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FORECAST PLANT DEVELOPMENT AND YIELD

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Abstract: Since it may help growers and farmers maximize crop yields and preserve resources, predicting plant development is a significant topic in agriculture and forestry. Machine learning offers a potential tool for forecasting plant development based on data, unlike older approaches that rely on the shape of the plant, we collect data on plant growth and shape and utilize a variety of machine learning techniques, including linear regression, decision trees, and neural networks. From the geometry of the plant, we extract a number of geometric properties, including curvature, length, and breadth, and we feed these data into the machine learning algorithms. Our tests demonstrate the great accuracy of the suggested method for forecasting plant development based on form.

Keywords: Plant Development and yield, machine learning, Prediction, Environmental elements.

I. INTRODUCTION

Predicting plant growth is a major problem in agriculture and forestry. The growth of plants is affected by many factors such as soil quality, Environmental conditions, and Genetics. The modern method of predicting plant growth relies on specialist knowledge and experience, which is time consuming and expensive.

This project proposes a new method for predicting plant growth using machine learning. The idea behind this method is to use the image of the plant to predict its growth. The shape of the plant can be represented in terms of geometric parameters such as curvature, length, and width.

To use this method, first collect data on plant growth and shape, then use this data to train a machine learning model that can predict the growth of a tree based on its shape. Here, several machine learning algorithms such as linear regression, decision trees and neural networks to compare their performance in predicting plant growth.

Contribution to this project is twofold. First, we propose a new method for predicting plant growth using machine learning. Second, we evaluate the effectiveness of various machine learning algorithms in predicting plant growth from images and provide insight into which algorithm is best for the problem.

II. PROBLEM STATEMENT

This research seeks to advance plant science and offer fresh perspectives on the variables affecting plant development by creating a unique shape-based technique for forecasting plant development using machine learning. The suggested method may be able to produce forecasts of plant development that are more precise and effective, which might be advantageous in various industries, including forestry, environmental science, and agriculture. The outcomes of this study may contribute to greater understandings of the variables affecting plant development, improved agricultural yields, and the creation of new plant species, all of which have the potential to have substantial economic and environmental effects. In general, this study is driven by the need for a more precise advantages that such a method may provide to many. In order to improve our understanding of the factors affecting plant development and maximize crop yields, we are developing and evaluating a novel shape-based technique for plant growth prediction using machine learning.

III. EXISTING SYSTEM

Numerous disciplines, such as agriculture, forestry, and environmental science, depend on the development of plants. In order to increase agricultural yields, create new plants species, and keep track of the health of plant ecosystems, it is essential to accurately anticipate how big plants will get. The use of traditional methods to forecast plant development necessitates the use of professional methods to forecast plant development necessitates the use of professional knowledge and expertise, which may be time-consuming and expensive. The structure of the plant is not taken into account by existing machine learning methods for forecasting plant development since they frequently concentrate on environmental elements, such as temperature, humidity, and sunshine. Consequently, a unique strategy is required that can anticipate plant development more precisely and effectively by taking the structure of the plant into account as a component impacting it.

IV.PROPOSED SYSTEM

Here, we create a system to identify plant characteristics from data given such as shape of plant, length, width, curvature and use them as input to forecast future plant characteristics based on observed growth trends. By reducing the time needed to grow and test plants, such as device has the potential to both properly assess plant systems and quicken the experimental cycle.This research seeks to advance plant science and offer fresh perspective on the variables affecting plant development by creating a unique shape-based technique for forecasting plant growth using machine learning. The suggested method may be able to produce forecasts of plant development that are more precise and effective, which might be advantageous in various industries, including forestry, environmental science, and agriculture. The outcome of this study may contribute to greater understanding of the variables affecting plant development, improved agricultural yields, and the creation of new plant species, all of which have the potential to have substantial economic and environmental effects. In general, this study is driven by the need for a more precise and effective method of forecasting plant development and the possible advantages that such a method may provide to many field.

