Testing And classification of soil For the Purpose of Cultivation Using M.L

Suchi Kumari
Department of Computer Science and Engineering
MIT School of Engineering
MIT Art, Design and Technology University
Loni Kalbhor, Pune 412201, Maharashtra, India
Ksuchi914@gmail.com

Prof. Swapnil Patil
Department of Computer Science and Engineering
MIT School of Engineering
MIT Art, Design and Technology University
Loni Kalbhor, Pune 412201, Maharashtra, India swapnil.patil@mituniversity.edu.in

***Abstract*—In a country like India where agriculture is the backbone of our economy, it is very important to identify the soil types and decide which type of crops to grow. The objective of our model is to provide a solution for intelligent agriculture by classifying soil type which can assist the farmers in increasing productivity to a great extent. The proposed system applies machine learning to identify the pattern among data and then process it as per input conditions. We will use physical properties like texture, density etc. by doing ribbon tests, squeeze tests and jar tests to train the model. We will be developing a user-friendly GUI using the selected machine-learning technique. It will be very cost-efficient for the farmers.**

***Index Terms*—Physical Features, Crop Prediction, Soil Classification, Machine Learning.**

I. INTRODUCTION

Agriculture is the art of cultivating the land, raising crops and raising animals. It is based on the preparation of plants and animals for human consumption and their sale in the market. Agriculture provides most of the household foods and textiles. Agriculture plays an important role in the world economy. The world population is growing rapidly and as the population increases, the demand for food also increases. Conventional farmers cannot meet the huge demand, so soil quality analysis is crucial.

In Agriculture, Machine learning is used to improve the quality of crops in agriculture. Machine learning is a learning technique that gives machines the ability to learn without human intervention. The main purpose of this study is to develop soil type prediction and crop recommendation models using monitoring systems. Soil and crop data were collected from the online datasets website. This information is used to evaluate the model and calculate the results . The data set is divided into two sets, the training data set and the test data set, to create the model. Many machine learning algorithms are used to classify soil as clay, loam or sand using its physical properties. Crops are also recommended based on soil type estimates. Analysis algorithms include SVM, decision trees, Naive Bayes, and linear regression, all of which can be used in machine learning models..

This paper is structured as follows: Section II provides details on the literature survey. Section III explains different algorithms used for soil type classification and crop recommendation; followed by conclusions and references.

II. LITERATURE SURVEY

Here we present some insights into soil analysis and crop forecasting using various machine learning techniques and some of their competitors. Machine learning is a decision-making process that requires modeling of data.

1.Soil classification and crop recommendations use machine learning techniques - the model predicts soil types and recommends suitable crops that can be grown in the soil. But it has some limitations: it does not have real-time information.

2. Soil Classification and Crop Suggestion using Machine Learning Algorithm- This ML model contains data of different parameters affecting soil like temp, humidity, pH.These parameters are used to find best suited crops from all crops, but the model is time consuming and more costly for home gardeners and farmers.

3. Soil Classification and Crop Suggestion using Machine Learning- This model takes the data-sets on the basis of chemical, geographical and climatic properties and predicts the crop based on these parameters.but a large amount of data-set is required.

4. Soil analysis and crop fertility prediction using machine learning- The model was designed to predict soil fertility and crop yield, as well as the types of crops that can be grown on fertile soils. This study was conducted on a region-specific soil dataset and crop dataset.

III. METHODOLOGY

A. Dataset

There are two different datasets are used for the prediction model.

I Soil Dataset
II Crop Dataset

I Soil Data Set: It consists of features like pH, rain,humidity, Temperature, ribbon Test, Squeeze Test etc. From all these features, we classify and define the soil type using the ML model.

II crop Data Set: It includes precipitation, humidity, pH,soil type. Based on all these characteristics, we recommend that the crops be grown in certain soil types..

B. Method and Experimentation

Datasets are collected from various resources and the data is categorized and grouped into two sets:

I Training Dataset II Testing Dataset

C. Implementation using ML Algorithm

When visiting our website, users are directed to questionnaire. Based on the questionnaire responses, these responses are provided as input to the ML soil type prediction model, which predicts soil type. After estimating the soil type, we recommend crops. Below is a basic flowchart of the ML model.

