Plant Disease Classification Using Deep Learning Technique

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Abstract -Farmers confronts great obstacles in detecting and monitoring plant diseases. The major cause of the reduction in the quality and amount of agricultural productivity is plant diseases. Therefore, it's of great importance to diagnose the plant diseases at early stages in order that suitable and timely action are often taken by the farmers to avoid further damages. The project focuses on the approach based on image processing for the detection of infections of plant diseases using leaf image. In this paper, we propose a system that helps farmers for finding plant disease by uploading a leaf image to the system. Using the dataset, the system classifies and then detects which type of disease as occur.

***Key Words*:**Agriculture, Plant Disease, Diagnose, Image Processing, Classifies, Dectection.

1.INTRODUCTION

Computers have evolved to be an important device in several applications like defense, medical, agriculture, engineering etc. with its ability to process digital information like images captured from some computing devices. A picture contains important information which can be retrieved by using some computational method. Image segmentation may be a task for partitioning a picture into smaller parts that are more meaningful. Interestingly, it can best as identification and classification of some region of interest. The segmentation is performed supported some common properties of the objects present during a picture like color, texture and, shape etc. Image segmentation could also be a preprocessing step for image processing generally performed by using two methods

(i)Traditional method

(ii) Soft computing method.

The classification of conventional method mainly negotiations soft threshold, edge- based, region based, and clustering methods and soft computing mainly compromise of mathematical logic, neural network, and genetic algorithm.

Soft computing having the potential to affect uncertainty has been most generally used for image segmentation nowadays. Soft computing methods are designed to simulate human intelligence by learning from their skills to perform some complex task automatically.

The Soft Computing (SC) methods may be a group of methods mainly symbolic logic (FL), Neural Network (NN), and Genetic Algorithm (GA)and warm Intelligence methods like Particles warm optimization (PSO), Bacterial foraging optimization (BFO) etc. Soft computing methods generally don't require human intervention they perform the segmentation task automatically.

Plants play a crucial role altogether the aspect so file. They function a backbone to sustain the environment. Plants do suffer from diseases, which affects the normal growth of plants. That cause an affect to a complete plant including leaf, flower, fruit and stem. Detection of such plant diseases may be a crucial task to perform. the prevailing method for the identification and classification of diseases from a plant is completed with the help of human intervention. Experts through eye make observations about the diseases of a plant by continuous monitoring of plants over an outsized period. Most of the time, these existing approaches of disease identifications are time-consuming and cumbersome. Soto monitor the disease at an early stage, use of some automatic method are often quite beneficial. Soft computing technique having the facility to simulate human thinking has the potential to perform the task of identification and classification of such plant diseases automatically in less time and price.

In this article, we've presented an automatic soft computing approach BRBFNN for identification and classification of disease from plant leaves. The proposed method uses Bacterial Foraging Optimization (BFO)to assign optimal weight to Radial Basis Function Neural Network (RBFNN) and to hunt out the optimal region for the varied disease present on the plant leaves. RBFNN is that the special linear function having a singular competence of which increases or decreases monotonically with distance from the center point capable of handling the complexity of the affected region on the plant leaf images. The efficiency of the RBFNN is further enhanced for region growing method used seed points and grouping them to find the similar attributes that help in feature

extraction process. BFO with its mimicking capability and multi-optimal function verifies to be an efficient and powerful tool for initializing the load of RBFNN and training the network which will correctly identify different regions on plant leaf image with high convergence speed and accuracy. The identification and classification of plant diseases using some automatic intelligence approach can have the expected significance like

1) and metric formation using some parameters related to a product such as a durability, cost, future needs and quality assurance etc.

2) Predetermination of the plant utilization based on the perilous climatic conditions that deleterious the plantation.

2. RELATED WORK

Identification and classification of plant disease may be a complicated task to perform. Many researchers have worked on traditional and soft computing approaches for the segmentation to find the infected area of leaves from the disease. In this part, we are going to try some of the soft computing approaches that have been utilized to perform this task. Support vector machine with radial basis function being its kernel has been used most often to identify and classify the disease present with an image of leaf with the disease. The NN with its learning and training capabilities has also been deployed for this task.

Generally, it has been seen from the literature that SVM has been applied for the identification of plant diseases. Whereas the learning ability of NN also contributes for the same purpose. As it is seen from the survey authors have majorly focused on the identification of a disease from the specific plant because it is a hard task to identify and categorize the disease among different categories. As deep learning algorithms are appearing in the number of applications a novel work introduced by Yang Lu et al. have applied convolutional neural network for the identification of rice diseases.

