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FARMER BUDDY SYSTEM USING MACHINE LEARNING

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Abstract

The major focus for soil management in agriculture for enhancing crop productivity is on the maintenance and improvement of dynamic soil parameters. The population stresses, terrestrial limitations and the decline of traditional soil management methods have directed to a deterioration in the fertility of the soil in developing countries like India. Crop health is a major element in the highly productive system of modern agriculture. A substantial increase in crop production can be attained by adopting the suitable crop health management strategy. The increased productivity could be achieved through effective soil resource management and corrective measures to apply micronutrients. Timely detection and controlling of problems connected with crop yield pointers enables the decision makers (agricultural experts) and farmers to decide on appropriate soil resource management and crop environment management. Keeping in account in this "Farmer Buddy System" a ML based website , the crop prediction and classification of soil problems are effective

Keywords: Soil Classification, Crop Prediction, Decision Tree, Neural Network, Support Vector Machine, Soil Parameters, Soil pH, Crop Health, Soil Resource Management, Micronutrients

1. Introduction

1.1 About Project

This project is aimed to developing an online Farmer Buddy System. The entire project has been developed keeping in view of the distributed client server computing technology, in mind. The Farmer Buddy System is to create an ML based website for the farmer and organization that are related to predicting the crop using soil features through this application any farmer can register himself. The project has been planned to be having the view of distributed architecture, with centralized storage of the database. The application for the storage of the data has been planned. The database connectivity is planned using the "SQL Connection" methodology. The standards of security and data protective mechanism have been given a big choice for proper usage.The application takes care of different modules and their associated reports, which are produced as per the applicable strategies and standards that are put forwarded by the administrative staff. The basic constructs of table spaces, clusters and indexes have been exploited to provide higher consistency and reliability for the data storage. The total front end was dominated using the HTML,JS,CSS technologies and classification of soil and crop prediction using machine

learning techniques. At all proper levels high care was taken to check that the system manages the data consistency.

1.2 Objectives of the Project

• To determine the pH value and exact texture of soil sample using image pre- processing technique.
• To implement the classification to classify the features of soil image.
• To recommend the crop based on soil features.

1.3 Scope of the Project

This project is about helping the farmer by providing suitable crop.
• The farmer(user) must have a correct user Id and password to log in to the website.
• If the incorrect password is given it shows an alert box with the message “Incorrect Password/Username.
• When a legitimate user logs in, then they can perform their actions.
• After farmer logs into the website it ask the farmer to upload soil image of their field.
• Farmer should upload the colour photo of soil.
• If farmer upload other than the soil photo it won’t warns the farmer that please upload the soil image.
• Image pre-processing done for better accuracy results.
• Soil classification algorithm should give high accuracy.
• Crop prediction algorithm should give high accuracy and that algorithm should give suitable crop for the farmer.
• Set of crops displayed as a output for the farmer .Farmer need to select one among them.
• After successful completion of farmer actions, farmer need to log out from the system.

2. Literature Survey

2.1 Existing System

Soil classification using machine learning techniques. Soil has a vital part in successful agriculture. The main role of the soil is to support the growth of agriculture and horticulture crops. They are several kinds of soil, each type of soil have distinct features and have different kinds of crops that can grow on. Therefore, it is needed to know the characteristics and features of soils to know which crop can grow better on a particular soil. In this case machine learning can be useful. This system for image classification of soil based on soil image. The initial step is gather soil test pictures which is the first important step in soil classification based on image processing because it needs to consider factors such as scale and soil under study. The image of soils are captured using color camera and provided as input to the system. The feature of each type of soil is collects and stored in a separate database .es, certain conditions are to be considered, they are availability of ground.

Methods used in existing system

Neural Networks

Generally a neural network is comprised of three layers input layer, hidden layer and output layer. There is only is only one hidden layer in this paper. Sigmoid is used as activation function. As per the number of attributes , the input layer is comprised of 10 input with one attributes as the class type. As per the number classes , the output layer consists of 12 outputs. A package called back propagation neural network software program , based on the back propagation procedure . Network with arbitrary layers, nodes per layer , link connections between layers and other basic network design components can be generated using this package.

Decision Tree

It is represented as binary tree. A single input variable(x) is represented on each node and a split on the variable . The output variable(y) containing on the leaf node of the tree is used to make a prediction s. Predictions are made by walking the spilt of the tree till entering at a leaf node. Decision trees are very fast for making predictions and very fast to learn . For a broad range of problems , decision trees do not need any special preparation for data and is also error free.

