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"Image-Based Disease Classification for Optimal Plant Spraying"

Ku. Prerna Surjuse[1], Ku. Gauri Jayale[2], Ku. Mrudula Belsare[3]

Department of Electrical Engineering Shri Sant Gajanan Maharaj College of Engineering Shegaon, India

ABSTRACT—

This paper presents a novel approach for the automated classification of plant diseases through image processing for optimised spraying purposes. Utilising a Matlab-based system with .M code, the proposed methodology integrates a Convolutional Neural Network (CNN) algorithm to accurately detect leaf diseases. The system features a user-friendly graphical interface for seamless leaf selection and result analysis. Employing image processing techniques, the system predicts the specific disease affecting the leaf and provides targeted solutions. Notably, the system operates exclusively on a predefined dataset, ensuring reliability and consistency in disease identification and resolution. This innovation holds significant promise for precision agriculture, enabling timely and targeted intervention strategies for crop health management.

Keywords- Image processing, Matlab-based system, Crop health management, Automated detection.

INTRODUCTION

In the realm of agriculture, efficient and timely identification of plant diseases is crucial for maintaining crop health and ensuring food security. Traditional methods of disease detection often prove time-consuming and labor-intensive, prompting the need for automated solutions. This research introduces a sophisticated system built on Matlab, employing a dedicated set of .M code, to harness the power of image processing for disease classification. The integration of a Convolutional Neural Network (CNN) algorithm enhances the accuracy and speed of disease detection, paving the way for more proactive and targeted agricultural interventions.

The heart of this system lies in its user-friendly graphical interface, designed to facilitate the seamless selection of leaves and simplify the analysis of disease detection results. By utilising advanced image processing techniques, the system not only identifies the specific disease affecting the leaves but also offers tailored solutions for effective mitigation. Importantly, the system operates within the constraints of a predetermined dataset, ensuring its reliability and applicability to real-world scenarios. This research marks a significant stride towards the development of precision agriculture tools, providing farmers with an innovative means to enhance crop yield and reduce the environmental impact of disease management practices.

LITERATURE REVIEW

1. Dhiman Mondal, presents classification and detection techniques that can be used for plant leaf disease classification. Here the preprocess is done before feature extraction. RGB images are converted into white and then converted into grey-level images to extract the image of the vein from each leaf. Then basic Morphological functions are applied to the image. Then the image is converted into a binary image. After that, if the binary pixel value is 0 it's converted to the corresponding RGB image value. Finally by using Pearson correlation and Dominating feature set and Naïve Bayesian classifier disease is detected.

2. Pranjali B, there are four steps. Out of them, the first one is gathering images from several parts of the country for training and testing. The second part is applying a Gaussian filter to remove all the noise and thresholding is done to get the all-green colour component. K-means clustering is used for segmentation. All RGB images are converted into HSV for extracting features.

3. Reza, Zarreen Naowal, et al. The paper presents the technique of detecting jute plant disease using image processing. The image is captured and then it is realised to match the size of the image to be stored in the database. Then the image is enhanced in quality and noises are removed. Hue-based segmentation is applied to the image with customised thresholding formula. Then the image is converted into HSV from RGB as it helps extract the region of interest. This approach proposed can significantly support detecting stem-oriented diseases in jute plants.

4. Tejoindhi M.R., they have proposed a technique that can be used for detecting paddy plant disease by comparing it with 100 healthy images and 100 samples of disease1 and another 100 samples of disease2. It's not sufficient enough to detect disease or classify its training data is not linearly separable.

5. Arya, M. S., K. Anjali, et al. In the paper detection of unhealthy plant leaves includes some steps are RGB image acquisition. Converting the input image from RGB to HSI format. Masking and removing the green pixels. Segment the components using Ostu's method. Computing the texture features using color-co-occurrence methodology and finally classifying the disease using Genetic Algorithm.

6. Tanvimehera, includes tomato disease detection using computer vision. A grayscale image is turned into a binary image depending on a threshold value. The threshold algorithm is used for image segmentation. The threshold values are given color indices like red, green, and blue. But the thresholding is not a reliable method as this technique only distinguishes red tomatoes from other colors. It becomes difficult to distinguish between ripe and unripe tomatoes. For this K-means clustering algorithm is used to overcome the drawbacks. K-means create a particular number of nonhierarchical clusters. This method is numerical, unsupervised, non-deterministic, and iterative. Then separating the infected parts from the leaf the RGB image was converted into YCbCr to enhance the feature of the image. The final step is the calculation of the percentage of infection and distinguishing the ripe and unripe tomatoes.

7. Ms. Poojapawer, The methodology includes image acquisition, image preprocessing, feature extraction with Gray level co-occurrence matrix (GLCM) and finally classified into two types: Unsupervised classification and supervised classification. The Paddy plant is an important plant in the continental region.

