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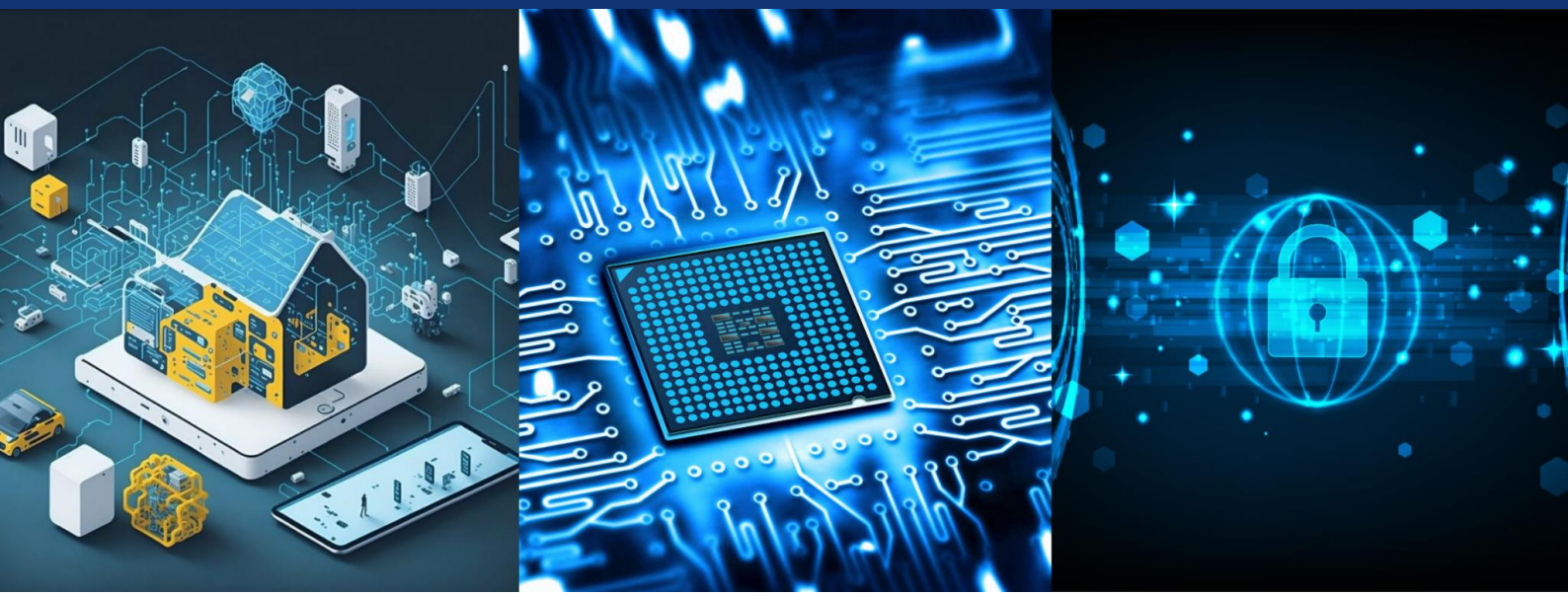