Shanwen Zhang et al. in this paper they used k-means clustering for the identification of cucumber leaf diseases. There are number of applications using SVM are presented like Pranjali B. Padol et al. in this paper they used it for identification of grapes plant disease , Jagadeesh D. Pujari et al. is used for identification of plant disease of crops like wheat, maize, grape and sunflower etc., Sushma S. Patil et al. for identification of tomato plant disease , Marion Neumann et al. for beet leaf disease, Rong Zhou et al. for identification of Cercospora leaf Spot form sugar beet then on. Though the researchers have worked with SVM, the problem of identifying multiple diseases by using SVM will be a complicated task, because of this the efficiency of the system will decrease both in the terms of cost and time. In this paper, we have introduced radial basis function network have been trained with bacterial foraging algorithm that is robust in nature for abrupt changes occur in leaf diseases and network along with radial basis function for feature extraction to identify and classify six fungal plant leaf diseases correctly.

Agriculture is that the primary sector of food providence in India, and it's a growing entity progressively. Segmentation is a technique for distributing and classifying image into several parts of the area n, where each area has similarity attributes but the result of attributes is not the same. The segmentation process is completed through k-means clustering technique. There various papers describing to detecting the diseases and methods suggesting the implementation ways as shown and consulted here.

Moshou, Bravo and west the alteration in spectral reluctance among healthy and diseased wheat plants is examined at an initial phase in the expansion of "yellow rust" illness. Though the use of neural network and more exactly multi-layer hidden layer, the classification presentation is rises 95% to 99% and accurate the leaf spectra for evaluating of both diseased and healthy spectra.

Nidhya and Sundaram Decision tree comes under the learning algorithms by using C4.5 decision trees algorithm wheat leaf disease is detecting. Decision tree is unbearable the standards of material gain; improvement ratio and gain index and find the percentage of it by using all the learning algorithms.

Vala and Baxi Image segmentation methods are best approaches for thresholding is its simple calculation. OTSU is an involuntary threshold selection district grounded segmentation technique. As decision of other threshold approaches OTSU performs well.

Shanwen and Chuanlei A supervised orthogonal non dimensionality discount algorithm, called orthogonal nonlinear dimensionality reduction (OLDP) presented aimed at plant disease recognition. The planned algorithm goal to discovery a prominent matrix by dragging the data numbers between different classes as far as imaginable. The new results on real maize disease leaf images validate that the proposed method is actual and possible for the detection of leaf plant disease.

Thangadunai and Padumavathi Gray image is easy to procedure and tool for various applications since they obligate better clarity and suited for examination than RGB images. Histogram equalization is used to enhance the contrast of images and delivers clear image to human eyes. Histogram equalization is castoff to realize better excellence images in gray scale which is used in numerous medical applications, biological sub missions etc.

Khan, Akram, Naqvi, Haider is used to build up a procedure for automatic detection of various plant diseases by utilizing an unsupervised learning segmentation technique and to identify the lightness and darkness of the image by using two lab colors space techniques CIELAB and RGB are used.

3. ANALYSIS AND DESIGN OF THE APPLICATION

3.1Existing Method

The system is implemented by using mobile application supported android operating system for identifying Indonesian medicinal plant images supported by two factors texture and color features of digital leaf images within the experiments they were used 51 species of Indonesian medicinal plants and each species consists of 48 images, therefore the entire images is used in this research are 2,448 images. They used to find the effectiveness of the fusion between the Fuzzy Local Binary Pattern (FLBP) and the Fuzzy Color Histogram (FCH) that are used to identify medicinal plants. The FLBP method is used for extracting leaf image texture and the FCH method is used for extracting leaf image color. The fusion of FLBP and FCH is completed by using Product Decision Rules (PDR) method. This research used in Probabilistic Neural Network (PNN) classifier for classifying medicinal plant species. The results of the fusion are can improve the accuracy of medicinal plants by the identification and the accuracy of identification using fusion of FLBP and FCH is 74.51%. This application is important to help people for identifying and finding information about Indonesian medicinal plant.

Disadvantages

- The most of existing methods has ignored the poor-quality images like images with noise or poor brightness.
- Less accuracy.