8. Narmadha, R. P., and G. Arulvadivu, In paper RGB images are converted into grayscale images using color conversion. Various enhancement techniques like histogram equalization and contrast adjustment are used for image quality enhancement. Different types of classification features like SVM, ANN, and FUZZY classification are used here. Feature extract6ion uses different types of feature values like texture feature, structure feature, and geometric feature. By using ANN and FUZZY classification, it can identify the disease of the paddy plant.

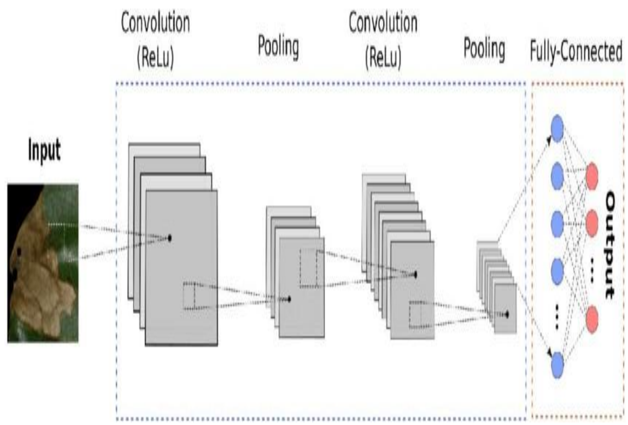
9. Mukesh Kumar Tripathi, popular methods have been utilizing machine learning, image processing, and classification-based approaches to identify and detect the disease of agricultural products.

10. Prakash, R. Meena, G. P. Saraswathy, In the paper image processing techniques are used to detect citrus leaf disease. This system includes Image preprocessing, segmentation of the leaf using K-means clustering to determine the diseased areas, feature extraction, and classification of disease. Uses a Gray-Level Co-Occurrence matrix (GLCM) for feature extraction and classification is done using a support vector machine (SVM).

METHODOLOGY

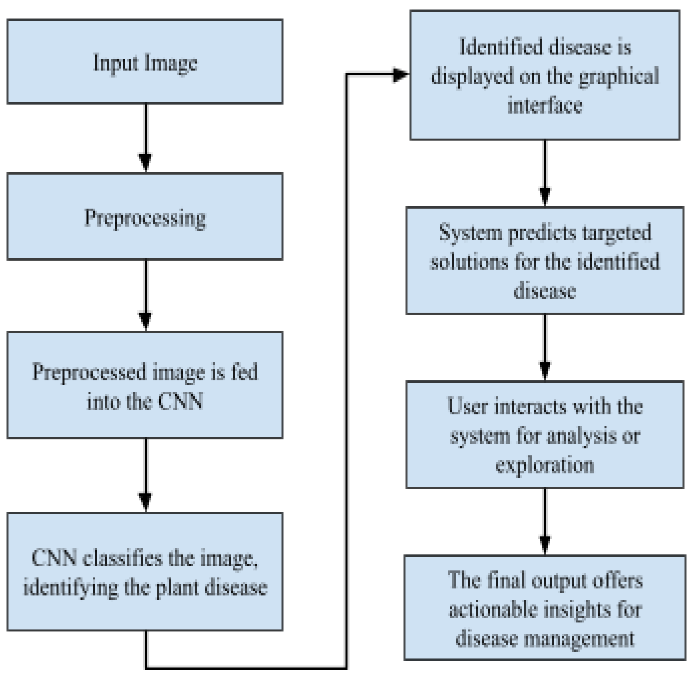
The proposed system aims to revolutionise plant disease management through an integrated approach using advanced image processing and artificial intelligence techniques. Initially, the user will interact with a user-friendly graphical interface to input leaf images into the Matlab-based system. The system will then employ a Convolutional Neural Network (CNN) algorithm to analyse the images, accurately detecting and classifying any potential diseases present. Subsequently, the results will be presented to the user through the graphical interface, facilitating seamless analysis. Leveraging image processing techniques, the system will predict the specific disease affecting the leaves. Finally, the system will provide targeted solutions for effective agricultural interventions, offering farmers actionable insights for precise and timely disease management practices. This step-by-step process ensures a comprehensive and user-centric approach to automated plant disease identification and mitigation.

BLOCK DIAGRAM



Proposed CNN Architecture

FLOW CHART



WORKING

The paper title is "Classification Of Plant Diseases By Image Processing For Spraying Purpose". In this paper, we are developing an integrated system for automated plant disease management using advanced image processing and artificial intelligence techniques. Through a user-friendly interface, users input leaf images, which are then analyzed by a Convolutional Neural Network (CNN) algorithm for accurate disease detection and classification. Leveraging image processing, the system predicts specific diseases and provides targeted solutions for effective agricultural interventions, empowering farmers with actionable insights for precise disease management practices.

