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A Novel System for Recommending Agricultural Crops Using Machine Learning Approach

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Abstract - *Farmers play a crucial role in our lives. It takes usually a couple of months in advance for a crop recommendation system to predict crop yields for improved production. Crop prediction is dependent on the use of computer programs that describe in quantifiable terms the interactions between plants and their environment, as well as their soil characteristics. It is first necessary to collect a soil sample from the field for soil testing. The Maharashtra state's agricultural production is decreased as a result of uncertainty caused by its coastal location. Productivity should increase as population and area grow, but it cannot. As a result of climatic factors, farmers are no longer able to use word-of-mouth. Farmers can benefit from good agricultural information thanks to the growth of IT in the world. Therefore, in this present climate, there is a need for intelligent use of modern technology in the agribusiness sector. Crop prediction is a challenging task for farming because it depends on feature selection and classification. Using a novel framework is proposed for choosing crop characteristics, assessing crop yields through classification. The categorization algorithms employed in this approach differ from those used in other research, as they employ multiple prediction methods.*

Key Words: Agriculture, Crop Prediction, Classification, Machine Learning, Segmentation

1.INTRODUCTION

There are few countries in the world that still practice agriculture as old as India. As a result of globalization, agriculture trends have changed dramatically in recent years. In India, agriculture has been adversely affected by a variety of factors. Health has been regained through the development of many new technologies. The use of precision agriculture is one such technique. India is experiencing a boom in precision agriculture.

"Site-specific" farming is precision agriculture. The technology has helped to achieve efficient inputs, outputs, and better decisions as far as farming is concerned. There are many systems available that can determine the inputs for a specific plot of land. Precision agriculture has brought about some improvements, but it has still faced some issues. In addition to crops and fertilizers, systems can also suggest farming techniques. Precision agriculture involves the recommendation of crops. Various parameters are taken into account when recommending crops.

The economy of a country is dramatically impacted by agriculture. Natural factors are causing Agriculture farming to degrade in modern times. It is directly dependent on the environmental factors such as sunlight, humidity, soil type, rainfall, maximum and minimum temperatures, crop fertilizers, pesticides, etc. To flourish in Agriculture, one need knowledge of proper harvesting. India has seasons:

1. From December to March, there is winter
2. From April to June, there is Summer
3. Between July and September is monsoon season
4. During October and November, the post-monsoon season occurs.

Various seasons and rainfall make it necessary to determine which crops are suitable for cultivation. The management of crops, the production of crops, and the productivity from the crops pose major challenges to farmers. As more and more young people are interested in agriculture these days, farmers and cultivators need proper assistance regarding crop cultivation. Assessment of real-world problems by IT sector is increasing at a faster rate. The amount of data in agriculture is increasing every day. Agricultural data can be accessed with the advancement of the Internet of Things (IoT). In order to extract or use useful information from the spreading data on agriculture, there is a need for a system which analyzes agricultural data in an obvious way.

By combining data with machine learning techniques, we can develop a model that can be predicted based on the data. The solution to farming issues such as crop prediction, rotation, water requirements, fertilizer requirements, and protection can be found here. A reliable method for crop cultivation and management is necessary since there are variable climatic factors in the environment [14]. Agriculturalists can use this information to improve their farming. By using data mining, farmers can receive recommendations to grow their crops. Based on climatic and quantity factors, such an approach is implemented. Agricultural databases can be analysed with Data Analytics. Based on productivity and season, the crop dataset has been analysed.

2. MOTIVATION

Farming plays an important role in everyday life. Classification and feature selection play a crucial role in crop prediction in farming. The study predicts crop yield by selecting characteristics from a crop, which is then classified. Our study uses a number of categorization algorithms instead of just one prediction approach as has been used in other studies.

3. LITERATURE REVIEW

Shreya S. Bhanose, Kalyani A. Bogawar et al.[1] stated as , Farmers require support with their decisions to enhance the quality of their farming by utilizing well-defined and systematic approaches to predict crops and yields. Since crop knowledge-bases are not readily available, predicting the best crops is complex. Better quality farming and higher revenues can be achieved through crop prediction. To extract useful information and give predictions in the field of data mining, it is efficient to use data clustering. In the past, a number of approaches have been used for crop prediction. Making correct decisions with crop prediction model. Indeed, this helps farmers generate better revenue and improve farming quality. As a result of a random selection of an initial cluster center and a decision regarding the number of clusters, traditional clustering algorithms such as k-means, improved rough k-means make the task of clustering more complex. Due to the initial cluster-centric selection, the modified K-Means algorithm improves accuracy of a system.