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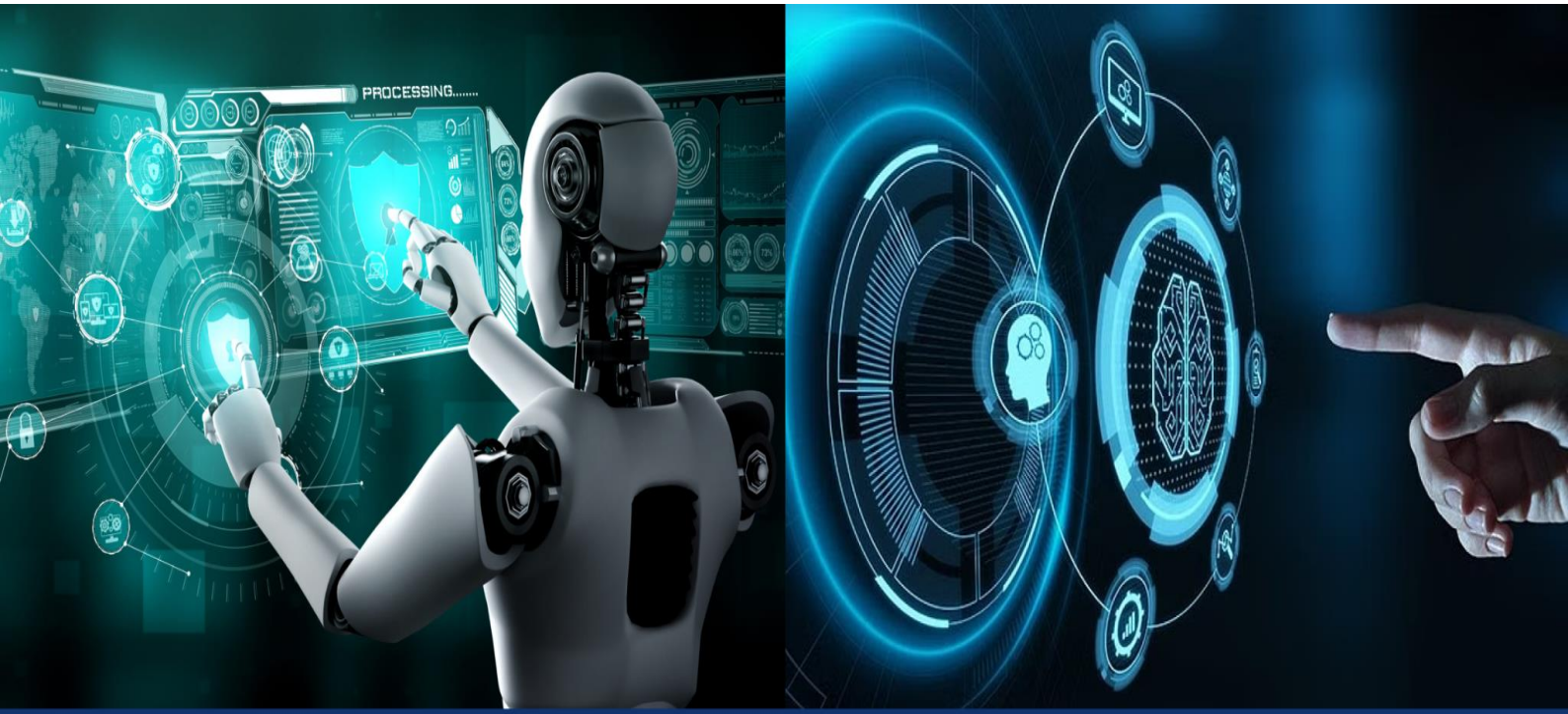

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Identification of Leaf Disease using Machine Learning

Vajja Tejaswini[1], Macha Sasi[2], Kodati Lakshmi Sai Neha[3], Burri Lakshmi Tirupathamma[4], Bairapogu Suchitra[5], Katikam Mahesh[6]

UG Student, Department of CSE (AIML), Tirumala Engineering College, NRT, Andhra Pradesh, India[1-5]

Assistant Professor, Department of CSE (AIML), Tirumala Engineering College, NRT, Andhra Pradesh, India[6]

ABSTRACT: Among the greatest threats to food safety worldwide is plant disease, which is eroding the productivity of agriculture and threatening livelihoods of millions. Its value in detecting and classifying plant leaf disease is in addressing some major issues for agriculture such as food security, farmer's livelihood, and sustainable development and it aims to avert losses to crops from being too great due to a lack of early detection of disease. The data utilized in this research is collected from Kaggle and the name of the dataset is Plantify and it is a public dataset released in 2021. The methods proposed are Convolutional Neural Network that is utilized for image classification wherein color co-occurrence method(CCM) extracts features. The proposed system not only identifies the particular kind of plant disease but also classifies and suggests appropriate remedies or supplements to cure the disease. This two-step method provides diagnosis as well as treatment suggestions and therefore is extremely helpful for real-world applications in agriculture. Otsu classifier and K means clustering are used for image segmentation. The proposed system will be more accurate than the existing method. The model output gives the disease identified and the solutions for the disease classified.