3.2 Proposed System

Image Acquisition: The pictures of the plant leaf are captured through the camera. This image is in RGB (Red, Green, and Blue) for color transformation structure for the RGB leaf image is made, and then, a device-independent color space transformation for the color transformation structure is applied.

Image Pre-processing: To remove noise within the image or other object removals, different pre-processing techniques is considered. RGB to Gray Converter-Weighted method or luminosity Method-You has seen the matter that happens within the average method. The weighted method features a solution thereto problem. Since red color has more wavelength of all the three colors, and green is that the color that has not only less wavelength than red color but also green is that the color that provides a more soothing effect to the eyes. It means we must decrease the contribution of red color, and increase the contribution of the green color, and put blue color contribution in between these two. So, the new equation that form is: New grayscale image = ((0.3 * R) + (0.59 * G) + (0.11 * B)). consistent with this equation, Red has contributed 30%, Green has contributed 59% which is bigger altogether three colors and Blue has contributed 11%. Image Resize- The resolution of document images is usually above 2000 _ 2000, which is just too large to be fed to a CNN with the present availability of computing resources. Large input dimension not only costs more computation resources but also results in a greater chance of overfitting. After Converting RGB image into Gray it resizes into a typical format that's either 400 × 400 for better resolution.

CLAHE -Ordinary AHE is used for amplify the contrast in near-constant regions of the image and for that we used the histogram in such regions is very concentrated and the result will cause cause noise to be amplified in near constant regions. Contrast Limited AHE (CLAHE) is a variant of adaptive histogram equalization which the contrast amplification is restricted, to scale back this problem of noise amplification.

Gaussian blur is used in image processing, a Gaussian blur also referred to as Gaussian smoothing and that the results of blurring a picture by a Gaussian function. It's a widely used effect in graphics software, and typically to scale back image noise and reduce detail.

Convolutional Neural Networks–After removing noise from the image it required to extracts the feature. We propose to use a CNN for document image classification.

The main idea is to find out a hierarchy of feature detectors and train a nonlinear classifier to spot complex document layouts. Given a document image, we first perform down sampling and pixel value normalization, then feed the normalized image to the CNN to predict the category label.

4. ARCHITECTURE DESIGN

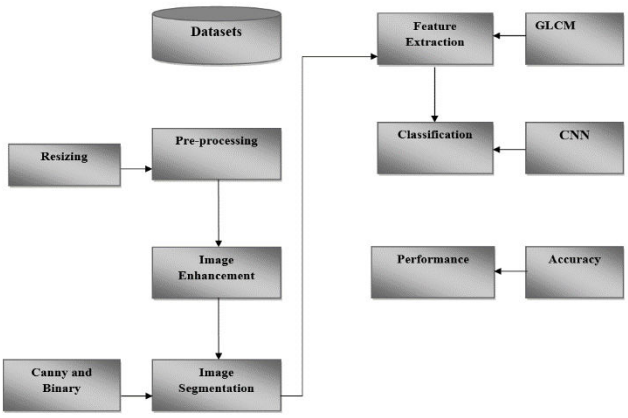

Fig -1:Architectural design of Leaf Detection

Plants do suffer from diseases, like citizenry and animals. These diseases affect an entire plant including leaf, stem, fruit, root and flower. there's the amount of plants diseases that occur and affects the traditional growth of a plant. When the

disease of a plant has not been taken care, the plant may suffer from disease or may cause leaves drop, flowers and fruits drop etc. Appropriate diagnosis of such diseases is required to for accurate identification and treatment of plant diseases. The diagnosis of diseases depends upon aspects like

1) Trying to find signs or symptoms: are often seen by naked eyes are the looks of some unwanted spots, dead areas etc. on a part of the plant.

2) Having the knowledge of the traditional characteristics of the host plant: one should realize the properties of the host plant then it's easier for one to diagnosis the disease.

3) The timing of symptoms: it depends upon two factors Disorder and a couple of Diseases. Disorders are caused supported some environmental problems, happens suddenly like within each day or week and doesn't cover the parts of the plant. Whereas, diseases are slow takes several days, weeks, months or maybe a year to grow, having the property of affecting the opposite parts of the plant.

4) Noticing the pattern of the diseases on the host plant: patterns are often uniform and non-uniform in nature. Uniform is understood as abiotic that are caused by non-living factors and non-uniform are biotic that are caused by some disease or insect.