Tripathy A.K et al.[2] elaborated, In developing countries like India, agriculture is one of the most important applications. Decisions related to agriculture are often based on data mining. Data mining is the process of extracting relevant knowledge from a set of data and converting it into a human-understandable format. Climate can have a huge impact on crop productivity in certain agriculture regions. Crop management depends on climatic conditions. In order to achieve good crop management, real-time weather data can be useful. In order to obtain knowledge and trends, information and communications technology can be used to automate the extraction of significant data, which eliminates manual processes and makes it simpler to extract data directly from electronic sources. Producing less costs, increasing yields, and raising market prices can be achieved in this way. Data mining is also used in analyzing and predicting useful patterns from vast yet dynamically changing climatic data. Researchers and engineers have developed fuzzy logic, artificial neural networks, genetic algorithms, decision trees, and support vector machines for studying soil, climate conditions, and water regimes that affect crop growth and pest control. There is a summary as well of data mining techniques, neural networks, support vector machines, big data analysis, and soft computing in agriculture in this paper.

Ramesh Babu Palepu at al.[3] said that, In developing countries such as India, agriculture is a backbone for fulfilling global food demands. It is possible to improve cultivation yields by applying data mining techniques to agriculture, especially soils, by revising pledge making situations and improving pledges. Several issues related to agriculture require soil analysis for resolution. There are several data mining techniques discussed, along with their related work, by several authors in context to soil analysis in this paper. Soil analysis uses very current data mining techniques.

Rajeswari et al.[4] given as, Agriculture relies heavily on soil. Using data mining classification techniques, the work will predict soil type. Methods used are JRip, J48, and Naive Bayes are used to predict soil type through data mining classification techniques. Two types of soil are taken into consideration when using these classifier algorithms, namely Red and Black soils. This data can be better modelled using JRip and Kappa Statistics were raised in the forecast.

Vikas Kumar et al.[8] given in their paper, CT has become a primary need for humans due to the evolution of Web 2.0. Farmers lack agricultural knowledge. Farmers and experts can communicate through ICT. Using spatial data and agricultural knowledge bases, a semantic web architecture for generating agricultural recommendations is proposed by the authors. In response to climate conditions and geographic data, our knowledge base will send recommendations to farmers. In order to find out information regarding a specific crop, farmers send queries to a query engine. GIS data and crop knowledge bases may be accessed in a query. On a mobile device, the query's results are displayed.

Additionally, it was found that data mining aids in the analysis and prediction of useful patterns from vast and constantly changing climatic data. Fuzzy logic, artificial neural networks, genetic algorithms, decision trees, and support vector machines have been developed by agricultural and biological engineers to study soil, climate, and water conditions related to crop growth and pest management. This study summarizes the use of Soft Computing, Big Data analyses, Neural Networks and Support Vector Machines in the agriculture field based on weather conditions. [10].

Table -1: Review of Existing Methods

Author and Year	Methodology	Advantages	Limitations
Shreya S. Bhanose et al. [1] 2021	Modified K-Means algorithm	Improves Accuracy	Using limited training data, for training
Tripathy A.K et	ANN with Fuzzy system	Eliminates manual	Limiting parameters

Author and Year	Methodology	Advantages	Limitations
al.[2] 2019		extraction of the data	and their effects
Ramesh Babu Palepu at al.[3] 2019	Data Mining	Helps to Improve cultivation yields	Sample Size
Rajeswari et al.[4] 2018	JRip, J48 and Naïve Bayes	Easy classification will be done	Further improvement and reduction of computation time
A. Swarupa Rani et al. [5] 2020	Enhanced SVM	Elaborates the Application in terms of agricultural field	Memory limitations
Vikas Kumar et al.[8] 2021	IoT Based Web 2.0	Uses spatial data and agricultural knowledge bases	Not Applicable
Ramesh A. Medar et al.[11] 2019	Data Mining Techniques	Detailed Examination of the Various Techniques are carried out	More Computational time needed

4. EXISTING METHODOLOGY

Using the data mining process, Tripathy et al. described how pesticides can be managed during crop cultivation. In order to apply a spatiotemporal analysis to crop estimation, Pritam Bose developed an SNN model. Modified k-means clustering algorithm was used by Deshpande Radhika and others [13] to predict harvest and water requirements for crops.

