WWW.IJRPR.COM

International Journal of Research Publication and Reviews

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

RECOMMENDATION OF AGRICULTURE CROP BASED ON PRODUCTIVITY AND SEASON

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ABSTRACT:

Agriculture is an important part of India's economy, providing a livelihood to more than half the population. Unfortunately, problems like the variability of rainfall, soil depletion, variability from seasonal changes, and a climate that is steadily changing, create numerous challenges for crop productivity. Farmers usually do not have a reliable system to guide them in determining the right crop to grow, which impacts their income and, ultimately, national food security. This study proposes a Machine Learning (ML) crop recommendation system which determines the best-suited crop for farming based on productivity and seasonal variability.

It uses several algorithms: Logistic Regression, Decision Tree, K-Nearest Neighbors (KNN), Support Vector Machine (SVM), and Naive Bayes. The data set used contains details of agriculture area in the state and district, year and season, area, and production information. We evaluate a model's performance using error metrics such as Mean Square Error (MSE), Mean Absolute Error (MAE), and the R2 Score. The proposed system has a reliable accuracy and in several instances a high accuracy, ultimately helping the farmer make more effective decisions. The framework combines data mining and predictive analytics to provide a connection among traditional knowledge and the most current technology, and it illustrates a sustainable approach to agricultural planning and decision-making.

Keywords: Agriculture, Crop Recommendation, Machine Learning, Productivity, Season, Data Mining, Decision Support System

Introduction:

India is one of the largest producers of agricultural commodities in the world, but farmers are faced with a considerable amount of uncertainty from climate variability, changes in soil fertility, and reduced available water supply. In states like Tamil Nadu (the "Rice Bowl of South India"), agriculture is heavily reliant on flows from the Cauvery river system. Seasonal patterns (winter, summer, monsoon, and post-monsoon) influence crop choices, although a disconnect between crop types and climatic conditions often leads to reduced yields.

Though farmers typically relied on generational knowledge about agricultural decision-making that has been been passed down orally, this mode of information dissemination is not trustworthy now as we see quickening climate change, growing urbanization, and regular clashes with chaotic weather patterns. Farmers need suggestions or recommendations that are grounded in data and can still adapt to changes in the environment.
Machine Learning (ML) gives us sophisticated tools that we can harness to analyze a much larger agricultural data set to discover hidden patterns in the data and provide crop recommendation based on area, season, and productivity factors. This research study proposes a recommendation system to support farmers addressing these objectives using several integrative machine learning methods.

LITERATURE SURVEY

Machine learning (ML) and data mining tools have become increasingly important in digital agriculture, enabling soil analysis, crop forecasting, and yield prediction. Ongoing evaluation research broadly shows evidence of a shift from descriptive analytics to executive dashboards and predictive and recommendation systems that consider multiple factors, like soil location, weather conditions, and management practices. However, data quality, scalability, and model adaptability are still unresolved issues.

There have been several cases of researchers using computational techniques in agriculture:

- **Soil and weather type analytics**: i.e., early work (Palepu, 2017; Rajeswari & Arunesh, 2016) aimed to estimate suitable crops for soil types using a classification technique, while another type of work discussed the importance of climate variables (Swarupa Rani, 2017; Shobana & Sabitha, 2021), mentioning rainfall and temperature as two crucial components for productivity. These studies provided either soil or weather information when farmers were determining productivity but have historically treated the two types of information separately without interacting the productivity of each element.

- **A more complex crop prediction one may consider:** Tripathy et al. (2011) used wireless sensor networks in combination with data mining techniques to check pests; while Bose & Kasabov (2016) used spiking neural networks to estimate yield. These methods provided accuracy but had significant barriers of computation time and data preparation, so it may be slow to achieve a practical outcome based on their ready availability.

- **Recommendation-system-type technologies in agriculture:** both Krishi Mantra (Kumar & Dave, 2013), and various hybrid recommenders (Iorshase et al., 2015), and web-based systems (Shinde, 2015) to some degree employed recommendation system rationale from e-commerce to c agriculture. These systems continue to be static scoping recommendations and often not considering time-bound decision making for seasons, and coupled with productivity value.

