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Crop Recommendation for Agriculture Considering Productivity and Seasonality

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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.

Keywords: crop recommendation, data mining, upcoming format, agriculturalist, better, forming

INTRODUCTION

Tamil Nadu being 7th largest area in India has 6th largest population. It is leading producer of agriculture products. Agriculture is the main occupation of Tamil Nadu people. Agriculture has a sound tone in this competitive world. Cauvery is the main source of water. Cauvery delta regions are called as rice bowl of Tamil Nadu. Rice is the major crop grown in Tamil Nadu. Other crops like Paddy, Sugarcane, Cotton, Coconut and groundnut are grown. Bio-fertilizers are produced efficiently. Many areas Farming acts as major source of occupation

Agriculture makes a dramatic impact in the economy o f a country. Due to the change of natural factors, Agriculture farming is degrading now-a days. Agriculture directly depends on the environmental factors such as sunlight, humidity, soil type, rainfall, Maximum and Minimum Temperature, climate, fertilizers, pesticides etc. Knowledge of proper harvesting of crops is in need to bloom in Agriculture. India has seasons of Winter which occurs from December to March Summer season from April to

June Monsoon or rainy season lasting from July to September and Post-monsoon or autumn season occurring from October to

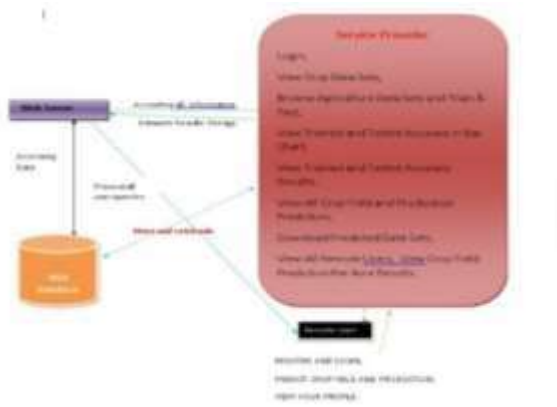
November. Due to the diversity of season and rainfall, assessment of suitable crops to cultivate is necessary. Farmers face major problems such as crop management, expected crop yield a productive yield from the crops. Farmers or cultivators need proper assistant regarding crop cultivation as now-a-days many fresh youngsters are interested in agriculture. Impact of IT sector in assessing real world problem is moving at a faster rate.

Data is increasing day by day in field of agriculture. With the advancement in Internet of Things, there are ways to grasp huge data in field of Agriculture. There is a need of a system to have obvious analyzes of data of agriculture and extract or use useful information from the spreading data. To get insights from data, it has to be learnt.

II. Knowledge discovery in databases Extracting knowledge from the data set is the process of mining. It aims to give accurate results to farmers. It finds hidden patterns. It discovers useful knowledge from the tremendous data set. It is one of the processes in Knowledge Discovery in Databases (KDD). Apart from the KDD process, in recent days with the development in IT world, Machine Learning has emerged to handle big volume of data and involves high performance computing too. Application of Machine Learning in

Agriculture peaks up day by day. Machine Learning techniques are used in crop management, livestock management, water management and soil management.

SYSTEM ARCHITECTURE



METHODOLOGY

In regions where climate conditions constantly change, it's challenging to calculate solely on rainfall data for crop civilization. Technology is essential for collecting crop data and guiding growers for better yields. also, proper toxin operation is pivotal, as inordinate operation can deplete soil fertility and affect in crummy crop yields. In India, where husbandry significantly impacts the frugality, accurate crop vaticination is vital. Employing data mining ways can give a further dependable vaticination tool, replacing hamstrung and guesswork-grounded styles in husbandry opinions. In the prevailing device climatic conditions range veritably constantly. So, it's long hauls tough to extend foliage with the useful aid of the use of data rainfall situations. We need to use some period to detect the crop data and guide the growers to increase foliage because of this and also toxin likewise one of the important factors to boom foliage as a forestall end result. If toxin is use more or less in the issue the soil might also likewise lose it fertility and crop may not supply the anticipated yield. So, toxin also becomes the number one element in it. In this system we applied different Machine Learning algorithms like Random Forest, Decision Tree, Support Vector Machine (SVM), Logistic Regression (LR), and Gaussian NB, K- NN algorithm. **1)** Random Forest Random Forest is an ensemble literacy algorithm that builds multiple decision trees during training and merges their prognostications. It operates by constructing a multitude of decision trees at training time and labors the mode of the classes (bracket) or the average vaticination

(retrogression) of the individual trees.