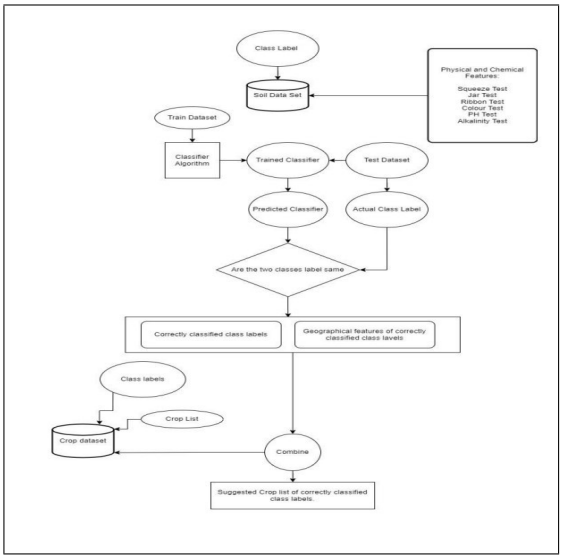

Fig. 1. ML Model Flowchart

D. Support Vector Machine (SVM)

Support vector machines, or SVMs, are one of the most popular supervised learning algorithms used for both classification and regression problems. The goal of the SVM algorithm is to create optimal lines or decision boundaries that can divide the n-dimensional space into classes so that new data points can be easily placed in the correct category in the future. This optimal decision boundary is called a hyperplane.

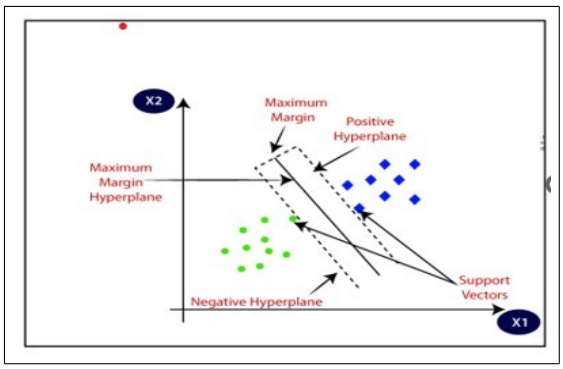

Fig. 2. Support Vector Machine

E. Decision Tree

A decision tree is a flowchart-like tree structure where each inner node specifies a test for an attribute, each branch represents the result of the test, and each leaf node (terminal node) contains a class label. Trees can be "learned" by "recursive splitting".

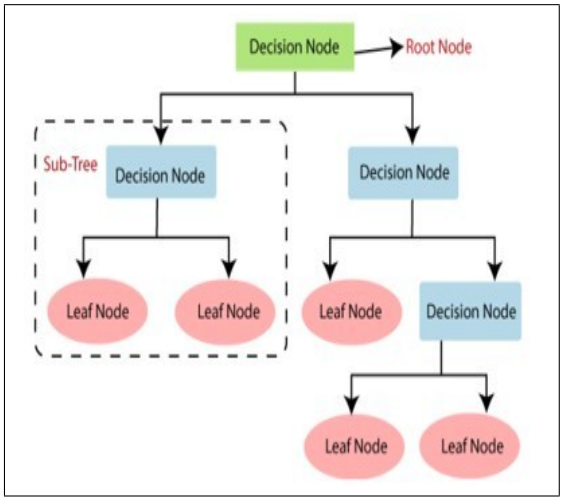

Fig. 3. Decision Tree

F. Logistic Regression

It helps to predict the outcome or decision. In this analysis method, the variable can be categorical or categorical, A or B (binomial regression) or infinite options of A, B, C or D (polynomial regression). It is used in statistical software to understand the relationship between a dependent variable and one or more independent variables by estimating the outcome using a logistic regression equation.

.

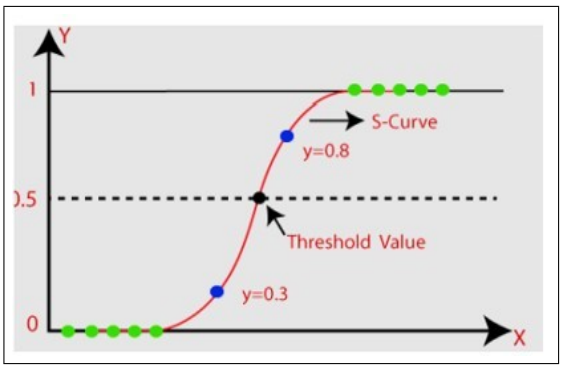

Fig. 4. Logistic Regression

G. Naive Bayes Classifier

Naive Bayes classifier is a classification method based on Bayes theorem to maximize posterior probability and can also be used to generate probability distributions of states of variables and attributes that are not used in the classification process.Cut class variance required for classification without full variance matrix.

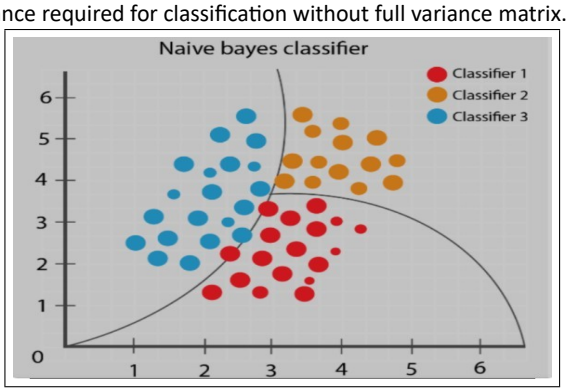

Fig. 5. Naive Bayes

IV. RESULT

The proposed method is based on these two datasets mentioned above. By applying various machine learning methods to identify the soil type,the crops that can be grown in this soil will be predicited . In the results analysis model, we calculated the accuracy rate.

