Agricultural Crop Recommendations Based on Productivity and Season

Mrs. Samundeeswari. K[1], Dr. Aysha Banu.B[2], M. Harini Priya[3], S.S. Deepika[4], A. Srikavi[5]
Department of Information Technology, Mohamed Sathak Engineering College, Kilakarai, Tamil Nadu,India

***Abstract*—As a coastal state, Tamil Nadu faces agricultural uncertainty due to climatic factors, limiting productivity despite its large population and area. Traditional word-of-mouth practices are no longer effective. Agricultural parameters generate data that can offer valuable insights. The growth of IT has impacted Agricultural Sciences, aiding farmers with better information. Modern technological methods, especially Machine Learning, are essential today. These techniques build models to predict and address issues like crop prediction, rotation, water and fertilizer needs, and crop protection. Due to changing climate, efficient techniques are needed to support cultivation and assist farmers. This can benefit future agriculturalists. A recommendation system, using data mining, can guide farmers in crop cultivation based on climatic factors and quantity. Data Analytics enables effective extraction from agricultural databases, and crop datasets are analyzed to recommend crops based on productivity and season.**

1. INTRODUCTION

The "Agricultural Crop Recommendations Based on Productivity and Season" project aims to optimize agricultural practices by providing tailored crop suggestions based on specific environmental factors such as soil conditions, climate, and seasonal variations. By analyzing data on crop productivity, weather patterns, and regional characteristics, the project seeks to identify the most suitable crops for different seasons and farming locations. This approach enhances yield efficiency, reduces the risk of crop failure, and ensures sustainable farming practices.

By integrating modern technology, this initiative provides farmers with data-driven insights to make informed decisions, ultimately improving food security and economic stability within agricultural communities.

2. EXISTING SYSTEM

Several studies have explored the use of data-driven approaches in agriculture. Tripathy et al. proposed a system for pesticide management in crop cultivation using data mining techniques. Pritam Bose developed a Spiking Neural Network (SNN) model for spatiotemporal crop analysis and estimation. Additionally, Shreya S. Bhamose introduced a Crop and Yield Prediction Model using a Modified k-means clustering algorithm to estimate crop harvest volumes and water requirements, enhancing agricultural planning and resource management.

3. PROPOSED SYSTEM

Crop production depends on various agricultural parameters. The proposed work recommends crops to farmers based on previous years' production data.

These suggestions help farmers understand if a particular crop has yielded good production in recent years. Low production may result from diseases, water issues, or other factors. Considering production data also helps farmers know which crops are abundant in the market in a given year, aiding decisions based on recent crop trends. Recommendations are provided based on crop production seasons.

The project aims to recommend crops using a Decision Tree Classifier. The process involves preprocessing the provided data, using it to build the backend model, and connecting it to a UI via Flask to display the final output. production

4. SYSTEM ARCHITECTURE

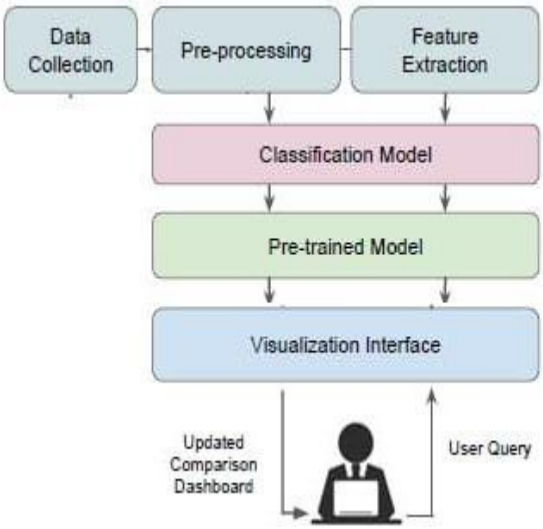

Figure 1: System Architecture

An Agricultural Crop Recommendation System based on Productivity and Season is designed to assist farmers and agricultural stakeholders in selecting the most suitable crops for cultivation, depending on seasonal patterns and expected productivity. The architecture of this system integrates multiple components to ensure accurate and data-driven recommendations. It begins with a data input layer, where diverse datasets such as soil characteristics (e.g., pH, nutrients), real-time and historical weather data, geolocation, farmer inputs, and past crop yield records are collected. This raw data is then processed in the data preprocessinglayer, which involves cleaning, normalizing, and transforming the data to create meaningful features. The core of the system is the crop recommendation engine, which uses a combination of rule-based logic and machine learning algorithms to analyze the data. This engine considers seasonal factors, climate forecasts, soil suitability, and past productivity trends to recommend optimal crops.

5. SYSTEM IMPLEMENTATION

Data Collection

This is the first crucial step in developing a machine learning model. The quality and quantity of data directly affect model performance — better data leads to better results. Data can be collected through methods like web scraping, manual input, and more. The dataset for this crop recommendation system in India was sourced externally.