Naive Bayes

In naive bayes, the input variable is independent that is a Naive Bayes classifier surmise that , an article feature of class which is present is unrelated to any other feature. It is based on the Bayes theorem . The method of maximum likelihood or Bayesian method are used for the parameter estimation for Naive Bayes. The supposition that input variable is independent is unpractical for real data Naive Bayes classification can be efficiently trained in a supervised learning setting. For wide range of complex problem

Support Vector Machine (SVM)

SVM is a heuristic algorithm, which comes under supervised learning . In SVM, a hyper plane that optimally separates two classes is determined . Between two classes , there is only one hyper plane that produce maximum margin. Nonlinear mapping functions are used to map the data into a higher dimensional space(H) for nonlinear equations. Classification function can be solved using kernel function

2.2 Proposed System

Farmer buddy system

The proposed system is a desktop-based application , which can be used for finding pH value of soil sample. The main objective of the project is to provide availability of soil testing . We are trying to implement it with Database Application. It is very useful for the farmer as well as for government laboratories.

1) To identify the type of soil.

2) To determine the soil parameters like nitrogen(N), phosphorous (P),potassium(K).

3) To determine the pH level of soil.

4) To determine the properties of soil.

5) To make the soil testing simple and easy for the farmer. 6) To recommend best suitable crop for the farmer.

As per the requirement of the system as automated. We want to make software which process and give some

intermediate results. So the people who want to test the soil can classify test it by using software. Digital image processing is a term in which digital image will be taken and calculate some values from it to perform particular operation on it. As many algorithms are used to perform mathematical as well as scientific operation on digital images. By using the digital image processing we can implement our system based on need. The system work as by providing the image file of soil sample as input and then RGB value of each image of soil sample will be calculated by using digital image processing and by using some constrained we give soil pH and the constraints of soil as output.To calculate pH value for new soil sample first we capture the Image of soil then by using the formula of Soil pH factor we calculate the new factor of new image .The image capture in the system can be taken as matrix of pixels associated with combination of red, green and blue values. The average of each sector can be used to calculate the Single soil pH factor value for each image.As we have only few samples pH values and their calculated pH factors (index). so we can add +0.01 and subtract -0.01 to get the approximation in the results. Then compare new value with values which is already stored in the database value which is in particular range return the Soil pH factor and according to it we return the Soil pH value of new soil sample. With this proposed system we not only give the Soil pH value of Soil sample but also the type of soil, the deficient nutrient present in the soil range and the type of the crop suitable for the soil. We provide the complete report of testing of soil to the farmer.

