# An Efficient Approach for Classification and Identification of Plant Leaf Diseases Based on Deep Neural Networks

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**Abstract-** *Plant sicknesses are primary purpose for massive damage and economic losses in the agricultural field. Identification of ailment inside the plant might be very essential for better farming results. The principal motive is to correctly identify leaf illnesses with the usage of neural networks. The feature extraction approach plays an essential role. Feature extraction techniques such as the SURF (Speeded-UP Robust Features) feature extraction technique is used for extracting the features. The input image in RGB form is converted to HSV (Hue Saturation Value) form for the segmentation process. The leaves with ailment are then classified on the premise in their similarity with the training dataset of disease samples formerly defined by using the feature extraction techniques. The proposed model implementation is done with the use of MATLAB and the proposed version result is the name of the disease present in the plant leaf. Here Back Propagation Neural Network and neural network classifier (PatternNet) is used for achieving the result.*

***Key Words***: Leaf disease, Disease verification, SURF, Backpropagation neural network, PatternNet.

## 1. INTRODUCTION

Plant diseases require careful analysis and well-timed management to guard them. It is a well-known truth that the diseases are identified with the aid of the farmers at a very late level of time after which it becomes very tough to manage them. This may lead to a big loss for the farmers on a financial level. Our proposed system uses feature extraction strategies for identifying infected part of the plant leaf. The feature extraction algorithms used in this paper are FAST (Features from Accelerated Segment Test) and SURF (Speeded-UP Robust Features). In this manuscript, the leaf disease detection model is implemented using the above cited feature extraction algorithms(techniques). In the first phase, the image processing is done using the above-mentioned feature extraction techniques and the motive of this phase is to locate the infected part of the plant leaf which is being used as input. In this phase, HSV (Hue Saturation Value) Segmentation is used for identifying the infected part. In the second phase, Back Propagation Neural Network (BPNN) is used during training and testing phase of the data. This is followed by the classification and identification of the plant leaf disease using the neural network classifier PatternNet). The aim of the model is to give the disease name as the output which is the final result of the proposed model.

## 2.LITERATURE REVIEW

In this Literature Review, a survey of the characteristic extraction strategies and classification algorithms, was done. Vijai Singh and A K Mishra present the set of rules for picture segmentation using genetic set of rules [1].

Prof. Sanjay B.Dhaygude proposed a method imaginative and prescient based totally detection algorithm of various leaves .The first step of the is the colour transformation structure for the enter RGB picture is created and converted to HIS. The second step is the inexperienced pixels are masked and eliminated using particular threshold price, then the picture is segmented and extracted is computed from SGDM matrices. Finally, the presence of diseases on the plant leaf is evaluated [3]

Prof.A.B.Patil proposed a way " Plant Diseases detection Using Image Processing " on this numerous techniques to section the illnesses a part of the plant and additionally mentioned some feature extraction and class of plant diseases .The use of ANN strategies to classify of ailment in plant life along with feature map, back propagation algorithms.[5]

Jayamala K. Patil, Raj Kumar describe the advances in numerous strategies used to look at plant diseases/tendencies the usage of photograph processing. This paper increasing throughput and decreasing springing up from human professionals in detecting the plant diseases in paper titled Advances in Image Processing for Detection of Plant Diseases.[8]

Hiteshwari Sabrol,Satish kumar The algorithm starts off evolved with digital photograph acquisition of infected and non-infected plants; carry out photo pre-processing, differentiate disease infected vicinity from a non-inflamed location using coloration area conversion ,segmentation, extract capabilities from segmented pictures for reputation and type based totally on Feature Analysis, Neural Network, Support Vector Machine and Fuzzy and Rule- Based Classification[10].

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## 3. METHODOLOGY

This paper includes several steps of Image Acquisition, Image pre-processing, Feature Extraction, and neural network. It works as follows:

### 3.1 Image Acquisition

The preliminary manner is to gather the statistics from the general public repository. It takes the photograph as to move to further processing.

### 3.2 Image pre-processing

As the photographs are obtained from the actual area it could contain dust, spores and water spots as noise. The motive of facts pre- processing is to dispose of the noise in the picture, in an effort to regulate the pixel values. It complements the pleasantness of the image.

