenario. Machine Learning Techniques develops a well-defined model with the data and helps us to attain predictions. Agricultural issues like crop prediction, rotation, water requirement, fertilizer requirement and protection can be solved. Due to the variable climatic factors of the environment, there is a necessity to have a efficient technique to facilitate the crop cultivation and to lend a hand to the farmers in their production and management. This may help upcoming agriculturalists to have a better agriculture. A system of recommendations can be provided to a farmer to help them in crop cultivation with the help of data mining. To implement such an approach, crops are recommended based on its climatic factors and quantity. Data Analytics paves a way to evolve useful extraction from agricultural database. Crop Dataset has been analyzed and recommendation of crops is done based on productivity and season.

## 1. INTRODUCTION

### 1.1. INTRODUCTION

Smart agriculture is transforming traditional farming by integrating advanced technologies to enhance productivity, sustainability, and decision-making. With the growing challenges of climate change, soil degradation, and fluctuating crop yields, farmers increasingly require intelligent systems that can analyze complex agricultural data and provide accurate guidance. Artificial Neural Networks (ANNs) offer powerful predictive capabilities by learning patterns from historical and environmental data such as soil properties, weather conditions, and crop characteristics. By leveraging ANNs for crop prediction and recommendation, smart agriculture systems can help farmers choose the most suitable crops, optimize resource usage, and improve overall yield outcomes. This data-driven approach not only supports smarter farming decisions but also significantly contributes to sustainable agricultural development. As a coastal state, Tamil Nadu faces uncertainty in agriculture which decreases its production.

With more population and area, more productivity should be achieved but it cannot be reached. Farmers have words-of-mouth in past decades but now it cannot be used due to climatic factors. Agricultural factors and parameters make the data to get insights about the Agri-facts. Growth of IT world drives some highlights in Agriculture Sciences to help farmers with good agricultural information. Intelligence of applying modern technological methods in the field of agriculture is desirable in this current scenario. Machine Learning Techniques develops a well-defined model with the data and helps us to attain predictions. Agricultural issues like crop prediction, rotation, water requirement, fertilizer requirement and protection can be solved.

Due to the variable climatic factors of the environment, there is a necessity to have a efficient technique to facilitate the crop cultivation and to lend a hand to the farmers in their production and

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management. This may help upcoming agriculturalists to have a better agriculture. A system of recommendations can be provided to a farmer to help them in crop cultivation with the help of data mining. To implement such an approach, crops are recommended based on its climatic factors and quantity. Data Analytics paves a way to evolve useful extraction from agricultural database. Crop Dataset has been analyzed and recommendation of crops is done based on productivity and season In the previous years, informal online communities like Face book and YouTube have become progressively common platform in an individual person's day to day life. People use social media as a virtual community platform to stay in touch with friends and family and to also share thoughts and ideas in blogs.

Crop production depends on many agricultural parameters. Proposed work is based on the production of crops in previous years, crops can be recommended to the farmers. This kind of suggestions will make farmer to know that whether that particular is yielding a good production in recent years. Production o f crops may become less due to any crop disease, water problem and many other factors. While considering about the production, farm ers may get knowledge about which crop is in high volume in the market in that year. Based on this farmer can take decision o f trend on crops in recent years. Farmers will be given recommendation by considering the season of crop production. Tamilnadu Agriculture Dataset of about 1,20,000 records were taken. It contains fields like crop year, crop name, District, Season, A reacultivated and production. Recommendations were given to user based on the production of crops, season when the crops cultivated. Recommender systems have lent its hands to users to choose items they like. Recommendation system is the approach to provide the suggestions to the users of their interest

This can be practiced for agricultural use too. Based upon the factors o f agriculture, farm ers are given with ideas for their cultivation process. New techniques to increase crop cultivation can also be recommended. Pesticides, fertilizers can also be recommended. Hybrid Recommender system built by AgajiIorshase to recommend agricultural products solves issues like serendipity, ratio diffusion and ramp-up. M any crop prediction yield models have been developed. Clustering approaches such as k-means, km eans++ are used to perform grouping of data as clusters to predict crop yield is used. Tripathy et al., provided a system to have management of pesticides for crop cultivation using data mining process. Essential parameter for agriculture analysis is nature o f soil. Diverse varieties o f soil are available in this India. Crops are cultivated depending on the type of soil in the land. The role o f soil in im proving crop cultivation is discussed.

