CROP YIELD RECOMMENDATION SYSTEM BASED ON PRODUCTIVITY USING MACHINE LEARNING ALGORITHM

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ABSTRACT:

A limitless measure of the population of India considers farming as its primary occupation. The production of crops plays an crucial part in our country. Farming is a spinal cord for an enhancing financial system in India and there is an enormous need to maintain the agricultural financial development. It is a consequential contribution towards the economic and agricultural prosperity of the countries across the world. Low production of crops is often due to unpredictable whether condition. The motto of this paper is to propose an ML (machine learning) based agriculture system that can assist farmers or agriculturist in prediction of crop yield condition. The data sensed by these sensors is stored on the microcontroller and analyzed using machine learning algorithms like random forest and light GBM based on which suggestions for the growth suitable crops are made. Based on different condition of field factors we recommend the crops.

KEYWORDS:

crop prediction, crop recommendation, machine learning, support vector machine(SVM),random forest, decision tree, k-nearest neighbor(KNN).

INTRODUCTION:

Agriculture is crucial area for the Indian economy and human survival. It is one of the primary occupation which is essential for human life. Similarly, it contributes a wide part to our day to day life .In most cases agriculturist commit suicide due to production loss because they are not able to pay the bank loans taking for farmers purposes. We have perceived in present times that the climate is changing persistently which is harmful to the crops and leading agriculturist towards debts and suicide. Precision agriculture plays an significant role in the recommendation of crops.

The recommendation of crop is dependent on various parameters.Machine learning focuses on the algorithm like supervise, unsupervised and reinforcement learning and each of them has its advantages and disadvantages.

This paper aims to recommend the most suitable crop based on input parameters like Nitrogen (N),Phosphorous(P), Potassium(K),PH value of the soil, Humidity, Temperature, and Rainfall . This paper predicts the accuracy of the future productions of the crops like rice, maize, mango, wheat, turmeric, banana etc….Various supervised machine learning approaches used in India to recommend the most suitable crops.The dataset contains various parameters like Nitrogen(N),Phosphorous(P),Potassium(K), PH value of soil,Humidity,Temperature and rainfall.This proposed system applied various kinds of machine learning like KNN(K nearest neighbor),Support Vector Machine(SVM),Random Forest(RF),Decision trees and Light GBM.

DATA COLLECTION:

The data related to the environmental factors like rainfall, climate, temperature, soil type, season and varieties are collected from the government website like www.tnagrisnet.tn.gov.in and www.tnau.in provides extensive paddy data.

The important attributes of the datasets are

Soil type: red soil(62%),black soil(12%),laterite soil(3%),coastal soil(7%).

Average rainfall: Rainfall variations immensely affects soil water accessibility to crops from season to season

Temperature: Dominates plant growth and development.

LITERATURE REVIEW

YEAR	AUTHOR	TITLE OF THE PAPER	ALGORITHM/METHODOLOGIES/ TECHNIQUES	FINDINGS
2019	Konstantinos G.Liakos	Machine learning In agriculture: A Review	ANN Algorithm	Machine learning is used for predict the future demand
2020	Shreya S. Bhanose, Kalyani A. Bogawar	Crop and yield prediction model	KNN Algorithm	Crop yield condition is predicted
2020	Avinash Jain, Kiran Kumar	Application of recommendation engines in agriculture	COLLABORATIIVE FILTERING RECOMMENDATION ALGORITHM	Its used for recommendation of agriculture using collaborative filter
2021	Rajeswari and K.Arunesh	Analysing Soil Data using Data Mining Classification Techniques	HYBRID RECOMMENDATION ALGORITHM	Its predict the soil conditions