### 3.3. Image Segmentation

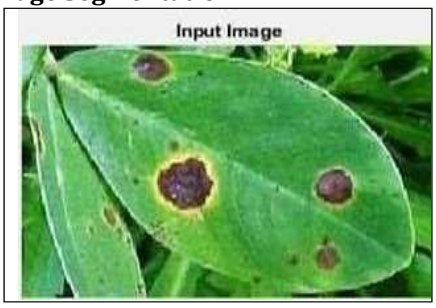


**Fig (1)**: Input Image

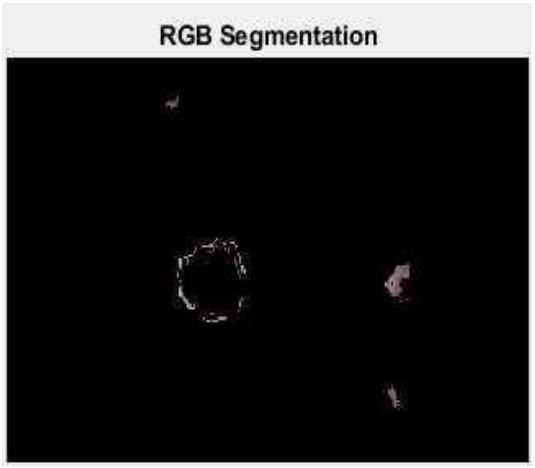


**Fig (2):** RGB segmentation

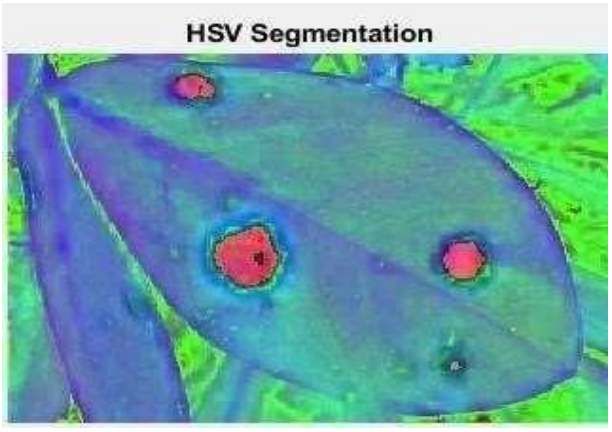


**Fig (3):** HSV segmentation

Segmentation is a way of identifying the region of interest and isolating the other parts. In this paper, we have HSV Segmentation as the segmentation technique. In Segmentation, we extract the capabilities of diseased infected location and classify the disorder in line with the functions. Segmentation is used to divide texture function of extracted illnesses portion. This is done by calculating HSV (Hue Saturation Value).

In order to make an in-depth evaluation of the leaves, the following steps are carried out and the codes are written in MATLAB 7.50 Version.

**Hue saturation Value:**

HSV shade area is preferred manipulation of Hue and saturation (to shift shade or regulate quantity of colour to convert RGB colormap to HSV colormap.

Cmap=rgb2hsv(M) convert an RGB colormap M to HSVcolor map. Both colormaps are m –by-3 matrix.

The detail of each color map is in the range zero to one. The columns of input matrix M constitute intensities of red, green, blue respectively. The columns of output matrix Cmap constitute Hue, saturation& Value respectively picture=rgb2hsv(rgb_image) converts the RGB image equal to HSV image. RGB is an m-by way of-n-through-3 image array whose 3 planes include the red, green, blue components for the photograph. HSV is returned as an m- by-n-by3 image array whose three planes incorporate the Hue, saturation, fee components for the picture.

**ALGORITHM**

**Step 1: Read the image**

**Step 2: Convert into RGB to HSV**

**Step 3: Set Image h = hsv(:,1); s = hsv(:,2); v = hsv(:,3)**
**Step 4: Gets the number of all pixels for each colour bin Step 5: To find the number of pixels**
**Step 6: Plots histogram**

### 3.4. Feature Extraction

The input image is enhanced to protect information of the pretentious pixels before colour from the background. The colour space equally is used to reduce effect of illumination and distinguish between disease and non- disease leaf colour resulting in colour pixels that are clustered to acquire groups of colors in the image. Leaf disease identification model is implemented using the texture features.

The plant leaf disease classification and identification is done using neural networks and Backpropagation algorithm. Key point detection is done using SURF.

If the distinction of the number of keypoints within the photo and test photograph is greater than 700 then routinely each leaf is treated as distinctive species. If the distinction of keypoints diagnosed are much less than seven-hundred keypoints then the algorithm continues by extracting the capabilities from the trained image and test picture by the use of SURF feature extraction method and proceeds to matching.

**FEATURE EXTRACTION USING SURF [SPEEDED-UP ROBUST FEATURE]:**

After figuring out the keypoints, the next step is to come back up with a descriptor for the function centred at each key point. This descriptor is the representation used to examine the capabilities in unique pics to peer in the event that they are healthy or not. The Speeded-Up Robust Features (SURF) descriptor scheme advanced by Bayetal was designed as an efficient alternative to SIFT. It is a lot quicker and extra robust as compared to SIFT. Its basic idea is to approximate the second one order Gaussian derivatives in an efficient way with the assist of vital pics for the usage as setoff field filters. The concept of SURF is based totally on sums of 2D Haar wavelet responses and makes an efficient use of integral pictures. For features, it makes use of the sum of the Haar wavelet reaction round the focal point with the resource of vitalphotograph.

The algorithm correctly identifies the leaf species. The keypoints are diagnosed for testing picture and training picture and if the distinction of keypoints is above seven- hundred it assumes it as extraordinary class of species. In that case, no one wants to proceed with extraction and matching and it is handled as extraordinary category of leaves. Otherwise, the features are extracted and matching rankings are calculated.