Data mining techniques are applied to analyze the soil parameter. Naive Bayes techniques are applied which produces m ore reliable results in analyzing red and Black soil. Impact of parameters o f agriculture in crop management is studied to improve productivity [5]. Neural networks, soft computing, big data and fuzzy logic methods are being used to examine the agricultural factors. Pritam Bose developed a SNN model to have a spatiotemporal analysis with crop estimation.

### 1.2. PROJECT OBJECTIVE

- Agriculture is highly affected by climatic uncertainty, reducing productivity.
- Traditional knowledge is no longer reliable due to rapid environmental changes.
- Machine Learning and Data Analytics enable accurate predictions in agriculture.
- Crop recommendation systems use data patterns to suggest optimal crops based on climate and productivity.
- The study analyzes crop datasets to provide seasonal and productivity-based recommendations for farmers.

## 2. SYSTEM ANALYSIS

### 2.1. EXISTING SYSTEM

Farmers rely on traditional experience and manual decision-making. Crop selection is based on intuition rather than scientific data. Lack of structured guidance for crop cultivation based on

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climate and soil factors. Agricultural predictions are not automated; they depend on human expertise. Limited use of advanced analytics or machine learning in current systems

### 2.1.1. Disadvantages

- Inaccurate crop selection due to changing climatic conditions.
- High risk of crop failure and low productivity.
- No real-time or data-driven recommendations available to farmers.
- Decision-making is slow, inconsistent, and not scalable.
- Poor utilization of available agricultural data.

## 2.2. PROPOSED SYSTEM

The proposed Smart Agriculture Crop Prediction and Recommendation System utilizes an Artificial Neural Network (ANN), specifically a Multi-Layer Perceptron (MLP), to automate the selection of optimal crops by modeling complex, non-linear relationships between environmental and soil parameters. The system architecture begins with a Data Acquisition Layer that gathers critical features—including soil nutrient levels (Nitrogen, Phosphorus, Potassium), pH values, temperature, humidity, and rainfall—sourced from IoT sensors or historical meteorological datasets. These inputs undergo a Preprocessing Phase involving normalization and outlier removal to ensure data consistency before being fed into the ANN. The neural network itself consists of an Input Layer, multiple Hidden Layers (often employing ReLU activation for feature extraction), and an Output Layer utilizing a Softmax function for multi-class classification. During training, the model optimizes its weights through back propagation to minimize prediction error, ultimately outputting a ranked recommendation of the most suitable and profitable crops for a specific plot of land.

### 2.2.1. Advantages

- Accurate and data-driven crop selection improves productivity.
- Reduces risk of crop failure caused by climate variability.
- Provides personalized recommendations to farmers.
- Enhances decision-making with scientific insights.
- Saves time and effort compared to manual planning.
- Supports sustainable agriculture and future agriculturalists.