- **Research gap:** The literature supports strong foundations in soil analysis, climate-aware models, and yield forecasting; however, the vast majority of systems are either unimodal (soils, or more exclusively climate), are focused on prediction not a recommendation with action, or they lack detail or adaptability across regions. There is a evident need for integrated, growing season and productivity recommendations sooner or later based on a set of environmental soil and seasonal parameters in order to produce operational information relevant to farmers. This paper is timely as we have addressed some of these areas by creating an on-demand recommendation framework focusing on productivity under seasonal conditions.

Methodology:

System Architecture

The architecture of the system is a three tier architecture.

1. Data collection Layer - The agricultural data is collected from government repositories and farmer responses to surveys**.**

2. Processing Layer - Data preprocessing and cleaning data (i.e. normalization, preprocessing, feature selection) before applying to machine learning models.

3. Recommendations Layer - The prediction results are returned and displayed via a web-based interface developed with Django ORM.

Dataset Information

The dataset contains:

•**Features -** State, District, Crop Year, Season, Crop Name, Area, Production

•**Target Variable -** Crop productivity (yield/acre).

Machine Learning Models Utilized

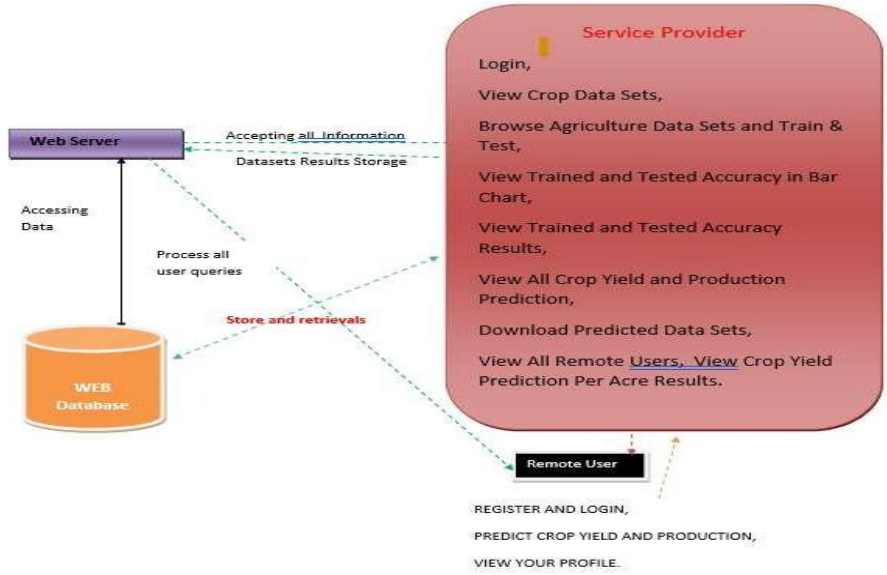
- **Naive Bayes -** A probabilistic classifier, Naive Bayes is similar to KNN, it is relevant to categorical data (i.e. crop names, seasons, and other categorical attributes in the datasets)
- **Support Vector Machine (SVM)** - An SVM classifies data into classes. An advantage of SVM is that it maximizes the margin or distance between the classes.
- **Decision Tree -** A Decision Tree is used to handle both categorical and numerical features. A decision tree is helpful for interpretation (speeding up a decision through categorization).
- **Logistic Regression -** Logistic regression classifies data in to two classes: recommended crops and non-recommended crops
- **K-Nearest Neighbors** - KNN predicts an output based on the *similarity* among seasonal and productivity trends with similar crop types

and seasons.

Evaluation Metrics

- **MSE & MAE –** Measure average prediction error.
- **Explained Variance Score –** Proportion of dataset variability explained by the model.
- **R^2 Score –** Goodness of fit, with values closer to 1 indicating high accuracy.

DESIGN



Implementation

The system will be implemented using:

- **Front-End:** HTML, CSS, JavaScript
- **Back-End:** Python (3.9) with Django ORM
- **Database:** MySQL
- **Tools:** Scikit-learn for ML models, Matplotlib/Seaborn for visualization

Interaction will occur via remote user interface by farmers or end-users which will take region, season, and crop information. The service provider module will support training the dataset, monitoring accuracy, and authorising users.