Algorithm 1: Pseudo code for the random forest algorithm

To generate c classifiers:
for $i = 1$ to c **do**
  Randomly sample the training data D with replacement to produce D_i
  Create a root node, N_i containing D_i
  Call BuildTree(N_i)
end for

BuildTree(N):
if N contains instances of only one class **then**
  return
else
  Randomly select x% of the possible splitting features in N
  Select the feature F with the highest information gain to split on
  Create f child nodes of N, $N_1, \ldots, N_f$, where F has f possible values ($F_1, \ldots, F_f$)
  for $i = 1$ to f **do**
    Set the contents of N_i to D_i, where D_i is all instances in N that match F_i
    Call BuildTree(N_i)
  end for
end if

2) Decision Tree Decision tree classifiers use greedy methodology. It's a supervised literacy algorithm where attributes and class markers are represented using a tree. The main purpose of using Decision Tree is to form a training prototype which we can use to prevision class or value of target variables by learning decision rules derived from former data (training data). **3)** Support Vector Machine (SVM) Support Vector Machine (SVM) is a supervised machine learning algorithm or model which can be employed for bracket and as well as for retrogression challenges. still, we substantially use it in bracket challenges. SVM is generally represented as training data points in space which is divided into groups by comprehensible gap which is as far as possible.

Algorithm 1: SVM

1. Set $Input = (x_i, y_i)$, where $i = 1, 2, \cdots, N, x_i = R^n$ and $y_i = \{+1, -1\}$.
2. Assign $f(X) = \omega^T x_i + b = \sum_{i=1}^{N} \omega^T x_i + b = 0$
3. Minimize the QP problem as, $min\ \varphi(\omega, \xi) = \frac{1}{2}\|\omega\|^2 + C.(\sum_{i=1}^{N} \xi_i)$.
4. Calculate the dual Lagrangian multipliers as $min\ L_\rho = \frac{1}{2}\|\omega\|^2 - \sum_{i=1}^{N} x_i y_i(\omega x_i + b) + \sum_{i=1}^{N} x_i$.
5. Calculate the dual quadratic optimization (QP) problem as $max\ L_D = \sum_{i=1}^{N} x_i - \frac{1}{2}\sum_{i,j=1}^{N} x_i x_j\ y_i\ y_j\ (x_i, x_j)$.
6. Solve dual optimization problem as $\sum_{i=1}^{N} y_i x_i = 0$.
7. Output the classifier as $f(X) = sgn(\sum_{i=1}^{N} x_i y_i (x \cdot x_i) +$ /.

4) Logistic Regression (LR) The Logistic Regression model is a astronomically used statistical model that, in its introductory form, uses a logistic function to model a double dependent variable; numerous further complex extensions live. In Retrogression Examination, Logistic retrogression is prognosticating the parameters of a logistic model; it's a form of Binomial retrogression. Logistic Retrogression is a double bracket algorithm used for prognosticating the probability of a case belonging to a particular class.

Properties	Description
Soil Types	Different land have Different types of soil such as black soil, medium black soil, sandy loam, alluvial soil etc. which could impact on selection of crops according to soil types.
pH value	Most soils have pH values ranging from 3.5 to 10 for higher rainfall areas ranging from 5 to 7 and dryer areas ranging from 6.5 to 9.
EC	Electrical conductivity is the soil properties which give the material the ability to transmit electrical charges and are expressed on mS / m and dS / m.
Organic Carbon (OC)	Soil organic carbon is a carbon part of the soil that is thought to range from 0.51 per cent to 0.75 percentage.
Nitrogen (N)	N contains all sources of nitrogen, such as organic and inorganic. Measured by Kg / H.
Phosphorus (P)	Phosphorus plays a crucial role in the preservation and distribution of energy which is helpful for growth of the crop. The optimal range of values is between 23 and 57 kg / ha.
Potassium (K)	It is important for the crop reproduction process. It's ideal range is between 145-337 kg / ha.
Sulphur (S)	It is important for the formation of chlorophyll and the building of amino acid blocks. The optimal value is greater than 10 ppm.
Zinc (Zn)	It is an essential component of the different enzymes responsible for several reactions in crops. It's ideal value is more than 0.6ppm.
Boron (B)	It is present in the soil in many forms, such as water and acidic type, and is important for the growth of large crops. It's ideal value is more than 0.5 ppm.
Iron (Fe)	Iron is required to produce chlorophyll with an ideal value of more than 4.5 ppm.
Manganese (Mn)	It plays a key role in physiological processes, in particular photosynthesis. Its value is more than 2.0 ppm.
Copper (Cu)	Copper (Cu) is one of the important plant micronutrients required. Needed for many plant activities and for the production of chlorophyll and seeds.
Land Area	Different crops required Different Minimum Land Area to cultivate. This parameter shows Farm Size in Hector. Which have been utilized to calculate crop yield and crop profit.
Water Level	Different Land have Different Water level. This Criteria suggest crop according to its required water level.