The plant diseases are generally classified into three categories 1. Bacteria 2. Fungus and three. Virus. during this article, we've focused upon fungal diseases identification that affects the plant on an outsized scale. Fungi is that the disease that attains their energy from the plant they live upon. Fungi disease is liable for a big amount of injury. consistent with a study, about 85% of all plant diseases are caused by fungi. The fungi diseases that were considered during this work for identification and classification.

5. IMPLEMENTATION

5.1 Preprocessing

- Pre-processing may be a common name for operations with images at rock bottom level of abstraction -- both input and output are intensity images.
- The main intention of pre-processing is used as an improvement of the image data that unwanted attributes or enhances for processing.
- It is one of the methods is use the considerable redundancy in images. Neighbouring pixels corresponding to at least one object in real images have essentially an equivalent or similar brightness value.
- The importance of the pre-processing stage of a personality recognition system lies in its ability to remedy several the issues which will occur thanks to several the factors.
- Thus, the utilization of pre-processing techniques may enhance a document image preparing it for subsequent stage during a character recognition system. to realize higher recognition rates, it's essential to possess an efficient pre-processing stage, therefore; using effective pre-processing algorithms makes the OCR system more robust mainly through accurate image enhancement, noise removal, image threshold, page segmentation, character segmentation, character normalization and morphological techniques.
- Pre-processing techniques are needed on colour, grey-level or binary document images containing text and/or graphics. In character recognition systems most of the applications use grey or binary images to get high result.
- The images can also contain non-uniform background and watermarks so it making difficult to extract the document text from the image without performing pre-processing, therefore it is used in the specified result from pre-processing.
- Thus, we use some of the methods like image enhancement techniques to get rid of noise or correct the contrast within the image, thresholding to get rid of the background contain like watermarks or noise, it is recovered by using segmentation in that using separate graphics from text and character segmentation is used to separate characters from each other and, we will use a morphological processing to strengthen the characters.

5.2 Image Enhancement

- Image enhancement is that the procedure of improving the standard and therefore the information content of original data before processing. The method which are used commonly it include contrast enhancement, spatial filtering, density slicing and FCC.
- Contrast enhancement or stretching is performed by linear transformation expanding the first range of gray level. Spatial filtering improves this linear feature like fault, shear zones and lineaments.
- Density slicing is used to converts the continual gray tone range into a series of density intervals marked by the separate colors or symbol to represent in different features.
- Image enhancement techniques are mathematical techniques that are aimed toward realizing improvement within the quality of a given image.
- The result's another image that demonstrates certain features during a manner that's better in some sense as compared to their appearance within the original image. One also can derive or compute multiple processed versions of the primary image, each

presenting a selected feature in an enhanced appearance.

- Simple image enhancement techniques are developed and applied in a billboard hoc manner. The techniques that are optimized about certain specific requirements and objective criteria it is used.
- Image enhancement tools are often is used to classify into point operations and spatial operations. Point operations include like contrast stretching, noise clipping, histogram modification, and pseudo-colouring.
- Point operations are, generally, simple nonlinear operations that are documented within the image processing literature and are covered elsewhere. Spatial operations utilized in image processing today are, on the other hand, typically linear operations.
- The rationale for this is often that spatial linear operations are simple and simply implemented. In linear image enhancement tools are often to adequate in many applications and have significant advantages in image enhancement are often to attained.
- Nonlinear methods effectively preserve edges and details of images while methods using linear operators tend to blur and warp them. Additionally, nonlinear image enhancement tools are less vulnerable to noise.
- Noise is usually representing in the image acquisition systems for instance, under-exposure and low-light conditions in analogy photography conditions cause images with film-grain noise.

5.3 Image Segmentation

- Image segmentation may be a commonly used technique in digital image processing and analysis to partition a picture into multiple parts or regions, often supported the characteristics of the pixels within the image. Image segmentation could involve separating foreground from background, or clustering regions of pixels supported similarities in color or shape.
- Image segmentation involves converting a picture into a set of regions of pixels that are represented by a mask or a labelled image. By dividing a picture into segments, you'll process only the important segments of the image rather than processing the whole image.
- Canny Edge Detection may be a popular edge detection algorithm. it had been developed by John F. Canny in 1986. it's a multi-stage algorithm and that we will undergo each stage.
- Image segmentation is that the process of partitioning a picture into multiple segments. Image segmentation is usually wont to locate objects and limits in images the segmenting results of a femur image. It shows the result of the outer surface (red), the surface is used between compact bone and spongy bone (green) and therefore the surface of the bone marrow (blue).
- Kristiadi et al. proposed using PSO to segment colors images. The testing applied an example of a picture segmentation to demonstrate PSO method to seek out best clusters of image segmentation. The results showed in the PSO runs 170% faster when it used in the GPU in parallel mode without from that used CPU alone. This speedup is growing because the number of particles gets higher.
- Image segmentation is considered an integral component in digital image processing which is employed for dividing the image into different segments and discrete regions. the result of image segmentation may be a group of segments that jointly enclose the entire image or a set of contours taken out from the image. we will divide image segmentation into different methods.
- The methods supported techniques that are propose that the simplest method of segmentation is that the one which minimizes data's coding length and therefore the general probable segmentation. In these methods histograms are well known used to find gauge additional segmentation schemes as they have only single exceed within the progress of the pixels.