Dataset

The dataset consists of 821 individual data. There are 14 columns in the dataset, which are described below. States: total number of states in India,Rainfall: rainfall in mm,Ground Water:Total ground water level,Temperature: temperature in degree Celsius, Soil type: Number of soil types**,**Season: Which season is suitable for crops,Crops: Types of crops, Fertilizers required: Types of Fertilizers required, Cost of cultivation: Total cost for cultivation, Expected revenues: Total expected revenues, Quantity of seeds per hectare: seeds for quantity per hectare,Duration of cultivation: number of day for duration of cultivation,Demand of crop: demand of crop (High, low),Crops for mixed cropping: which crop can mixed for cropping.

Data Preparation

Wrangle and clean data (remove duplicates, fix errors, handle missing values, normalize, convert types). Randomize to remove ordering effects. Visualize to find variable relationships or class imbalances. Split into training and evaluation sets.

Model Selection

A decision tree is a flowchart-like structure where internal nodes represent features, branches represent decision rules, and leaf nodes represent outcomes. The topmost node is the root node. It learns to partition data based on attribute values using recursive partitioning. This visual flowchart format aids decision-making and mimics human thinking, making decision trees easy to understand and interpret.

Decision Tree is a white-box ML algorithm that shares its internal logic, unlike black-box models like Neural Networks. It trains faster than neural networks, with time complexity depending on the number of records and attributes. Being non-parametric, it doesn't rely on probability assumptions and can handle high-dimensional data effectively.

Decision rules typically follow an if-then-else format. Deeper trees have more complex rules and are more fitted.

Terminologies: Instances: Feature vectors defining input space, Attribute: Describes an instance,

Concept: Function mapping input to output, Target Concept: The actual function to find**,** Hypothesis Class: All possible functions, Sample: Input-output pairs (Training Set), Testing Set: Used to evaluate the candidate concept's performance.

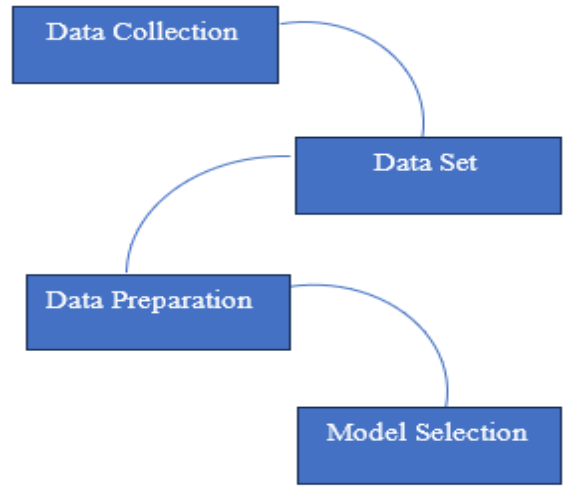

Figure 2: System implementation

6. DATAFLOW DIAGRAM

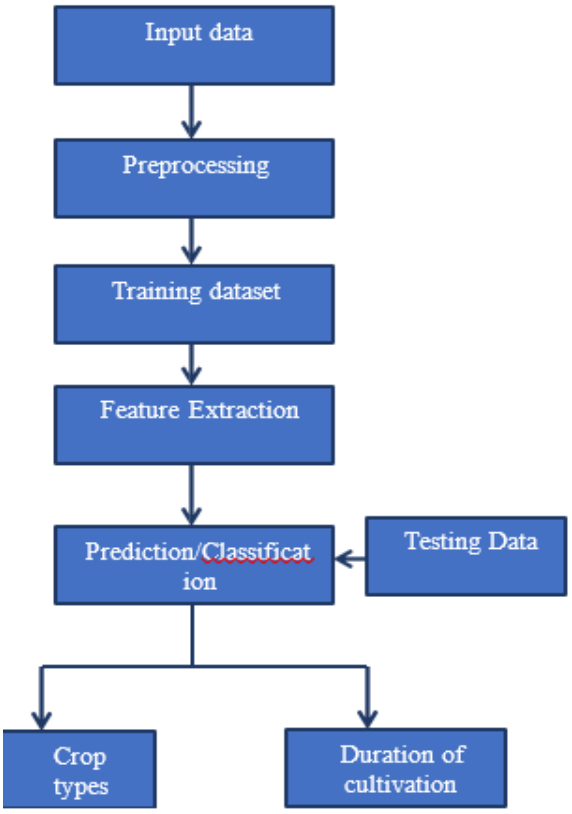

Figure 3: Dataflow Diagram

The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of the input data to the system, various processing carried out on these data, and the output data is generated by the system

The data flow diagram () is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.

DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output Monitoring and Maintenance: Post-launch, the system is continuously monitored for performance, user engagement, and technical stability. Regular updates and patches are released to improve functionality and fix issues. Feedback from users is actively collected and analyzed for system improvement.