Table 1: Description of Different Parameters

Soil Test Results					
District Agriculture Office, JUNAGADH , GUJARAT					
Soil Type: Medium black soil					
Sr.No.	Parameter	Test Value	Unit	Rating	Normal Level
1	pH	8.1		Moderately alkaline	7, Neutral
2	EC	0.33	dS/m	Normal	0 - 2 dS/m
3	Organic Carbon (OC)	0.18	%	Very Low	0.51 - 0.75%
4	Available Nitrogen (N)	--	kg/ha		
5	Available Phosphorus (P)	21	kg/ha	Low	23 - 57 kg/ha
6	Available Potassium (K)	163	kg/ha	Medium	145 - 337 kg/ha
7	Available Sulphur (S)	21	ppm	Sufficient	> 10 ppm
8	Available Zinc (Zn)	1.72	ppm	Sufficient	> 0.6 ppm
9	Available Boron (B)	0.55	ppm	Sufficient	> 0.5 ppm
10	Available Iron (Fe)	1.58	ppm	Deficient	> 4.5 ppm
11	Available Manganese(MN)	13.1	ppm	Sufficient	> 2.0 ppm
12	Available Copper (Cu)	1.64	ppm	Sufficient	> 0.2 ppm

Table 2: Land property detail

Service Provider:

In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as Login, Browse Diabetic Data Sets and Train & Test, View Trained and Tested Accuracy in Bar Chart, View Trained and Tested Accuracy Results, View All Primary Stage Diabetic Prediction, Find Primary Stage Diabetic Prediction Type Ratio, View Primary Stage Diabetic Prediction Ratio Results, Download Predicted Data Sets, View All Remote Users.

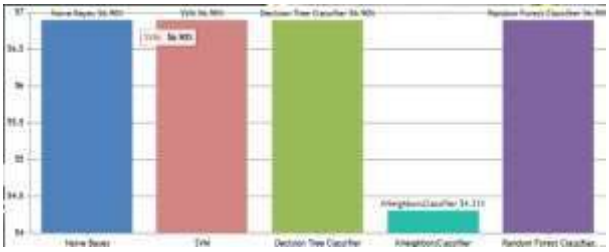
View and Authorize Users:

In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorize the users.

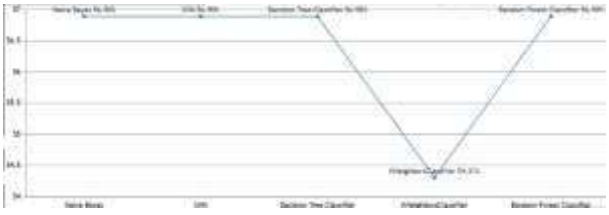
Remote User:

In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like REGISTER AND LOGIN, PREDICT PRIMARY STAGE DIABETIC STATUS, VIEW YOUR PROFILE.

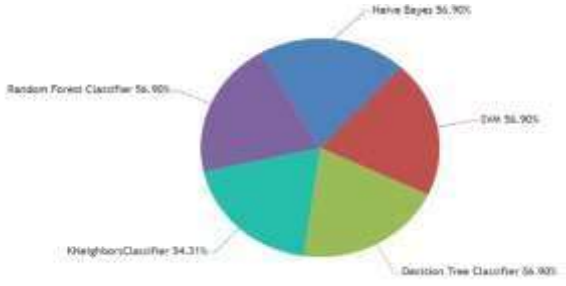
RESULT ANALYSIS



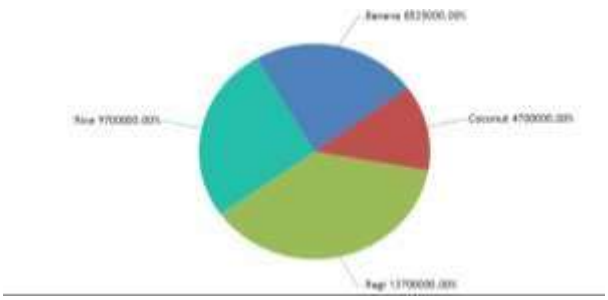
Trained And Test Data Accuracy Bar Chart



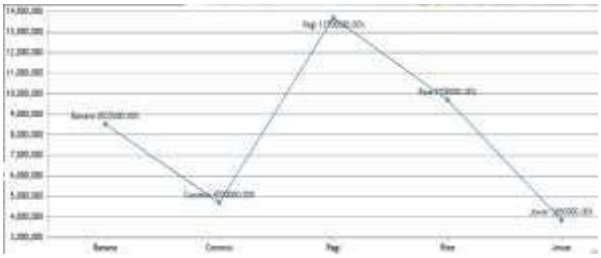
Trained And Test Data Accuracy Line Chart



Trained And Test Data Accuracy Pie Chart



Crop Yield Prediction per acre pie chart



Crop Yield Prediction per acre line chart

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.

FUTURE ENHANCEMENT

Integration with IoT sensors: Real-time data from in-field sensors (soil moisture, temperature) can be incorporated for more dynamic recommendations.

Market-driven considerations: The system could integrate with market data to suggest crops with favorable prices alongside high yield potential.

Blockchain technology: A secure blockchain based platform could ensure data transparency and traceability within the agricultural ecosystem.

User feedback loop: The system can learn and improve its recommendations by incorporating feedback from farmers on the accuracy of yield predictions and the success of implemented recommendations.

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