COMPARATIVE STUD

Types of crops	Attributes	Datasets	Methodology	Accuracy
Various crops	Temperature Rainfall, Humidity, pH	Kaggle website	RF,DT	RF gives best accuracy result
Rice,Jowar,Wheat, Soya beans,Sun flower,Cotton Sugar cane,Tobacco,Onion Dry chilli	Soil nutrients, location, data, weather information, temperature, humidity, Atmospheric pressure	Online sources	SVM,RF	SVM=99.47% RF=97.48%
Groundnut,pulses, cotton,vegetable, paddy	Soil characteristics,soil types,weather	Nagpur, Maharashtra, India	RF,CHAID,KNN,NB	RF gives accuracy result
Millet, groundnut , pulses, cotton, vegetables, Banana, Paddy, Sugarcane, Coriander	Soil characteristics, Soil types	Madurai, Tamilnadu, India	RF,CHAID,KNN,NB	RF=88%
Rice, Ragi, Gram, Potato, Onion	Precipitation, Cloud cover, Area, Pressure, Season	Andhra pradesh	RF,LR,DT,SVM	MV=94.78%
Millet,Groundnut,Pulses,Cotton,Vegetables,Banana,Paddy, Coriander	Soil characteristics, Soil types, Crop yield, Data collection	Online sources	RT,KNN, NB	RT gives the best accuracy result
Various crops	Seasonal soil, weather	Database server	CHAID,KNN,K means, DTNN,NB, LAD	SVM gives best accuracy results
Bajra,Jowar,Maize, Rice,Wheat,Barley, Cotton,Groundnut, Gram,Jute,Potato,Ragi,Mustard,Sesame,Sugarcane,Sun flower, Tobacco	Season, Geographical locations, soil characteristics, Temperature, Rainfall	Data contains from 13 major state of India	DT,KNN, RF,NN	DT=90.20% KNN=89.78% R=90.43% NN=91.00%
Cotton, Sugarcane, Rice, Wheat	Soil type, pH value, NPK value, Rainfall, Temperature, Sowing season	Government of India(data.gov.in)	RF, NB, linear, SVM	The average accuracy of crop classification into kharif and rabi crops is 99.91%

MACHINE LEARNING TECHNIQUES:

Using repository from various sources , enormous non linear complication could be autonomously solved by machine learning techniques.ML authorizes finer decision making with minimal human intervention in real world scenarios.ML not only produce a dynamic framework for data driven decision making , but also malleable for incorporation of eminent knowledge into system.ML is clustered into supervised or unsupervised learning .

In this paper we use light GBM which comes under supervised learning.

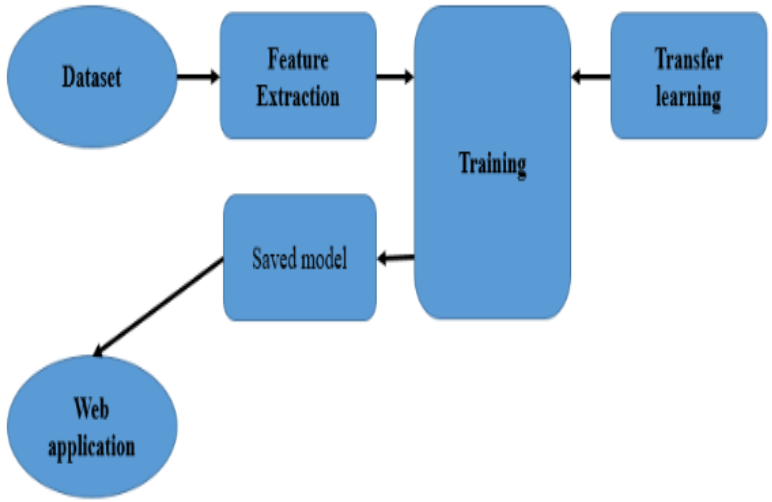
LIGHTGBM:

LightGBM is a gradient boosting framework which increases the potency of the model and reduces memory usage. LightGBM is a quick , distributed, high performance framework based decision tree algorithmic program. Used for ranking, classification and many other machine learning task. The significance of lightGBM are quicker training speed and higher potency, better accuracy than any other boosting algorithms, capable of large number of data, compatibility with enormous datasets.

Mathematical equation:

$$\tilde{v}_j(d) = 1/n \left(\Sigma x\{ \left(\Sigma_{xi \in A1} gi + 1\text{-}a/b \; \Sigma_{xi} \in B1^{g}_{i}\right)^2 / n_1^j(d) + \left(\Sigma_{xi} \in Ar^{g}_{i} + 1\text{-}a/b \; \Sigma_{xi} \in Br^{g}_{i}\right)^2 / n_r^j(d) \}$$

ARCHITECTURE:



In our framework, we have proposed a procedure that is separated into various stages as appeared in Figure

The five phases are as per the following:

1) Collection of Datasets

2) Pre-processing (Noise Removal)