SYSTEM REQUIREMENT SOFTWARE REQUIREMENT

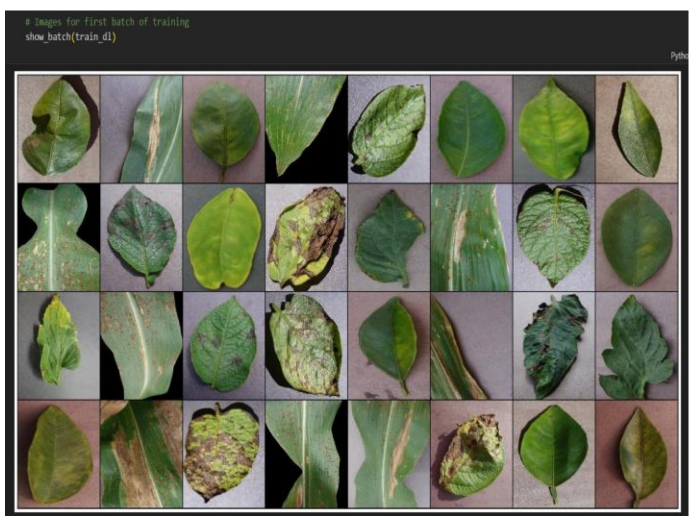
- Matlab Software

IMPLEMENTATION

Convolutional neural networks (CNN) can be used for the computational model creation that works on the unstructured image inputs and converts them to output labels of corresponding. classification. They belong to the category of multi-layer networks which can be trained to learn the required features for classification purposes. Less preprocessing is required in comparison to traditional approaches and automatic feature extraction is performed for better performance LeNet consists of convolutional, activation, max-pooling, and fully connected layer LeNet is a simple CNN model. This architecture is used for the classification of leaf diseases in the LeNet model. It consists of an additional block of convolution, activation, and pooling layers in comparison to the original LeNet architecture. The model used in this paper . Each block consists of a convolution, activation, and max pooling layer. Three such blocks followed by fully connected layers and soft-max activation are used in this architecture. Convolution and pooling layers are used for feature extraction whereas the fully connected layers are used for classification. Activation layers are used for introducing non-linearity into the network Convolution layer applies convolution operation for extraction of features. With the increase in depth, the complexity of the extracted features increases. The size of the filter is fixed to 5 × 5 whereas the number of filters is increased progressively as we move from one block to another. The number of filters is 20 in the first convolution block while it is increased to 50 in the second and 80 in the third. This increase in the number of filters is necessary to compensate for the reduction in the size of the feature maps caused by the use of pooling layers in each of the blocks.

After the application of the convolution operation feature maps are zero-padded, to preserve the size of the image. The max pooling layer is used for reduction in the size of the feature maps, speeding up the training process, and making the model less variant to minor changes in input. The kernel size for max pooling is 2×2. The reLU activation layer is used in each of the blocks for the introduction of non-linearity. Also, the Dropout regularization technique has been used with a keep probability of 0.5 to avoid overfitting the train set. Dropout regularization randomly drops neurons in the network during an iteration of training in order to reduce the variance of the model and simplify the network which aids in the prevention of overfitting. Finally, the classification block consists of two sets of fully connected neural network layers each with 500 and 10 neurons respectively. The second dense layer is followed by a soft max activation function to compute the probability scores for the ten classes.

DATASET



Sample images in the dataset IMPLEMENTATION STEP BY STEP

STEP 1: Open the software and use GUI for disease detection.