## 3. SYSTEM DESIGN

### ARCHITECTURE DESIGN

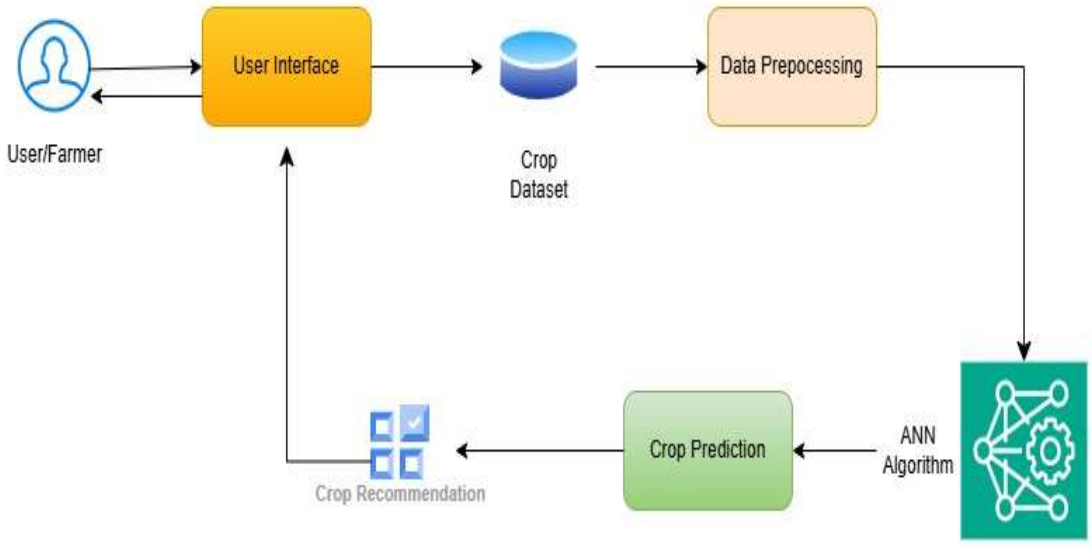

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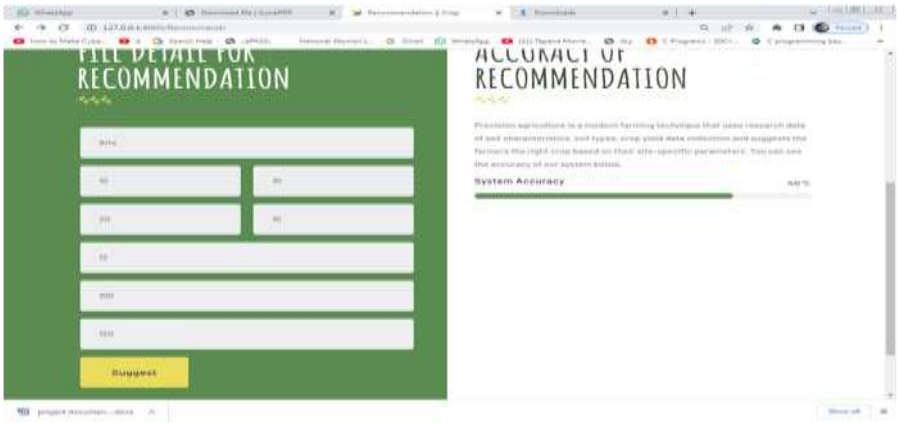
**Fig 1: Architecture Design**

## MODULES DESCRIPTION

**Data Collection** Agricultural data is collected from reliable sources such as government agricultural records. The dataset contains Crop name, Season, Year, Production.
**Data Processing** Raw data is organized into a structured format. Unnecessary attributes are removed. Data is prepared in a form suitable for machine learning and soft computing algorithms.
**ANN Model** : This module trains ANN using historical data, adjusting weights through back propagation, and produce trained module.
**Prediction Module :** The prediction module acts like a smart decision-making engine that predicts the best crops based on environmental and soil conditions.
**Recommendation Module** : The Recommendation Module provides the final crop suggestion to the farmer based on the prediction results.

## 4. SCREEN SHOTS


**Screen : Details to Be Input as per formered paramter**




**Screen : Input Farmer Parameters**

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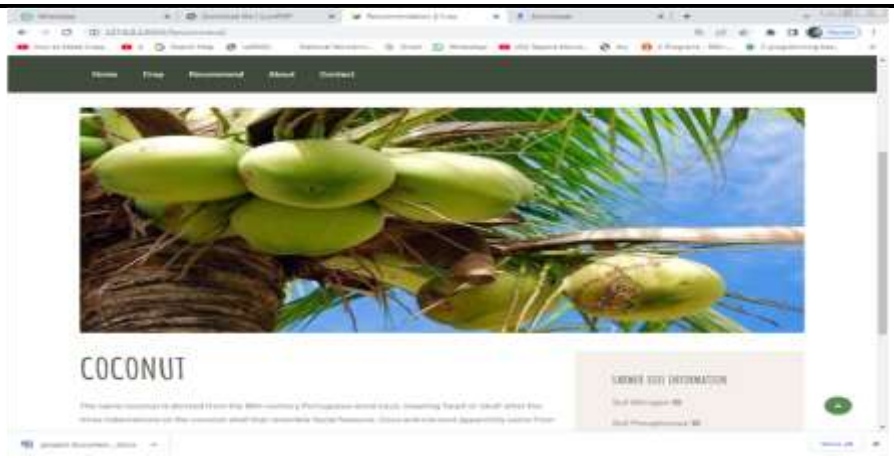