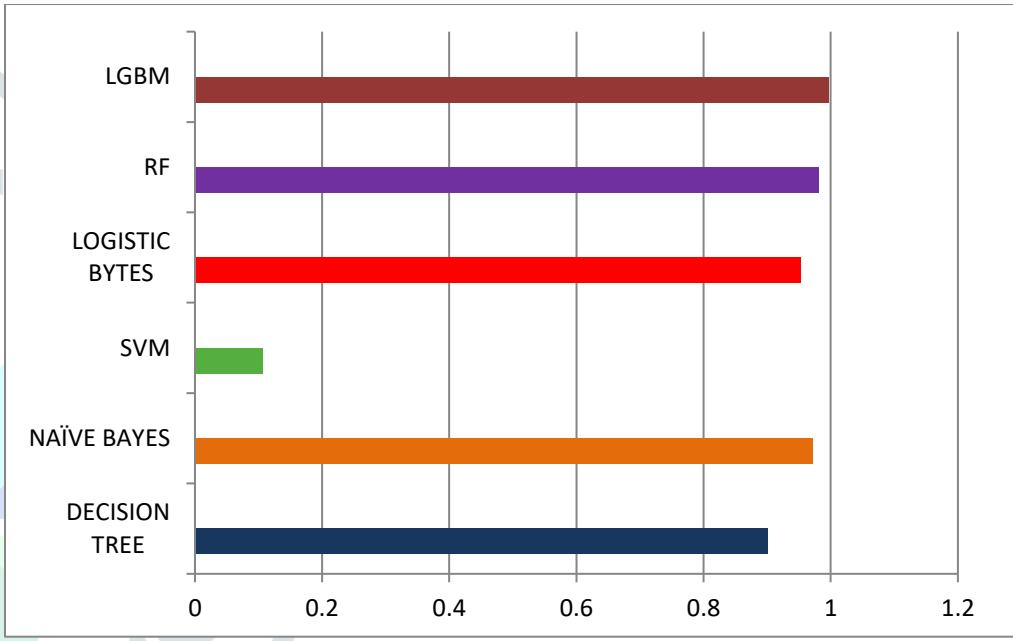
3) Feature Extraction

4) Applied Various Machine Learning Algorithm

5) Recommendation System

6) Recommended Crop

EXPERIMENTAL RESULTS:



Here ,

Blue represents Decision tree

Orange represents Naive bayes

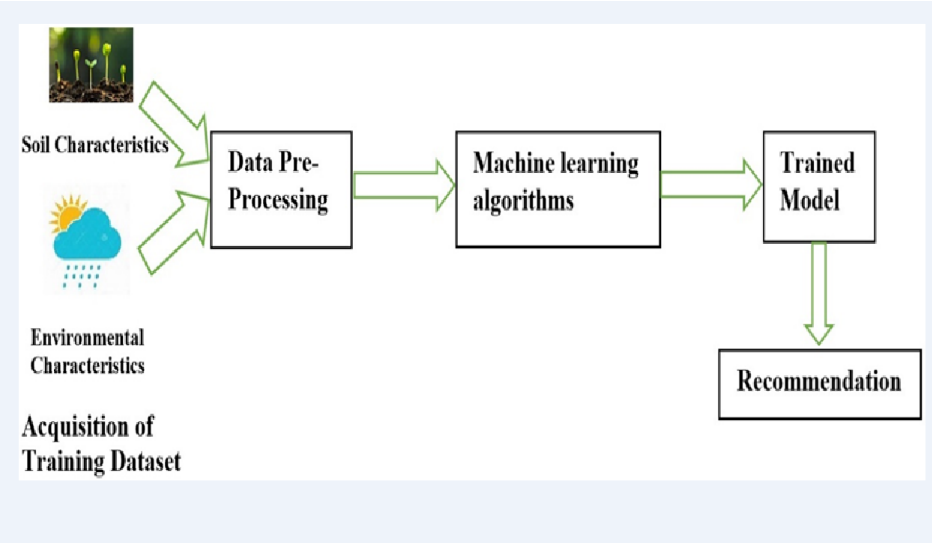
Green represents Support Vector Machine(SVM)

Red represents Logistic Regression

Violet represents Random forest(RF)

Brown represents Light GBM.

Algorithm	Performance
Decision tree	0.9
Naive Bayes	0.990909091
SVM	0.106818181
Logistic Regression	0.952272723
RF	0.9909091
LGBM	0.99428181827



RESULT AND DISCUSSIONS:

Before in the suggested model crop recommendation system we observe the features such as climate, soil nature, temperature, rainfall. With this we will assure that the agriculturists to get a supreme yield .It also helps to overcome the less production by recommending suitable crops for appropriate field.

Algorithm	Accuracy
Decision tree(DT)	90%
Naïve bayes(NB)	98%
Support Vector Machine(SVM)	10.68%
Random forest(RF)	99%
Light GBM	99.52%

CONCLUSION:

The proposed work will welfare agriculturists to enhance productivity in agriculture .By recommending the right crop considering various attributes.The proposed work aids agriculturists

to accurately select the crops for cultivation and attain sustainability.In upcomimg days the proposed system can be extended to consider market demand and availability of market infrastructure.This would deliver a comprehensive predictions on the basis of environmental factors.

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