After the specific keypoints and descriptors are extracted from each leaf snap shots, an identical ought to be done. Basic enhancement strategies are histogram-based totally because they can be smooth, rapid and with them appropriate consequences for various packages can be executed. In this task we've used histogram-based colour enhancement to achieve better outcomes. We have used adaptive histogram equalization rather than basic histogram equalization. As adaptive histogram equalization works on small location unlike simple histogram equalization which goes at the entire image. For disease identification in citrus leaves we require simplest affected element so that adaptive histogram is more suitable in this example. In case of adaptive histogram equalization of a colour image, the histogram is anticipated to provide the range of times a specific shade has occurred within the image.

### 3.5. Neural Network

In this model, neural networks have been used for the classification of the leaves. The model has been trained with the images of different leaves (ones with disease as well as the healthy ones). The neural network consists of a hidden layer where the processing happens. There can be more than one hidden layer. Back Propagation algorithm is used during the training and testing phase. The neural network classifier (PatternNet) is the classifier used. This leads to the final output i.e. the name of the underlying disease. The input image is tested against the trained images and it is iterated across the trained images. The iterations are called epochs. The input image is matched with the suitable trained image and we get the disease name as the output. The performance graph created through the neural network training tool gives the trend between the training, testing and the validation data.

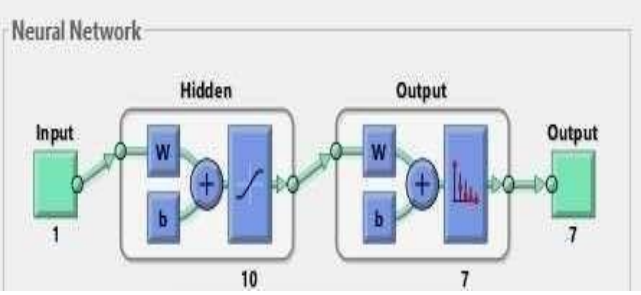


**Fig (4):** Neural Network

**Back Propagation Neural Network (BPNN)**

BPNN uses the back-propagation algorithm. This neural network helps in identifying the underlying disease present in the plant leaf. The classifier used is the Pattern Net classifier which is a deep neural network classifier.

**PatternNet**

This is trained to classify input according to the desired classes. This is the classifier used to identify the disease present in the plant leaf. The targeted data for pattern recognition networks should consist of vectors of all zero values except for a 1 in element I, where I is the class they are to represent.

Patternnet (hiddensize, trainfcns, performfcns) takes these arguments, and returns a pattern recognition neural network.

| | |
|---|---|
| hiddensize | Row vector of one or more hidden layer sizes(default=10) |
| trainfcns | Training Function(default='trainscg') |
| performfcns | Performance function(default='crossentropy') |

## 4. RESULT(Output)

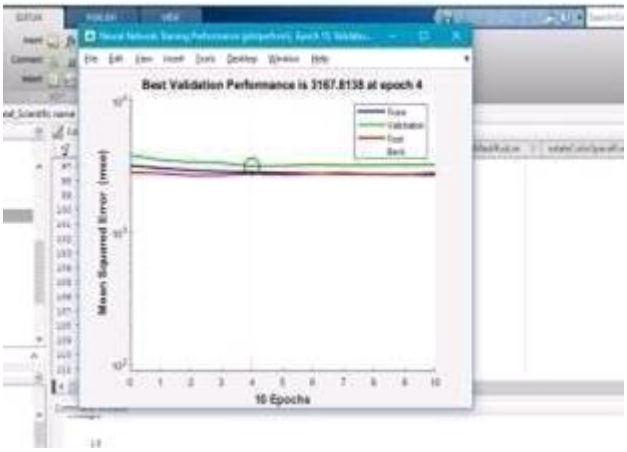


**Fig (5):** Performance Graph

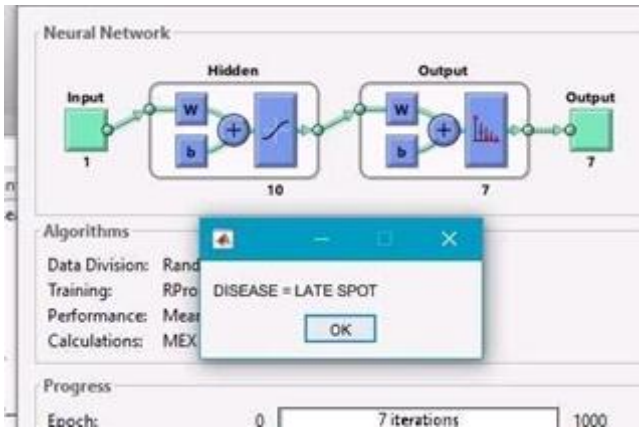


**Fig (6):** Disease Identified

The disease identification is the result of the model. This can help the farmers take the required precautions for the prevention of the diseases.

## 5.CONCLUSION

Hence the plant disease identification model helps in classification the plant leaf as infected or healthy. The model then further identifies the name of the disease in the leaf. This is preceded by finding the location of the infected region in the leaf through the feature extraction techniques. This model can prove beneficial for farmers in identifying the underlying disease and providing the plants with the appropriate treatment to prevent disease from spreading.

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