4. 1 Drawback of Existing Approach

- There was no consideration of other parameters or states in the existing system.
- Build time is slower.
- Complicated.
- Costly from a computational point of view

5. PROPOSED METHODOLOGY

A number of agricultural parameters influence crop production. A recommendation can be made to the farmer based on previous years' crop production. The farmer will be able to determine whether a certain crop has been yielding a good yield recently by this kind of suggestion. Several factors can reduce crop production, including crop disease, water problems, and many others. Farmers may be able to obtain useful information about the crop in high demand on the market during that year while examining the production. The farmer can use this information to determine the trend in crops in recent years. Based on the crop production season, farmers will receive recommendations.

5. 1 Advantages of Proposed Approach

- As opposed to the existing system, which considers a single state, our proposed system considers all the states of India.
- It is possible to extract these recommendations for educating the farmers. Farmers are given a better understanding of crops to cultivate through pictorial representations.
- Normalization and scaling are not required
- Interpretation is simple and easy to understand

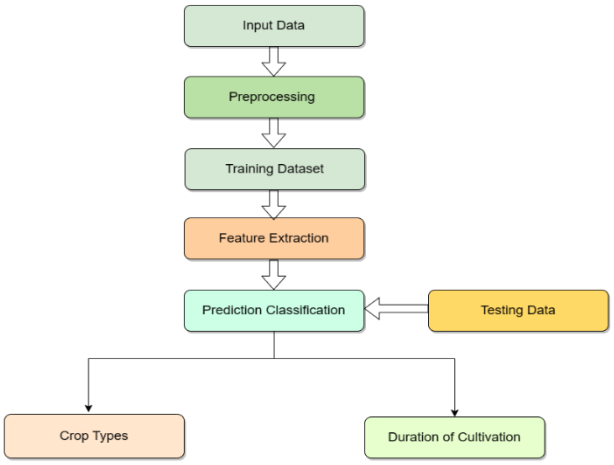

Fig -1:Proposed Method

5. 2 Machine Learning

Machine Learning is the process of learning from examples without being explicitly programmable. The purpose of machine learning is to predict an outcome that can be used to make useful decisions by combining data with statistical tools. Data-driven machines can produce accurate results by learning from data (i.e., example). A close relationship exists between machine learning and data mining [14]. Using an

algorithm, the machine formulates answers from data. Recommendations are typically provided by machine learning. In order to personalize recommendations, tech companies use unsupervised learning.

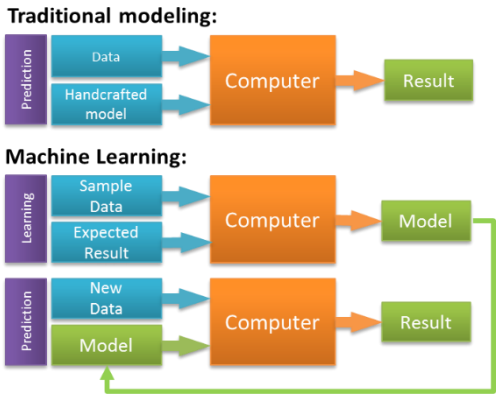

Fig -2: Traditional Modeling vs Machine Learning

(Source:https://www.azavea.com/blog/2017/09/21/building-inspection-prediction/)

5.3 Working of ML

All the learning happens in machine learning. Machines learn similarly to humans. Experience is the key to human learning. We are better able to predict the future when we know more. We are less likely to succeed when dealing with an unknown situation than when dealing with a known one. The same training is given to machines. In order for the machine to make an accurate prediction, it needs to see an example. Machines can predict outcomes when given similar examples. Like humans, the machine has difficulty predicting if it is fed an unseen example [15].