3. Proposed Architecture

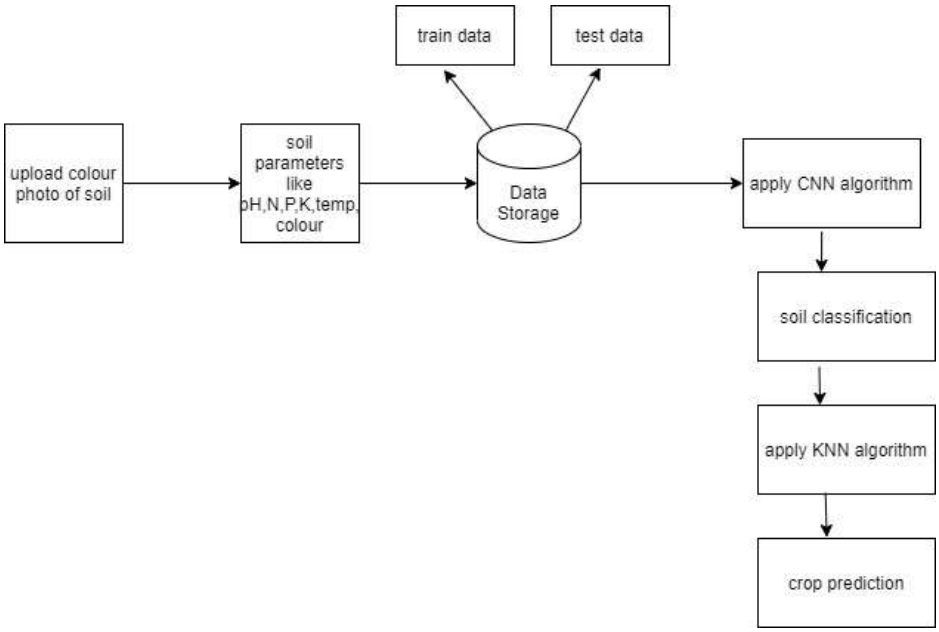

Fig.1. System Architecture

DATA FLOW DIAGRAM

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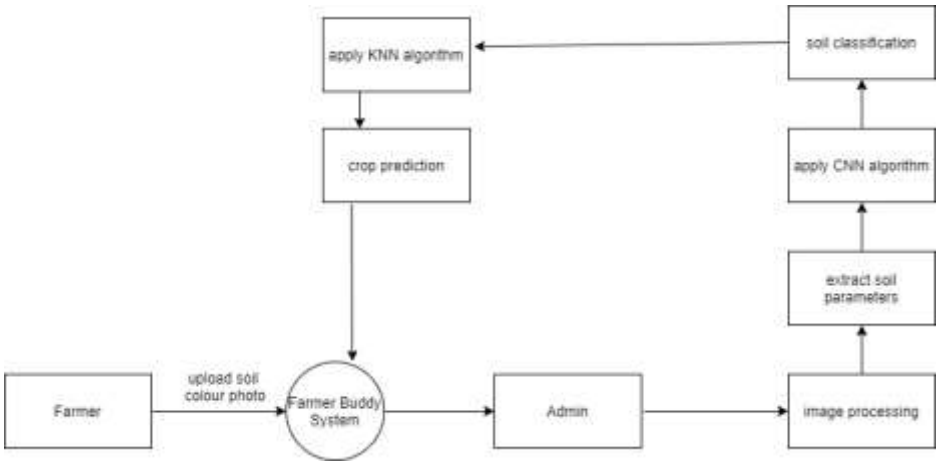

Fig.2. Data Flow Diagram

4. Implementation

4.1 Algorithm

- The login form takes the values provided by the user and validates it against the values present in the database if the values present in database matches the values provided by the user then the validation is considered to be successful and as a consequence the home page is loaded on the screen. If the validation is unsuccessful, the UI prompts the user to register first by loading the registration form. Once the user is registered, He / She can login with the same process.
- Farmer(User) logs into the system using his credentials. The system verifies for the credentials, if the user entered the valid credentials then he gets logged into the system. If the credentials are not valid then the user will not be logged into the system until he enters the valid credentials. Once the farmer is logged into the system then the system asks the farmer to upload color photo of soil and wait for the suitable crop to be displayed as output then farmer need to select one crop among them. After successful completion of actions, farmer needs to log out from the system.
- To the soil photo, apply CNN algorithm for the soil classification. Compare soil parameters with existing values in the dataset, if photo is not match with any of the photos in the dataset it means it is not a soil photo then system warns the farmer that please upload soil photo.
- After soil classification, the system will recommend crop based on soil features. For crop prediction we apply KNN algorithm. After crop prediction, the system will display set of suitable crops. Farmer need to select one among them and then log out from the system.

4.2 Code Implementation

SQLyog. SQLyog is an easy-to-use, compact and very fast graphical tool to manage your MySQL database anywhere in the world. There are a number of features designed to help you speed up your database development.

Python 3.6. Python 3.6 also provides support for DTrace and SystemTap, brings a secrets module to the standard library, introduces new string and number formats, and adds type annotations for variables. It also gives us easier methods to customize the creation of subclasses.

Anaconda. Anaconda is a free and open-source appropriation of the Python and R programming for logical figuring like information science, AI applications, large-scale information preparing, prescient investigation, and so forth. Anaconda accompanies in excess of 1,400 packages just as the Conda package and virtual environment director, called Anaconda Navigator, so it takes out the need to figure out how to introduce every library freely. to Anaconda appropriation that enables clients to dispatch applications and oversee conda packages, conditions and channels without utilizing command line directions.

5. Result

The image capture in the system can be taken as matrix of pixels associated with combination of red, green and blue values. The average of each sector can be used to calculate the Single soil pH factor value for each image. As we have only few samples pH values and their calculated pH factors (index). so we can add +0.01 and subtract -0.01 to get the approximation in the results. Then compare new value with values which is already stored in the database value which is in particular range return the Soil pH factor and according to it we return the Soil pH value of new soil sample. With this system we not only give the Soil pH value of Soil sample but also the type of soil, the deficient nutrient present in the soil range and the type of the crop suitable for the soil. We provide the complete report of testing of soil to the farmer.

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Soil pH	Soil Type	Nutrient s	Suitable crops are
3.5-4.0	Strongly Acidic	All nutrient s	Not suitable for any crop
4.5-6.0	Moderately acidic	ca, mg,N,P, K,B,Mo	Wheat, soybean, Rice, potato, Pea, Peanut.
6.0-6.5	Slightly acidic	Ca,Mg, S,N,P.	Wheat, soybean, Rice, sweet potato, corn, Beetroot.
6.5-7.5	Neutral	No Deficient Nutrient s.	Wheat, soyabean,Barly,vegetables,oilseeds,Mushrooms,oats ,cotton.
7.5-8.5	Slightly Alkali ne	Fe, Mn,P.	Vegetables, oilseeds,Mushrooms,oats ,cotten,Cucumber,Garlic.
8.5-9.0	Strongly Alkali ne		Not suitable for any crop.