KEYWORDS: Machine Learning, Plant Disease, Food Security Convolutional Neural Network (CNN)Image Classification Color Co-occurrence Method (CCM), Platify dataset, Feature Extraction

I. INTRODUCTION

Disease identification in plants is required to avoid yield loss and ensure agricultural output. Infected plants undergo stunted growth, poor-quality produce, and complete loss of crops. Early detection of the disease enables farmers to take quick action, avoiding further infection and minimizing economic losses. Plant disease occurs due to bacteria, fungi, viruses, or environmental stress. Farmers who lack identification might use inappropriate treatments and end up causing more damage to the crops. It relies mostly on visually noticeable symptoms found on leaves, stems, fruits, and roots. Symptoms could include discoloration, spots, wilting, mold growth, and deformities. Farmers and agricultural professionals rely on such symptoms to identify certain diseases that have infested plants. Visual inspection is not always foolproof, though, because the same symptom could be the result of numerous different diseases. Old methods of identifying diseases are time-consuming and demand much experience and knowledge. Even experienced professionals may struggle to distinguish between different plant diseases. Certain diseases spread very rapidly and need prompt attention, and hence quick identification becomes imperative. Delayed identification is linked with greater chances of large-scale crop damage and economic losses to farmers. Rapid detection of plant diseases is one of the most important factors in sustainable agriculture. Sustainable agriculture is concerned with sustaining high productivity while conserving environmental resources. Excessive use of pesticides due to disease outbreaks can harm soil health and biodiversity. Farmers can reduce pesticide application and use environmentally friendly treatment methods by detecting diseases early. This minimizes the risk of chemical contamination in food and water sources. Sustainable farming practices seek to balance food production with long-term environmental conservation.

II. RELATED WORK

Plant Leaf disease detection and classification have totally,building on machine learning techniques to early disease detection of leaf.[1]introduced information theory about plant disease.it describes an approach for disease detection of crop for economic growth of rural area. This paper discussed about an automated system for identifying and classifying different diseases of the contaminated plants is an emerging research area in precision agriculture.,yashpal sen,2019.[2] getting the dataset for the classification.Work expertise in plant diseases requires successive processing time hence

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image processing is used for the detection of plant diseases, this paper discuss the method used for the detection of plant diseases using the leaves images, and also various techniques to segment the disease part of the plant this paper ,Elangovan,2011.[3] k-means clustering for image segmentation, sandesh raut,2020.[4] otsu's classification for the threshold value,sagar patil,2016.[5]a applied cnn model for the image,Rumpf,2009.[6] machine learning advancements,prathanesh rane,2018.[7]CCM for feature extraction to image classification.presented a concept of plant disease lassification using image segmentation and SVM techniques. This paper describes an image processing technique that identifies the visual symptoms of plant diseases using an analysis of colored images, work of software program that recognizes the color and shape of the leaf image. ,savitha,2014.[8]training the model,manisha sharma,2016.[9]image-perprocessing,newlin shebiah,2016[10]model performance jayamala,2013, and [11]domingues,brandao,2022

III. PROPOSED ALGORITHM

Design Considerations:

The proposed algorithm aims to predict the plant leaf disease with high accuracy using machine learning techniques.

1. **Input :-** Load the dataset

2. Preprocess the image

Resize all images to 224x224 pixels. Normalize pixel values to scale them between 0 and 1. p′=p/255

p = Original pixel value (0-255)

p′ = Normalized pixel value (0-1)

Normalization makes the input uniform for the CNN

3. Define the convolutional neural network

In convolutional layer a filter/kernel is utilized to detect the features.