The learning and inference process are at the core of machine learning. In order to learn, a machine must discover patterns first. Data scientists must be careful when choosing which data to feed to the machine. In solving a problem, a feature vector consists of the attributes that go into the problem. The feature vector can be thought of as a subset of data that addresses a particular issue. The machine simplifies the reality and transforms it into a model using some fancy algorithms. Consequently, a model is developed by describing and summarizing the data.

Here are the points that summarize the lifecycle of Machine Learning programs:

1. Question definition
2. Data collection
3. Data visualization
4. Algorithm training
5. Algorithm testing
6. Feedback collection
7. Algorithm refinement
8. Repeat steps 4-7 until satisfied with the results
9. Make a prediction based on the model

It applies new data sets to the algorithm once it becomes adept at drawing the right conclusions.

5.4 Supervised Learning

To learn the relationship between inputs and outputs, algorithms use training data and human feedback. An analyst can predict sales of cans by using marketing expenses and weather forecasts, for example. When you know the output data, you can use supervised learning. Predicting new data will be the task of the algorithm.

Supervised learning can be divided into two categories:

1. Performing classifications
2. Performing regressions

5.5 Unsupervised Learning

It involves exploring input data without being given a clear output variable (for example, to identify patterns from customer demographic data). The algorithm will classify the data for you if you do not know how to classify the data.