USE CASE DIAGRAM:

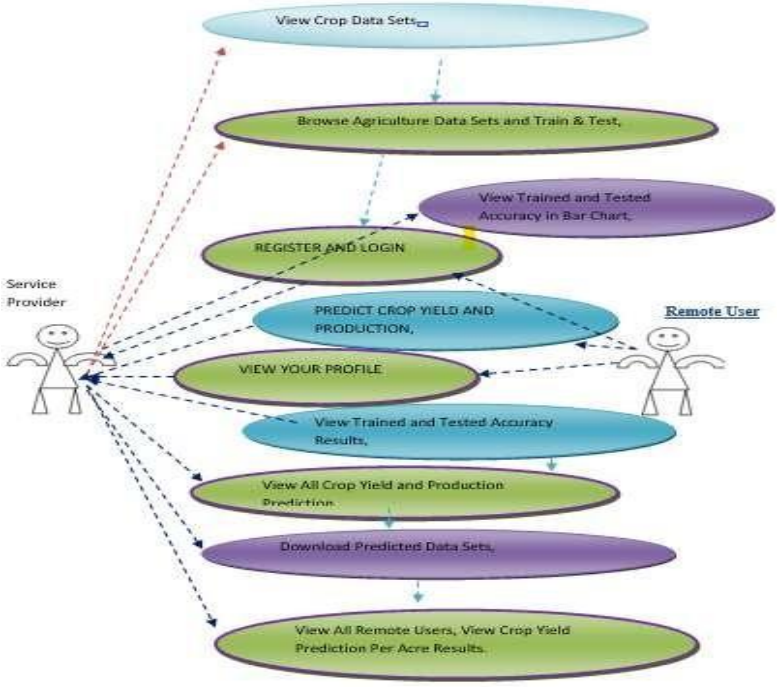
A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor.

GOALS:

The Primary goals in the design of the UML are as follows:

1.Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.

2.Provide extendibility and specialization mechanisms to extend the core concepts. Be independent of particular programming languages and development process. Provide a formal basis for understanding the modeling language.
3.Encourage the growth of OO tools market.
4.Support higher level development concepts such as collaborations, frameworks, patterns and components.
5.Integrate best practices.



Results

- **Accuracy Comparison:**
  The experimental results indicate that Decision Tree and SVM achieved the highest accuracy above the other compared models, with Logistic Regression providing moderate accuracy results and KNN sensitive to the size of the dataset.

- **Visualization**
  Bar charts were utilized to compare individual accuracy scores. Line graphs were used to visualize the effect of older crops in the prediction performance of the training and test set data. Pie charts were used to summarize the percentages of crop suitability for identified regions of interest.

- **Key Findings**
  Decision Tree models provided an accuracy of more than 85% for crop recommendations. Seasonal parameters significantly increased the overall prediction reliability when compared to soil only models. With this recommendation system Farmers will be able to have access to avoid choosing crops that are unsuitable for the environmental data gathered, ultimately increasing yield and reducing financial risk.