V.LITERATURE SURVEY

A Novel Shape Based Plant Growth Prediction Algorithm Using Deep Spatial Transformation (April 13, 2022)

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This study aims to use deep learning to predict the future growth behaviour of plants. Specifically, research focuses on the overall shape of the leaves, trying to predict the future shape of the plant from the past and present shape of the plant. Predicting the complex motion of leaves is essential for growth prediction, a problem similar to predicting future video frames in computer vision. However, there have been a few articles in the past devoted mostly to clipping, using auto encoders with ConvLSTM as the backbone. Recently, a method for plant growth estimation has been proposed to use a linear transform (STN) in U-Net with the ConvLSTM model.

The plan used all pictures of the leaves, which is good because leaves and weight are often used to measure the growth of the plant. The task of plant growth prediction is divided into two tasks: image prediction and RGB reconstruction. To improve the estimation process, this study proposes to use STN-induced dynamic change, which is also applied to the future video frame. The research was supported by the National Research Foundation of Korea, and the proposed system can provide more accurate and efficient plant growth prediction, making it more meaningful in terms of factors 2. Affecting plant growth and improving crop quality [1].

Predicting Phenotypes from High-Dimensional Genomes Using Gradient Boosting Decision Trees (May 9, 2022)

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This study focuses on the use of genomic selection (GS) to predict phenotypic values using genome-wide marker coverage. GS is a promising technique for efficient crop breeding, but it faces several challenges such as limited training population size, genotype-environment interactions, and complex interaction patterns between molecular markers. To address these challenges, the study employs ensemble learning algorithms to construct gradient boosted decision tree (GBDT) models and compare their predictive performance with six others widely used GS models. The study uses the wheat GS dataset and evaluates the ability of each model to select individuals with high phenotypic values using the mean normalized discounted cumulative gain (MNDCG) method. The results show that Bayesian models achieve high prediction accuracy, but their computational efficiency decreases significantly with an increase in the number of iterations. On the other hand, the GBDT model is 70 times more computationally efficient than the Bayesian model, and its prediction performance is competitive for some traits. The study also demonstrates that the selection of an appropriate subset of genetic markers can significantly improve the prediction performance of the models. Overall, the study suggests that ensemble learning algorithms such as GBDT can be an effective approach to enhance the prediction accuracy of GS models and improve crop breeding efficiency [2].

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VI.METHODOLOGY

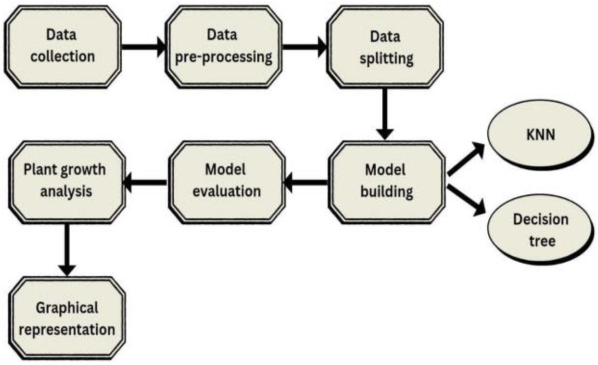

Fig. 6.1. Plant Growth Prediction Methodology

KNN (K-Nearest Neighbor):
KNN is a non-parametric algorithm that can be used for classification or regression tasks. It is a lazy learning algorithm, which means it does not have a specific training phase, but rather memorizes the training dataset.

In our project, as shown in Fig.3.1 KNN can be used to predict the plant growth based on the similar plants from the dataset. For instance, it can calculate the distance between the feature attributes of a given plant and its K nearest neighbors in the dataset. Then, based on the average of the growth of these neighbors, it can predict the plant growth.

Decision Tree:
A Decision Tree is a supervised learning algorithm used for classification and regression tasks. It creates a tree-like model of decisions and their possible consequences. The algorithm divides the data set into smaller subsets based on the attributes, which results in a tree-like structure.

In our project, as shown in Fig.3.1 the Decision Tree algorithm can be used to predict the plant growth based on the feature attributes of a given plant. The algorithm will use a top-down approach by dividing the dataset into subsets based on the most significant features. The goal is to create a tree-like model, where each internal node represents a test on an attribute, each branch represents the outcome of the test, and each leaf node represents the predicted plant growth.