Formula: [(W−K+2P)/S]+1

w=input size(width of the image), K=kernal size

p= padding(Padding inserts pixels along the input image prior to applying the filter), stride(Stride is how many pixels the filter traverses with each step).

4. ReLu activation function

It helps in non-linearity where all the negative pixels are removed and helps the model learn complicated patterns.

f(X)=max(0,X)

x is the input of the ReLu

5. Batch Normalization (BN)

This is used to make the activations (outputs values of a layer) neither too big nor too small.

x^=(x−μ\t)/σ

where:

μ = Batch mean (average value of inputs).

σ= Batch standard deviation (how dispersed the values are). x= Input value.

tx^ = Normalized value.

Max pooling Reduces image size by using the maximum value in a tiny region and Prevents overfitting by only keeping the most important features.

6. **Prediction:** of diseases is done using softmax classifier.

Stop

IV. PSEUDO CODE

Step 1: Load and preprocess Data

Load csv files(disease_info.csv,supplements_info.csv)

Load the dataset.

Step 2: Split dataset into training and testing.

Split data into 80% of training and 20% of testing

Step 3: Train CCN model

Convolutional layers are applied and ReLU activation function is applied for the noise reduction in the image

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Perform K-Means and otsu's classifier for the image segmentation.

Step 4: Evaluate Model performance
Calculate Evalution metrics for trained model on testing dataset
Compare the result for the performed model

Step 5: Model evaluation
After every convolution layer the ReLU activation function is applied.
ReLU gives non-linearity for the image features(bacterial spots,yellowish spots,shape,size)

Step 6: Predict the disease.
It detects the disease of the leaf gives the information of the disease
The supplements and remidies are provided for diseased leaf

Step 7: End.

V. SIMULATION RESULTS

The experiment consisted of identifying and classifying leaf diseases in plants using several machine learning models and assessing the performance of models by using primary measures like Accuracy, Precision,. The data utilized was the public dataset Plantify Dataset (2021) available on Kaggle consisting of high-resolution leaf images of various plant species infected with various types of diseases. Every image was marked with disease class and plant type.

For measuring model performance, we utilized and compared some models such as Convolutional Neural Networks (CNN),K-Means Clustering,otsu's Classifier.These models were all trained and tested on preprocessed and augmented images with an 80:20 train-test split.Results depicted that the CNN model far exceeded the rest of the models in performance with 93.5% highest accuracy. This clearly shows very high reliability in determining the presence as well as type of plant disease.Also, visual inspection through confusion matrix validated the better ability of the CNN in separating closely related classes of diseases with very few misclassifications.