Figure :1 Home page

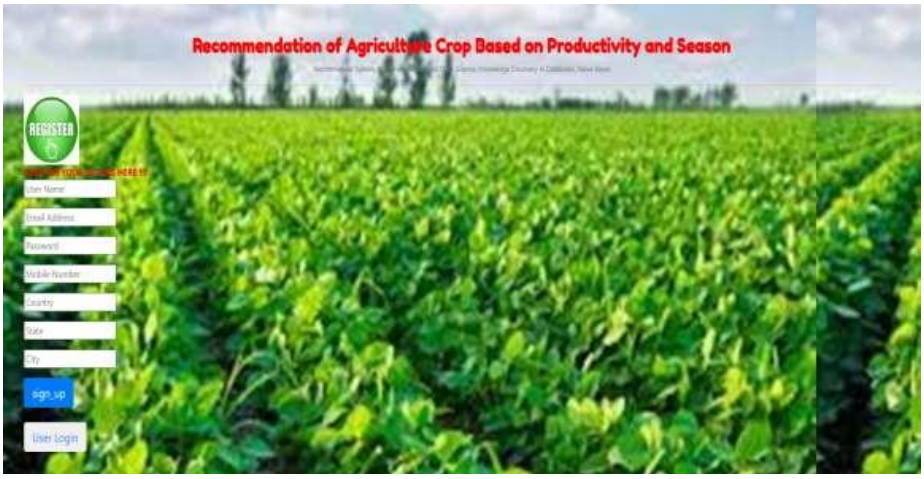


Figure : 2 Register form

Figure : 3 After registration user logged in successfully

Figure :.4 After choosing an excel file upload it

Figure :.5 After uploading the excel sheet successfully

Figure : .6 after clicking on the predict crop yielding and production

Figure : 7 remote user filling details

Figure : 8 after filling click on the predict crop yeild

Figure : 9 result of the user data

Figure : 10 user click on the log out button after getting the necessary details

Figure : 11 User profile

Figure : 12 service provider login

Figure : 13 after logging in as the service provider

Figure : 14 view of crop data sets

Figure : 15 agriculture datasets and train and test

Figure :16 view of trained and tested accuracy in bar chat

Figure :17 line chart of trained and tested accuracy results

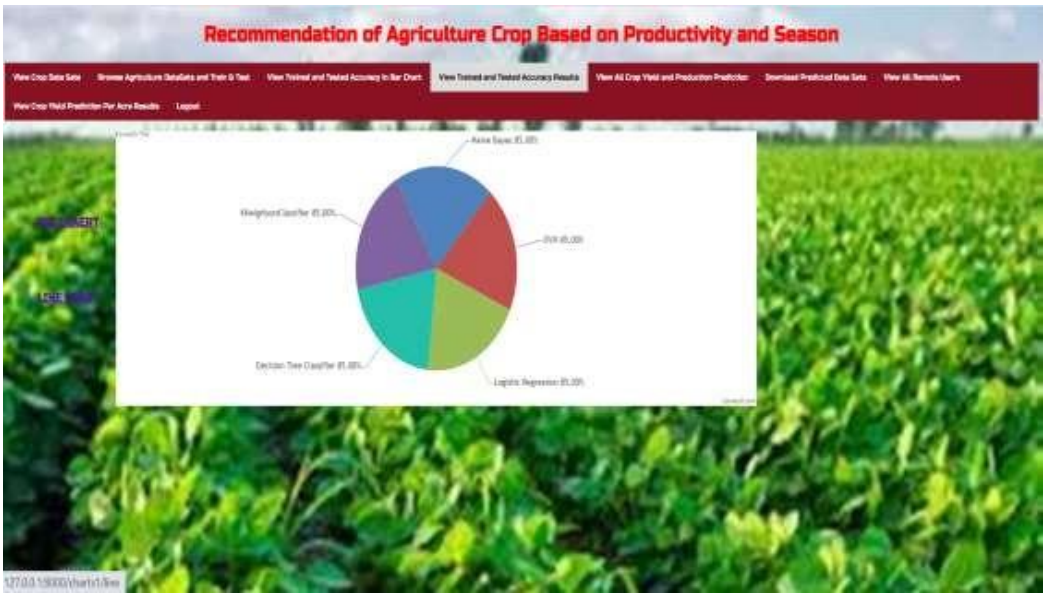


Figure : 18 pie chart of trained and tested accuracy results

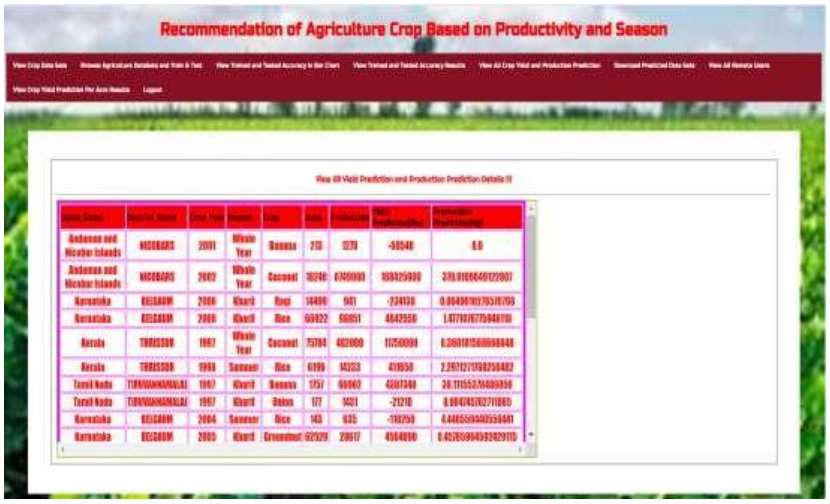


Figure : 19 view of all crop yield production prediction

Figure : 20 view of all remote users

Figure : .21 line chart of crop yield prediction per acre results

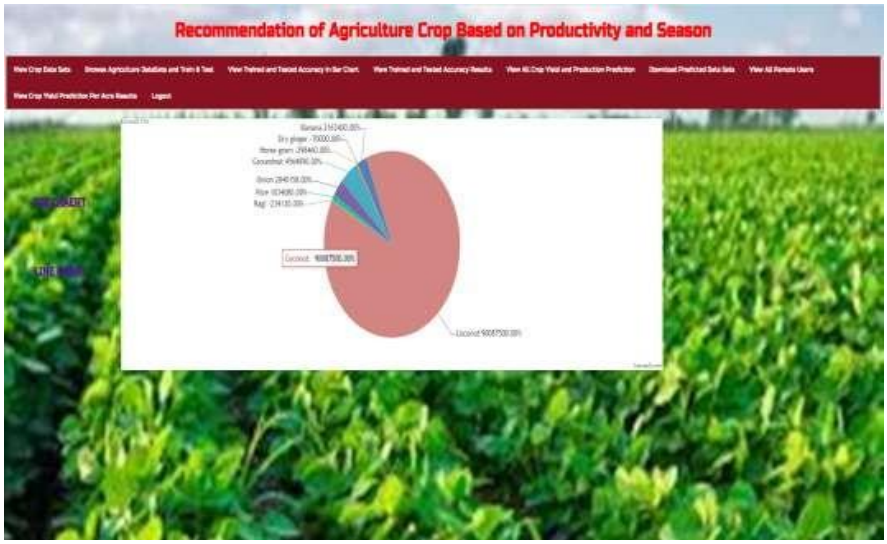


Figure : 22 pie chart of crop yield prediction per acre results

Figure : 23 after logout it returns to home page

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.

This study proposes a machine learning–based agricultural recommendation system that predicts crops based on productivity and season. Unlike existing approaches, the system draws on multiple parameters to improve accuracy and context-aware recommendations.Through experimental evaluation, it is demonstrated