6. EXPERIMENTAL RESULTS

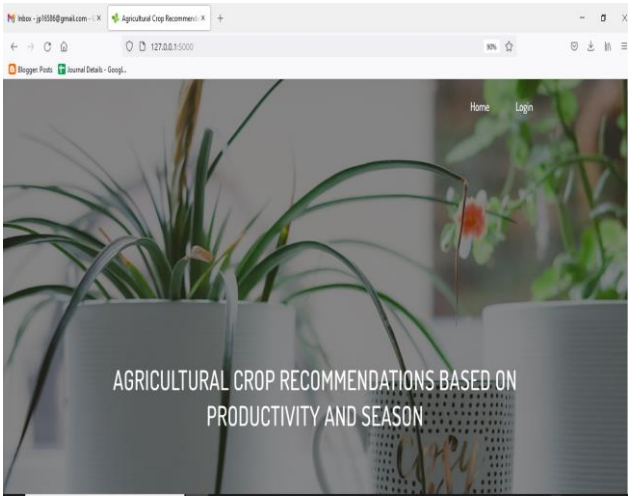

Fig-3: Home Screen

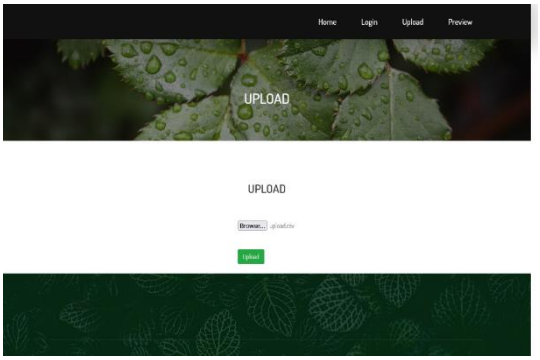

Fig-4: Upload File

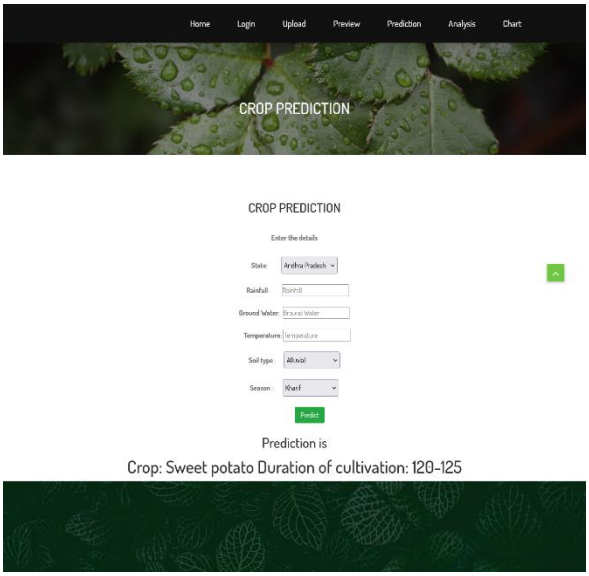

Fig-5: Prediction Result

Fig-6: Performance Aanlysis

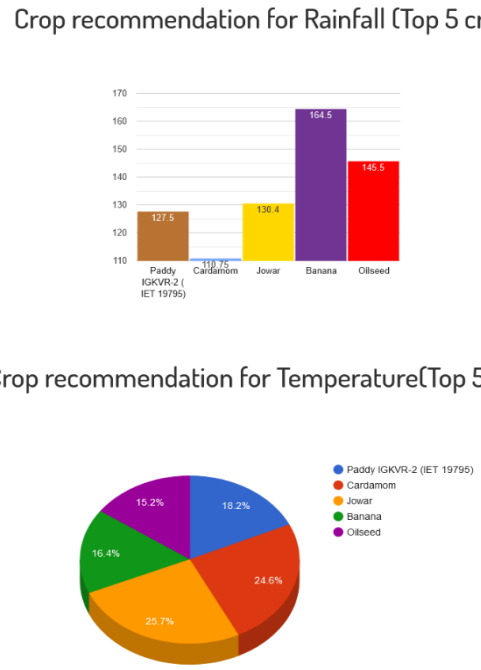

Fig-7: Crop Recommendation for Waterfall and Temperature

CONCLUSION

The latest technology can assist farmers in growing their crops. Agriculturalists can be informed of accurate predictions of crops in a timely manner. Analysing agriculture parameters has been done using a variety of Machine Learning techniques. In a literature review, different agricultural techniques are examined. Farmers can receive personalized and relevant recommendations based on parameters such as production and season, resulting in good crop yields.

REFERENCES

[1] Shreya S. Bhanose, Kalyani A. Bogawar (2021) "Crop And Yield Prediction Model", International Journal of Advance Scientific Research and Engineering Trends, Volume 1,Issue 1, April 2021

[2] Tripathy, A. K., et al.(2019) "Data mining and wireless sensor network for agriculture pest/disease predictions." Information and Communication Technologies (WICT), 2019 World Congress on. IEEE.

[3] Ramesh Babu Palepu (2019) " An Analysis of Agricultural Soils by using Data Mining Techniques", International Journal of Engineering Science and Computing, Volume 7 Issue No. 10 October.

[4] Rajeswari and K. Arunesh (2018) "Analysing Soil Data using Data Mining Classification Techniques", Indian Journal of Science and Technology, Volume 9, May.

[5] A.Swarupa Rani (2020), "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] 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] Priyanka P.Chandak (2017)," Smart Farming System Using Data Mining", International Journal of Applied Engineering Research, Volume 12, Number 11.

[8] Vikas Kumar, Vishal Dave (2021), "KrishiMantra: Agricultural Recommendation System", Proceedings of the 3rd ACM Symposium on Computing for Development, January.

[9] SavaeLatu (2019), "Sustainable Development : The Role Of Gis And Visualisation", The Electronic Journal on Information Systems in Developing Countries, EJISDC 38, 5, 1-17.

[10] Nasrin Fathima.G (2018), "Agriculture Crop Pattern Using Data Mining Techniques", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, May.

[11] Ramesh A.Medar (2019), "A Survey on Data Mining Techniques for Crop Yield Prediction", International Journal of Advance Research in Computer Science and Management Studies, Volume 2, Issue 9, September.

[12] L. Anand et al., "Development of machine learning and medical enabled multimodal for segmentation and classification of brain tumor using MRI images," Computational Intelligence and Neuroscience, vol. 2022, pp. 1–8, Aug. 2022. doi:10.1155/2022/7797094

[13] Deshpande Radhika, Bhalekar Dipali, Mutkule Prasad, Sanjay Pandhare, Nawale Akshay(2015) , "One Stop Solution for Farmer Consumer", Interaction, IJCA Proceedings on National Conference on Advances in Computing NCAC.

[14] Mutkule Prasad R., "Interactive Clothing based on IoT using QR code and Mobile Application", International Journal of Scientific Research in Network Security and Communication, vol. 6, issue-6, 2018.

[15] P. Mutkule and M. Ankoshe, "A survey on interactive clothing based on IOT using QR code and Mobile Application," International Journal of Computer Sciences and Engineering, vol. 6, no. 6, pp. 652–654, Jun. 2018. doi:10.26438/ijcse/v6i6.652654