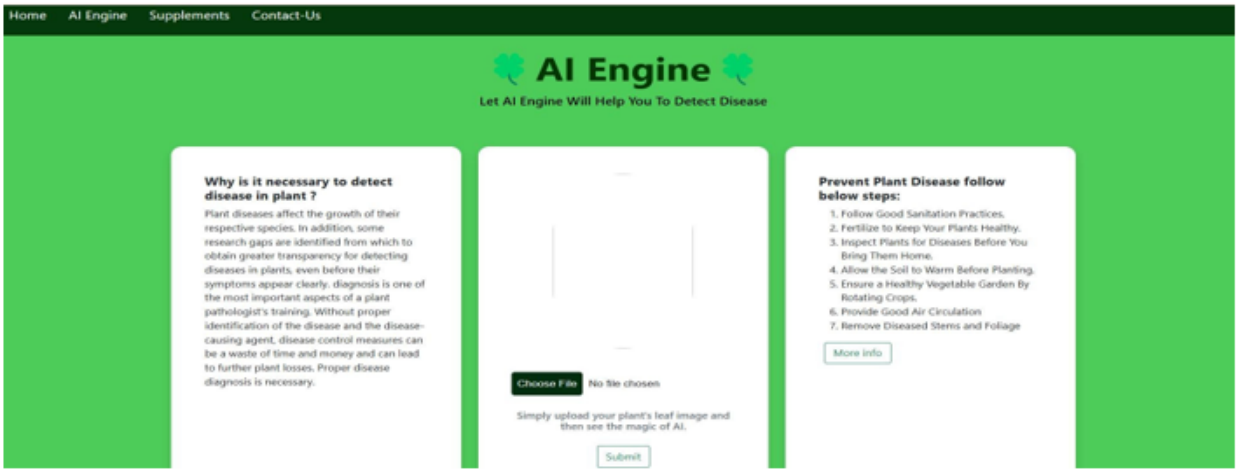

Fig:1 Choose image from the dataset and click submit

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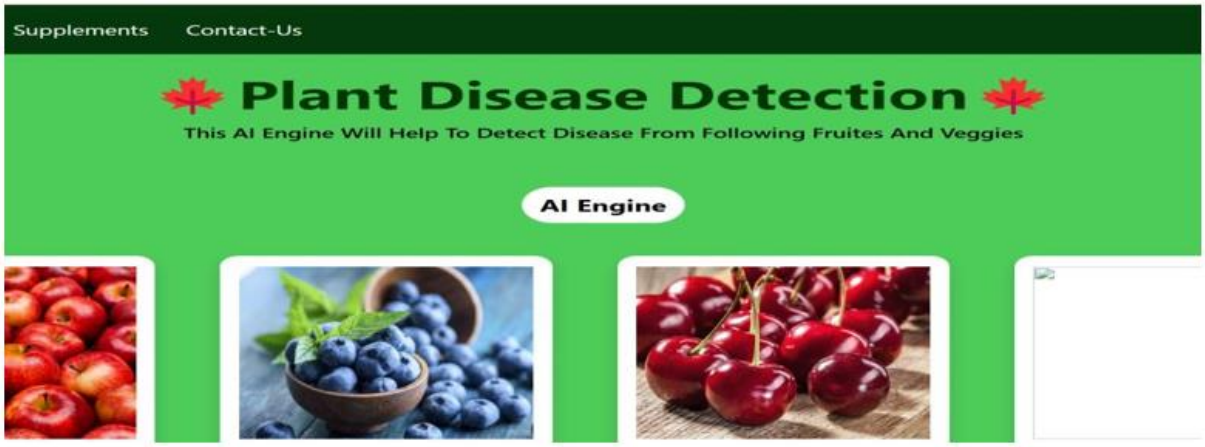