7. SYSTEM DESIGN

The system design forAgricultural Crop Recommendations based on Productivity and Season involves a layered and modular architecture that integrates data collection, processing, analysis, and user interaction to provide tailored crop suggestions.

Output Design

The output design for an Agricultural Crop Recommendation System based on Productivity and Season is structured to deliver clear, actionable, and personalized information to farmers and agricultural advisors. The primary output is a list of recommended crops that are best suited to the user's specific location, current or upcoming season, soil properties, and climate conditions. Each crop recommendation includes detailed metadata**,** such as expected yield (productivity forecast), optimal planting and harvesting times, required soil type and irrigation needs, and estimated profitability. The output is typically ranked or scored based on suitability and projected performance, allowing users to compare

options easily. Additionally, the system can provide visual outputs**,** such as graphs showing yield trends,

seasonal calendars, and weather impact charts, to support decision-making. Outputs are designed to be interactive and user-friendly, often delivered through a mobile app or web dashboard that supports multiple languages and offline access. The system may also include alerts or notifications**;** the system can export output reports in formats like PDF or Excel for further analysis. Overall, the output design prioritizes clarity, relevance, and accessibility to ensure farmers can act confidently on the recommendations provided.

Input Design

The Input design of an Agricultural Crop Recommendation System based on Productivity and Season is crafted to deliver concise, informative, and actionable results to end-users, primarily farmers and agricultural planners. The output is generated after analyzing various inputs such as soil characteristics, climatic data, seasonal factors, and historical crop performance. It typically includes a ranked list of suitable crops**,** tailored to the user's location and current or upcoming season. Each recommended crop is accompanied by key information such as the expected yield (in tons/hectare or kg/acre)**,** ideal sowing and harvesting periods**,** required soil conditions**,** irrigation needs**,** and estimated profitability or market value**.**

8. CONCLUSION

In this paper, significance of management of crops was studied vastly. Farmers need assistance with recent technology to grow their crops. Proper prediction of crops can be informed to agriculturists in time basis. Many Machine Learning techniques have been used to analyze the agriculture parameters. Some of the techniques in different aspects of agriculture are studied by a literature study. Blooming Neural networks, soft computing techniques plays significant part in providing recommendations. Considering the parameter like production and season, more personalized and relevant recommendations can be given to farmers which makes them to yield good volume of production.

9. FUTURE ENHANCEMENT

In the future, collecting all required data by giving GPS locations of a land and by taking access from Rain forecasting system of by the government should be done, we can predict crops by just giving GPS location. Also, we can develop the model to avoid over and under crisis of the food. When the farmers sow a particular crop, there might face some issues or diseases in the crop before harvesting. In that case, they can upload the photographs of the crop and the soil report. Then the AI model can identify the problems and provide them with probable solutions. We can also provide IOT solutions through APIs virtual agents which can help the farmers connect with raw material dealers, who can provide them with the materials, required for instance seeds and fertilizers according to the crop recommended to them by the model.

REFERENCES

[1] Shreya S. Bhanose, Kalyani A. Bogawar (2016) "Crop and YieldPrediction Model", International Journal of Advance ScientificResearch and Engineering Trends, Volume 1, Issue 1, April 2016

[2] Tripathy, A. K., et al. (2011) "Data mining and wireless sensornetwork for agriculture pest/disease predictions." Information andCommunication Technologies (WICT), 2011 World Congress on.IEEE.

[3] Ramesh BabuPalepu (2017)" An Analysis of Agricultural Soils byusing Data Mining Techniques", International Journal of EngineeringScience and Computing, Volume 7 Issue No. 10 October.

[4] Rajeswari and K. Arunesh (2016) "Analysing Soil Data using DataMining Classification Techniques", Indian Journal of Science andTechnology, Volume 9, May.

[5] A.Swarupa Rani (2017), "The Impact of Data Analytics in CropManagement based on Weather Conditions", International Journal ofEngineering Technology Science and Research, Volume 4, Issue5, May.

[6] Pritam Bose, Nikola K. Kasabov (2016), "Spiking Neural Networksfor Crop Yield Estimation Based on Spatiotemporal Analysis ofImage Time Series", IEEE Transactions on Geoscience and RemoteSensing.

[7] PriyankaP.Chandak (2017)," Smart Farming

System Using DataMining", International Journal of Applied Engineering Research,Volume 12, Number

[8] Vikas Kumar, Vishal Dave (2013), "KrishiMantra: AgriculturalRecommendation System", Proceedings of the 3rd ACM Symposiumon Computing for Development, January.

[9] SavaeLatu (2009)," Sustainable Development: The Role of GisAnd Visualisation", The Electronic Journal on Information Systemsin Developing Countries, EJISDC 38, 5, 1-17.

[10] NasrinFathima.G (2014), "Agriculture Crop Pattern Using DataMining Techniques",International Journal of Advanced Research inComputer Science and Software Engineering, Volume 4, May.