5.4 Feature Extraction

- Feature extraction involves reducing the quantity of resources required to elucidate an outsized set of data. When performing analysis of complex data one of the most problem's stems from the quantity of variables involved.
- Analysis with an outsized number of variables generally requires an outsized amount of memory and computation power, also it's getting to cause a classification algorithm to overfit to training samples and generalize poorly to new samples.
- Feature extraction could also be a general term for methods of constructing the combinations of the variables to solve the problems while still describing the data with enough accuracy. Many machine learning techniques is used to believe that properly optimized feature extraction is that the key to make an effective model construction.
- A statistical method of examining texture is that considers the spatial relationship of pixels by using that the gray-level co-occurrence matrix, and using the gray-level spatial dependence matrix. The GLCM function is used to find the texture of an image by converting the pairs of pixels with specific values and through a specified spatial relationship, and we creating a GLCM, then extracting statistical measures from the matrix.

- The grey Level Co-occurrence Matrix and associated texture feature techniques are used as image analysis techniques. It takes an image as input to composed of pixels in each image to find the intensity, the GLCM could also be used as a tabulation and it is used in the different combinations of gray levels co-occur during a image section. Texture feature is used as the contents of the GLCM and it can supply to measure the variation in intensity at the pixel of interest.
- The virtual variable is formed within the subsequent way (using the settings on the GLCM Texture page of the Variable properties panel identified in bold):
- Quantize the image data. Each sample on the echogram is treated together image pixel and thus the worth of the sample is that the intensity of that pixel. These intensities are then further quantized into a specified number of discrete gray levels as specified under Quantization. A an example, methods supported compression techniques propose that the simplest method of segmentation is that the one which minimizes data's coding length and therefore the general probable segmentations. Methods supported histograms are known to be extremely well-organized to gauge additional segmentation schemes as they have only single exceed within the progression of the pixels.

5.5 Classification

- The convolutional neural network (CNN) may be a class of deep learning neural network. CNNs represent an enormous breakthrough in image recognition. They're most wont to analyse visual imagery and are frequently working behind the scenes in image classification. they will be found at the core of everything from Facebook's photo tagging to self-driving cars.
- A CNN convolves (not convolutes…) learned features with input file and uses 2D convolutional layers. this suggests that this sort of network is right for processing 2D images. Compared to other image classification algorithms, CNNs use little or no pre-processing. this suggests that they will learn the filters that need to be hand-made in other algorithms. CNN are often utilized in plenty of applications from image and video recognition, image classification, and recommender systems to tongue processing and medical image analysis.
- The pattern of connectivity during a CNN comes from their research regarding the organization of the visual area. during a mammal's eye, individual neurons answer visual stimuli only within the receptive field, which may be a restricted region. The receptive fields of various regions partially overlap in order that the whole field of vision is roofed.
- CNN have an input layer, and output layer, and hidden layers. The hidden layers can contain convolutional layers, ReLU layers, pooling layers,and fully connected layers. Convolutional layers can apply in a convolutional operation to the input.
- Pooling combines the outputs of clusters of neurons into one neuron within the next layer.
- Fully connected layers connect every neuron in one layer to each neuron within the next layer.
- In a convolution layer, the neurons which as been design only for receiving input from the subarea of the previous layer during a fully connected layer and each neuron in the CNN will receives input from every element of the previous layers.
- A CNN is used for extracting features from images and it can be classified by the features which we got like values of attributes. This eliminates unwanted usage in the image by using the feature extraction. The features are not trained and they are learned while the network trains on a group of images. It's made deep learning models extremely used to provide an accurate for computer vision tasks. CNN is used to learn the feature for detection through tens or many hidden layers and each layer can increase the complexity of the trained features.
- The data is fed into the model and output from each layer is obtained and this step is called as feed forward, we then calculate the error using a mistake function, and we can find some common error functions are like cross entropy, square loss error etc then, we back propagate into the model by calculating the derivatives. This step is process is called Back propagation. and fully connected layers. Convolutional layers apply a convolution operation to the input. This passes the knowledge on to subsequent layer.