Fig.3. Results of Soil Testing

#Main screen

Fig.4. Main Screen

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#Registration of user

Fig.5. Registration

Login

Fig.6. Login

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#Home page

Fig.7. Home page

#Upload image

Fig.8. Upload image

#View image and track soil details

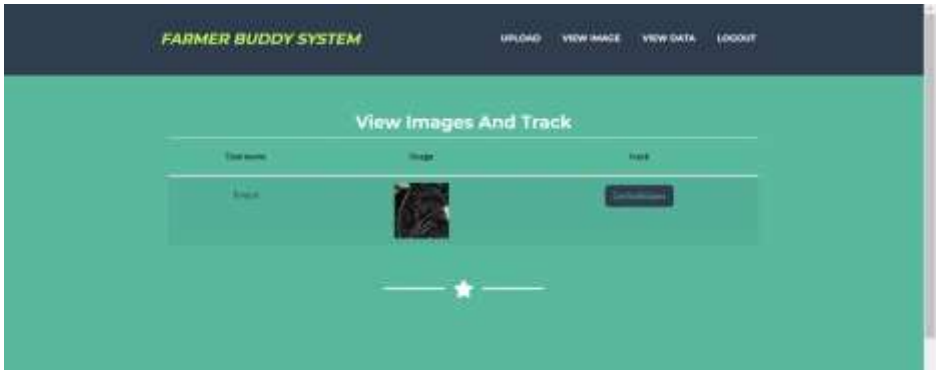

Fig.9. View image and track soil details

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View data to predict crop

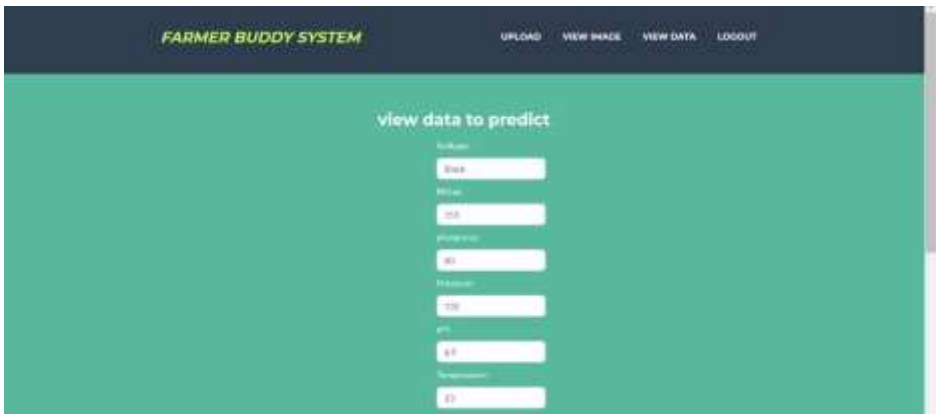

Fig.10. View data

#View crops data

Fig.11. Predicted crops

6. Conclusion

Soil classification is one of the main concerns in the field of engineering. Some knowledge about the type of soil is necessary before staring any construction work. There existed some traditional methods for this purpose but now they are replaced by the image processing methods employing techniques such as Decision trees, SVM‟s. Each method has its own relevance of application. Machine learning techniques have boosted the process of soil classification by a great extent. There exist various machine learning based soil classification approaches which have also been discussed here. SVM is one of the most commonly used machine learning algorithm to classify soil.

7. Future Scope

Soil Testing is the way to access the soil constituent which is useful to know fertility and acidity of the soil. This system helps to determine the type of soil and pH of soil that must be applied. From Farmers perspective soil pH and soil nutrients value plays an important role because growth of plants and vegetables based on pH factor present in the Soil. Generally soil pH and soil nutrients are measured manually in Government Labs. There are various labs but instrument used for this is not available everywhere. So we need to implement calculation of soil pH and soil nutrients by using digital Image Processing. Ten soil samples were collected and their pH and nutrients value firstly tested in Government Soil Testing Lab, and also it was determined by using digital image processing technique. On the basis of RGB values, pixels properties and their digital correlations, results showed that our pH values were approximately matching with results from Government Testing lab and the system will recommend suitable crops based on soil features.

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