**Screen : Crop Predicted as Per User Input**

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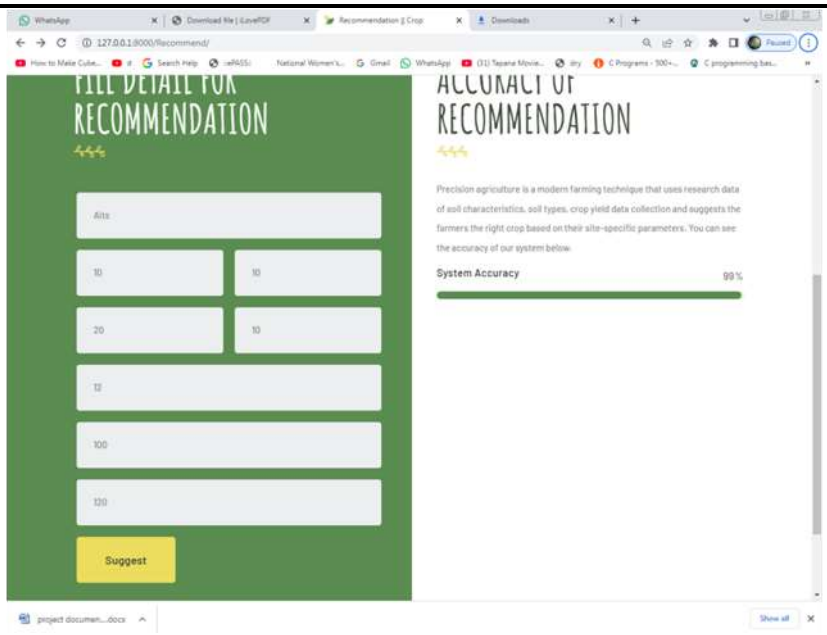


**Screen : Accuracy Predicted**

## 5. CONCLUSION

The Smart Agriculture system for Crop Prediction and Recommendation using Artificial Neural Networks (ANN) demonstrates the potential of artificial intelligence in transforming traditional farming practices into data-driven decision-making processes. By analyzing critical parameters such as soil nutrients (N, P, K), temperature, humidity, rainfall, and pH values, the ANN model effectively predicts suitable crops and provides accurate recommendations to farmers. This approach enhances crop productivity, optimizes resource utilization, reduces input costs, and minimizes the risk of crop failure. The system supports sustainable agricultural practices by enabling farmers to make informed decisions based on predictive analytics rather than intuition alone. Overall, the integration of ANN in agriculture contributes to improved yield quality, economic growth, and technological advancement in the farming sector. The future scope of this system includes integrating real-time IoT sensor data, satellite imagery, and weather forecasting APIs to further enhance prediction accuracy and adaptability to changing environmental conditions. Advanced deep learning models such as CNNs and hybrid architectures can be explored for improved performance. The system can also be expanded to include pest and disease prediction, fertilizer optimization, irrigation scheduling, and market price forecasting. Deploying the solution as a mobile or cloud-based application will increase accessibility for farmers in rural areas. Additionally, incorporating explainable AI techniques can improve transparency and trust in recommendations, paving the way for large-scale adoption of intelligent agriculture systems

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## 6. FUTURE ENHANCEMENTS

The offline and online Imagery data of North Dakota, United States Imagery for North Dakota, as our study taken Live Landsat and Offline data for the North Dakota, United States will be downloaded from ADSV Satellite Facility (Alaska Data Search Vertex) and pre-processed as per the steps mentioned in this article. The pre-processing of the imagery data from Landsat and Offline images can be performed using Batch Processing. As project achieved a good test accuracy using CNN and ANN methods. Further, we need to study pre-processed images of the same polarization with different dates preferably at a gap of say two or three months. As different dates data to be studied for Variation analysis over time considerably over different areas needs to be studied. After, initial Imagery pre-processing scripts will be built using python for further processing and classification. As our designed calculations are used to know the test accuracy and acreage of various crops calculation.

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