5.6 Experimental Steup

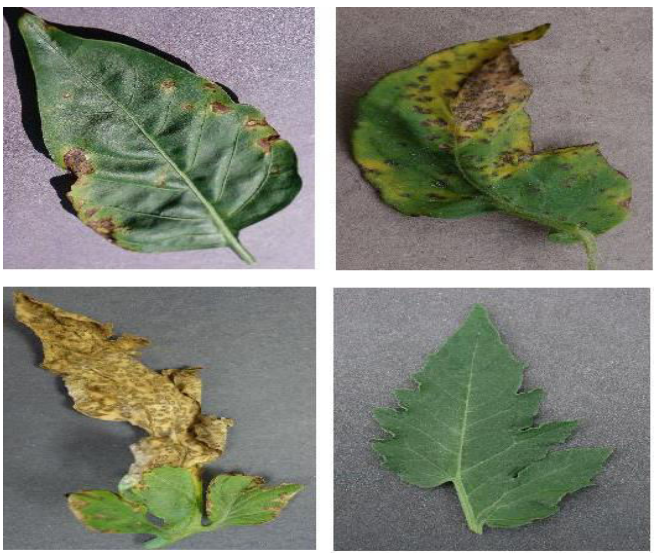

Fig -5.1: Above images represent the input of leaf which is suffering from disease.

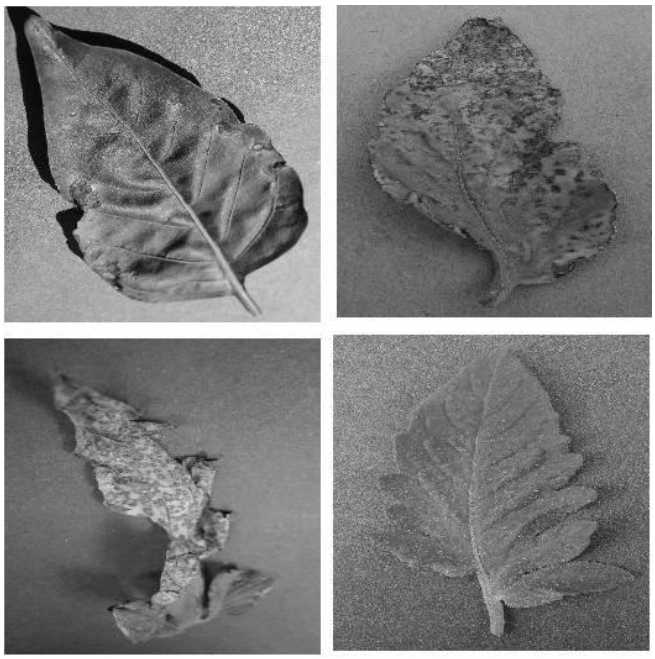

Fig -5.2: Above images of the input is converted into grayscale image to processed subsequent process.

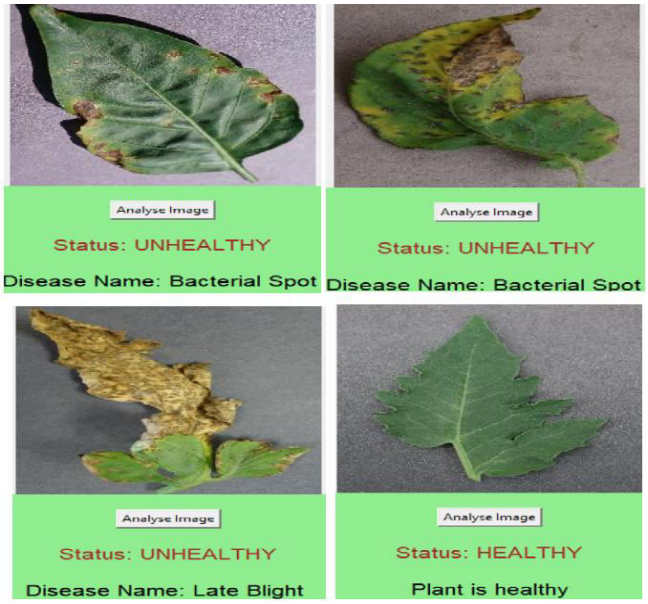

Fig -5.3: Above images are represent the disease which is effected to the leaf.