that model improves crop prediction and suitability, regardless of state and season. Our model can serve as a decision-support tool to facilitate crop selection in agriculture, promoting enhanced yield, developing sustainable agriculture, and informing agricultural decision-making.

REFERENCES:

List all the material used from various sources for making this project proposal

Research Papers:

1. 1.Shreya S. Bhanose, Kalyani A. Bogawar (2016) “Crop and Yield Prediction Model”, International Journal of Advance Scientific Research and Engineering Trends, Volume 1, Issue 1, April 2016
2. 2.Tripathy, A. K., et al. (2011) "Data mining and wireless sensor network for agriculture pest/disease predictions." Information and Communication Technologies (WICT), 2011 World Congress on.IEEE.

3. 3.Ramesh Babu Palepu (2017)" An Analysis of Agricultural Soils by using Data Mining Techniques", International Journal of Engineering Science and Computing, Volume 7 Issue No. 10 October.

4. 4.Rajeswari and K. Arunesh (2016) "Analyzing Soil Data using Data Mining Classification Techniques", Indian Journal of Science and Technology, Volume 9, May.

5. 5.A.Swarupa Rani (2017), "The Impact of Data Analytics in Crop Management based on Weather Conditions", International Journal of Engineering Technology Science and Research, Volume 4,Issue 5,May.

6. 6.Pritam Bose, Nikola K. Kasabov (2016), "Spiking Neural Networks for Crop Yield Estimation Based on Spatiotemporal Analysis of Image Time Series", IEEE Transactions on Geoscience and Remote Sensing.

7. 7.Priyanka P.Chandak (2017)," Smart Farming System Using Data Mining", International Journal of Applied Engineering Research, Volume 12, Number 11