Fig:2 Home page, click AI Engine

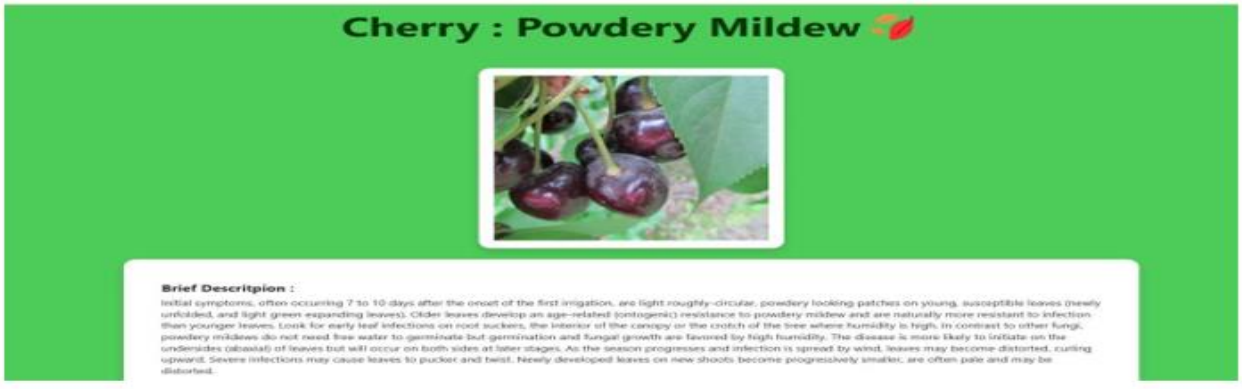

Fig:3 leaf if diseased and gives the description of disease

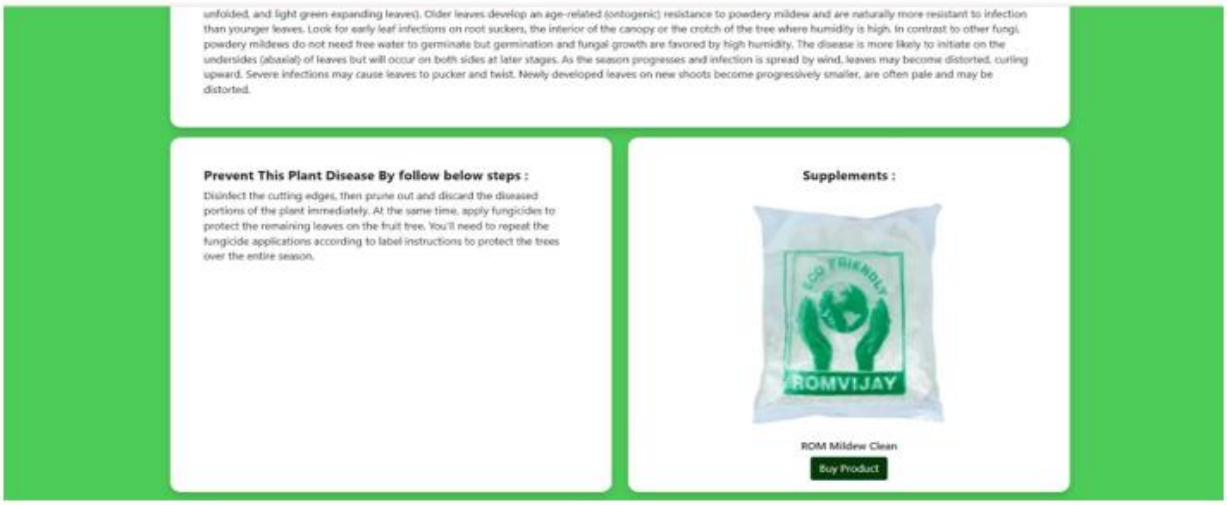

Fig:4 shows remides and Supplements for the diseased leaf

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Its accuracy is especially effective for detecting diseases at their onset and crop management. With its maximum accuracy, precision, and zero or very low error, the CNN model is best suited for real-time plant disease monitoring schemes and can aid farmers in making on-time diagnosis and treatment decisions, thereby promoting sustainable agriculture.The Machine Learning approach to classifiy the leaf disease by image segmentation and preprocessing.This project impressive result , achiveing a 93.5% accuracy with the k-means clustering to remove noise in the image for the better preformance based on features like color,shape,texture on the leaf.It provides detailed performance thorugh classification and image pre-processing.While the diseases to “disease_info.csv” had information about the diseases and supllements to “supplements_info.csv” had information about the supplements.It offers real time usability via a flask web frame work interface with HTML outputs.

VI. CONCLUSION AND FUTURE WORK

There are various means through which we can identify disease of plants and recommend solutions to them. All of them possess some advantages along with disadvantages.On one hand visual examination is cheapest and easy method, yet it is less efficient and trustworthy. Image processing is a method which is most in demand for extremely high precision and minimal usage of time are key advantages provided. Applications of K-means clustering and Neural Networks (NNs) have been designed for disease clustering and classification that affect plant leaves. Identification of the disease precisely and effectively is the primary aim of the proposed solution. The results of experiments demonstrate that the proposed solution is an effective solution, which can potentially assist an precise identification of leaf diseases in minimal computational effort. In addition to the provision of cultivation equipment, the farmers also require access to precise information that they can utilize for effective crop management and there is no better means than giving them a service that they can use through the software.

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