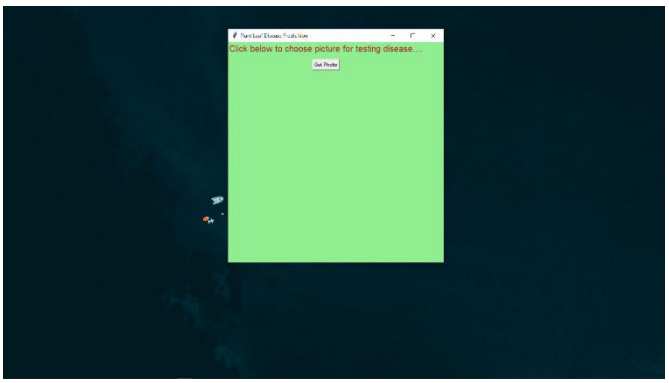

Fig -5.4: Using OpenCV-Python. Select the image of the leaf.

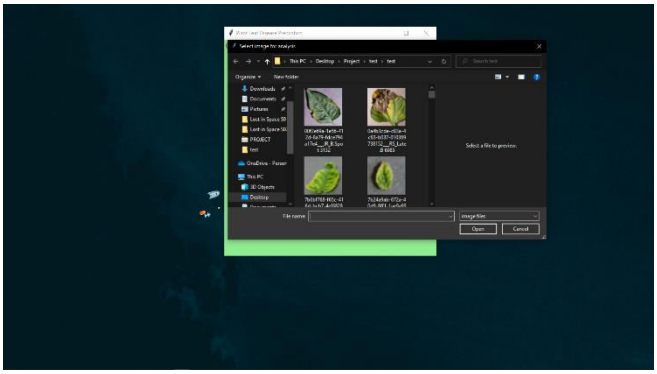

Fig -5.5: Selecting the Image of the leaf to analyse it.

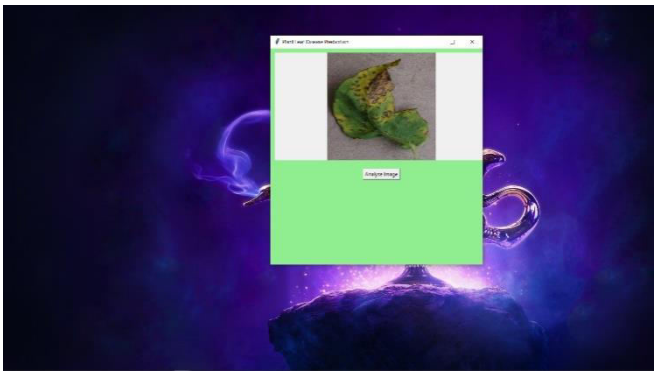

Fig -5.6: Analyse the selected image to identify the disease occur.

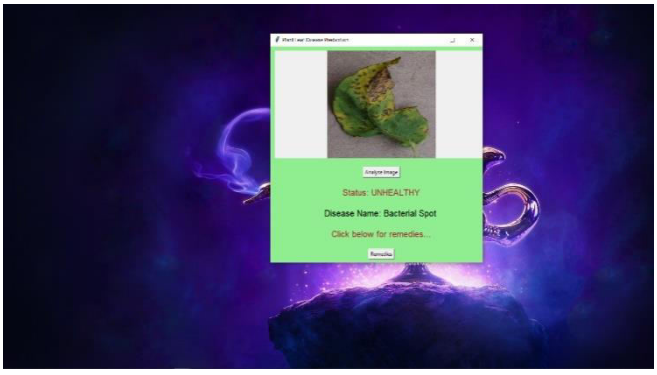

Fig -5.7: Analysed result of the image of the leaf.

6. CONCLUSION

This paper reviews and summaries various techniques used for classifying and detecting various bacterial, fungal and viral plant leaf diseases. The classification techniques help in automating the detection of plant leaf diseases and categorizing them centred on their morphological features. The future work of this paper focuses on identifying the mulberry plant leaf diseases with CNN as classifier. It is also intended to focus on increasing the recognition rate and classification accuracy of severity of leaf diseases by using hybrid algorithms.

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