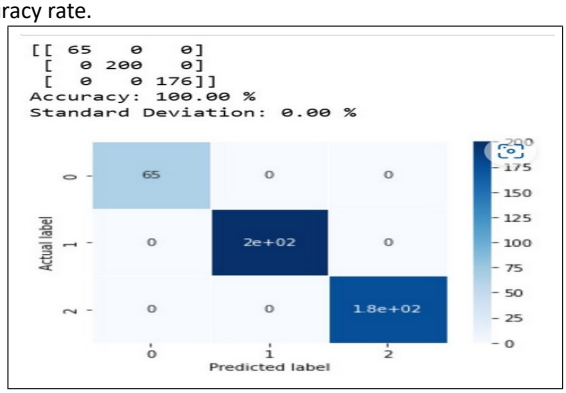

Fig. 6. Accuracy of SVM Classifier

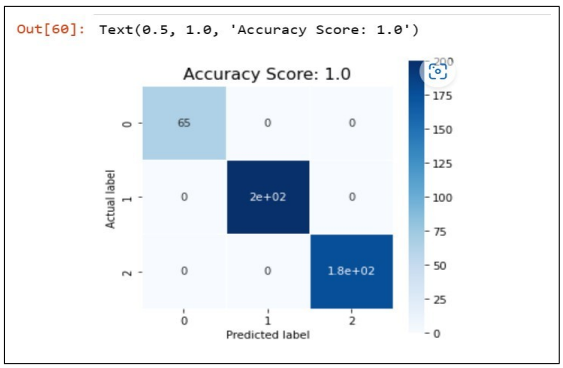

Fig. 7. Accuracy of Decision Tree

V. CONCLUSIONS

In this paper, a model is proposed to predict the soil type and the crops that will grow in that soil. studies were conducted from soil data and crop data in Indian regions. The model has been tested using different machine learning algorithms.

ACKNOWLEDGMENT

We owe a debt of sincere gratitude, and respect to our guide and mentor Prof. Swapnil Patil, MIT Art, Design and Technology University, Pune for his sagacious guidance, vigilant supervision and valuable critical appreciation throughout this project work. We would also like to thank our principal Dr. Kishore Ravande, honorable HOD ma'am and our project coordinator for giving us a great opportunity to turn our idea into a viable project. Working on this major project, we began to understand many theoretical differences and new ideas. Not only does it provide information, it also teaches us how to work together in a group. Finally, we would like to thank all the teachers and collaborative students who directly or indirectly helped us turn our ideas into practical projects.

REFERENCES

[1] Classification of Soil and Crop Suggestion using Machine Learning Techniques [online]. Available: https://www.ijert.org/ classification-of-soil-and-crop-suggestion-using-mach ine-learning-techniques.

[2] SOIL CLASSIFICATION AND CROP SUGGESTION USING MACHINE LEARNING [online]. Available: https://www.irjet.net/archives/V7/i6/IRJET-V7I6691.pdf

[3] Soil Analysis and Crop Fertility Prediction using Machine Learning [online]. Available: https://www.academia.edu/46014132/Soil_Analysis_and_Crop_Fertility_Prediction_using_Machine_Learning

[4] A comprehensive review on soil classification using deep learning and computer vision techniques [online]. Available: https://www.researchgate.net/publication/348913407_A_comprehensive_review_on_soil_classification_using_deep_learning_and_computer_vision_techniques

[5] Soil Fertility Prediction Using Machine Learning [online]. Available: https://www.enjoyalgorithms.com/blog/ soil-fertility-prediction-using-ml

[6] Soil Analysis and Crop Recommendation using Machine Learning [online]. Available: https://jpinfotech.org/ soil-analysis-and-crop-recommendation-using-machine-learning/

[7] Soil Nutrient Analysis Using Machine Learning Techniques [online]. Available: https://srec.ac.in/iqac/resource/uploads/documents/AQAR_2020-2021/C-3/3.4/3.4.4/Conf%20Proceedings/104.pdf

[8] Exploration of machine learning methods for prediction and assessment of soil properties for agricultural soil management [online]. Available: https://opscience.iop.org

[9] Improved Soil Quality Prediction Model Using Deep Learning for Smart Agriculture Systems[online]. Available: https://www.techscience.com/csse/v45n2/50375/html