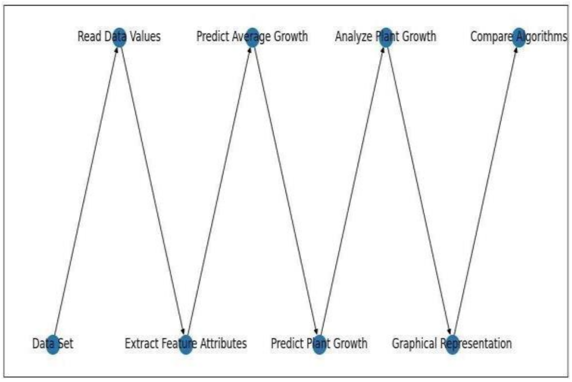

Fig.6.2 Flow Diagram of Plant Growth Prediction.

The Process entails a number of phases, as seen in fig.6.2.

1. Data Gathering: Gathering information on plant growth is the initial stage. Information on elements like plant age, ambient circumstances, and growth rate may be included in this.

2. Data pre-processing: After the data has been gathered, it is read and processed. In order to prepare the data for algorithms that use machine learning, the data must be cleaned any outliners removed, and transformed.

3. Feature extraction: The pre-processed data must be used to extract features. These characteristics might consist of characteristics like plant height, leaf size, and stem diameter.

4. Prediction of average growth rate: The average rate of development of the plant during a specific time period is predicted using the retrieved characteristics.

5. Plant Growth Prediction: Based on the present state of the plant and its surrounding environment, the project uses machine learning algorithms to forecast the plant's future development.

6. Growth Analysis: following the prediction of development of plants, any potential issues or areas for growth enhancement are identified and addressed.

7. Graphical Representation: To help with the comprehension of the data, the growth analysis is displayed through graphs and charts.

8. Algorithm comparison; based on how well decision tree and KNN forecast plant growth, two distinct machine learning algorithms performance is compared.

The approach often entails gathering and pre-processing data, extracting characteristics, projecting growth rates, examining growth trends, and evaluating the effectiveness of machine learning algorithms.

VII.RESULTS

The results of this system is verified by two algorithms they are KNN and Decision tree algorithms and the accuracy is clearly stated by plotting the graph between the results of those two. As shown in the fig.7.1 the result of predicting the plant development is clearly depicted.

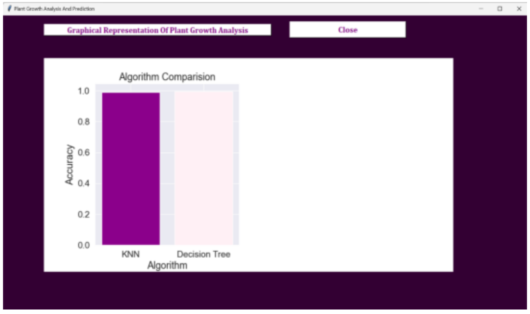

Fig. 7.1 Algorithm comparison of Plant Growth Analysis

Another result that is obtained in this process is the normality and abnormality of the plant which is bifurcated based on algorithms and a graphical notation is obtained. The graphical representation is of predicted plant growth and the bar graph is for number of results.

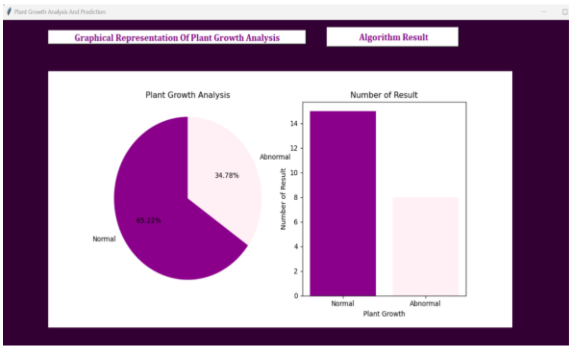

Fig. 7.2 Graphical Representation of plant growth analysis

VIII.CONCLUSION

The venture points to anticipate plant development utilizing machine learning calculations. Two calculations, KNN and Decision Tree, were utilized to foresee plant development based on the include qualities of the plants. The precision of both calculations was compared, and the one with higher exactness was chosen for encourage investigation. The plant development examination was conducted, and outcomes were spoken to graphically. The project has the potential to contribute to the field of agribusiness by giving a precise forecast of plant development based on the plant's stature and other properties. The strategy utilized within the venture can be expanded to other plants and datasets, making it pertinent to a more extensive run of plant species.

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