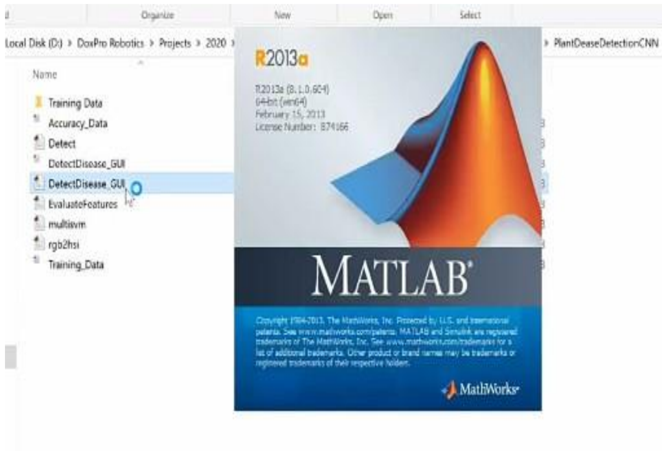


Fig 5.1 shows the GUI with Matlab software

STEP 2: Load the Image

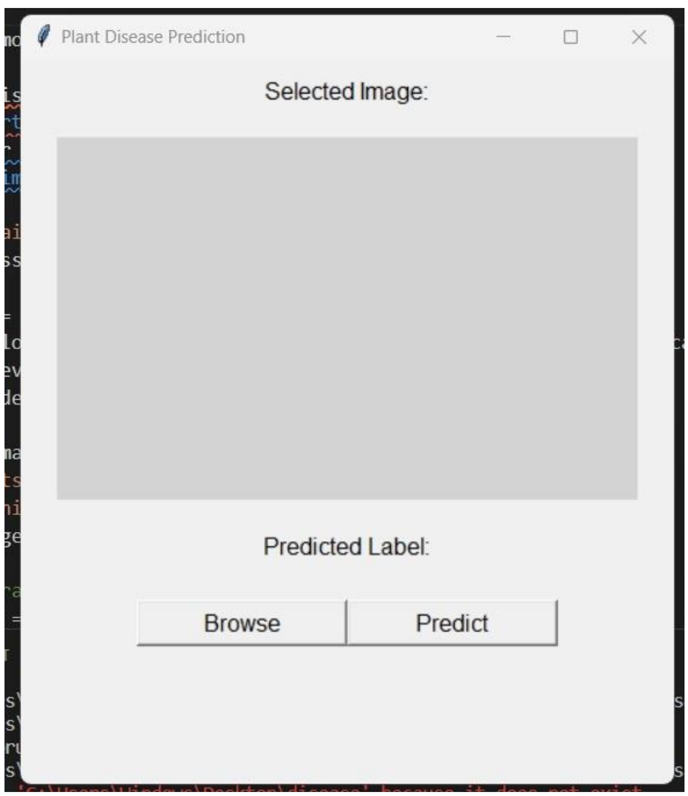


Fig 5.2 shows the GUI page for Predict leaf diseases.

RESULT

After implementing a Convolutional Neural Network (CNN) algorithm for leaf disease detection through image processing, the system successfully predicts the disease of corn maize leaves based on a pre-selected dataset. Specifically, when presented with a corn maize leaf image, the CNN algorithm identifies and classifies the leaf disease, yielding results that indicate the presence of common rust disease.

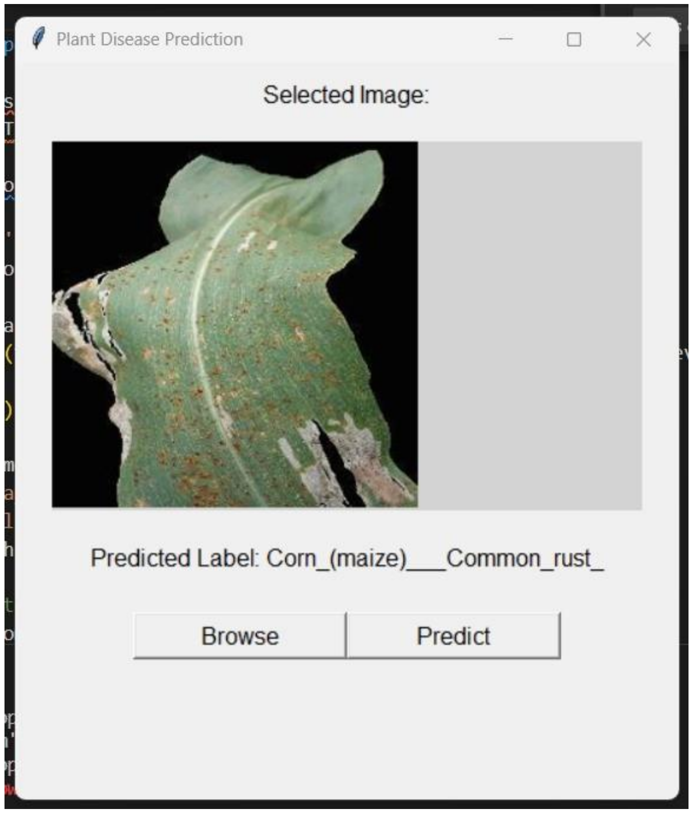


Fig 5.3 shows the prediction of corn leaf diseases.

It's important to note that the system's predictions are limited to the characteristics present in the provided dataset, emphasising the need for a diverse and representative dataset for optimal model performance.

V. CONCLUSION

This paper introduces a robust and innovative system for automated plant disease identification and management. By integrating a Matlab-based platform with a sophisticated Convolutional Neural Network (CNN) algorithm, the system provides a user-friendly interface for seamless interaction. Through advanced image processing, it accurately detects and classifies leaf diseases, offering a reliable tool for farmers to assess and address crop health challenges. The system's predictive capabilities and targeted solutions underscore its potential to revolutionise precision agriculture, minimising the environmental impact of disease management practices and optimising crop yields. The comprehensive approach of this system signifies a significant stride towards sustainable and efficient agricultural practices, ensuring the resilience and productivity of crop cultivation in the face of evolving plant health threats.

VI. REFERENCE

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