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MULTI-CLASS CLASSIFICATION OF PLANT LEAF DISEASES USING FEATURE FUSION OF DEEP CONVOLUTIONAL NEURAL NETWORK AND LOCAL BINARY PATTERN

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Abstract

Crop diseases pose a significant risk to food safety, but rapid identification of evidence remains difficult due to a lack of critical infrastructure in many parts of the world. The result of precise methods in the fi eld of pagebased image distribution is very well demonstrated. This paper uses random forest to identif y healthy and diseased leaves from the generated data. Our implementation includes several levels of im plementation, such as dataset creation, feature extraction, training classifiers, and classification. Data fr om diseased and healthy leaves were collected in a random forest to classify diseased and healthy image s. We use Histogram of Oriented Gradients (HOG) to extract shape from images. Overall, using machin e learning to train on large publicly available datasets allows us to clearly see the presence of diseases i n plants at scale.Keywords - disease and leaf health, random forest, feature extraction, training, classific ation.

1. Introduction

Farmers living in the state may have difficulty distinguishing diseases that may occur in their crops. The y would not need to go to the agricultural market and find the disease. Our main goal is to distinguish di seases in plants by monitoring plant morphology through image processing and machine learning.Pests and diseases can damage crops or production, reducing food availability and therefore food insecurity. Additionally, in many less developed countries there is less information about pest management or cont rol and disease. Toxicity, poor disease control and climate change are the main reasons for declining fo od production.Many modern technologies have emerged to reduce postharvest processing, improve agri cultural sustainability and increase profitability. Various analysisbased tests such as polymerase chain r eaction, gas chromatography, mass spectrometry, thermal imaging and hyperspectral methods are used t o identify the disease. However, this process is expensive and time consuming.In recent years, server-based and mobilebased virus detection systems have begun to be used in virus detection. Many of these technologies are advanced cameras, high performance and many home appliances, which greatly contri bute to automatic disease detection.Modern methods such as machine learning and deep learning algorit hms have been adopted to increase the recognition and accuracy of the results. A lot of research has bee n done on machine learning for detection and diagnosis of plant diseases.Traditional machine learning methods include random forest, artificial neural network, support vector machine (SVM), fuzzy logic, K means method, and convolutional neural network. EtcRandom Forest is a complete learning system that works by creating a forest of decision trees during the course, used for classification, recovery and othe r tasks. Unlike decision trees, random forest overcomes the disadvantages of overprocessing training dat a and can handle numerical and categorical data.Histogram of Oriented Gradients (HOG) is a descriptiv e concept used as part of PC vision and image processing for object detection. We use three description s here:

1. Moment of Communication
2. Haralik Texture
3. Color Histogram

The call time is used to remove the image from the page. Haralick texture is used to obtain the texture o f the leaf, and color histogram is used to represent the distribution of colors in the image.

2. Literature review

[1] S. S. Sannakki and V. S. Rajpurohit et al. proposed "Pomegranate disease classification based on ba ckpropagation neural network", which uses the technique of segmenting only the defective areas and usi ng color and texture as features. Here they use a neural network classifierfor classification. Its main adv antage is that the image is converted toL * a * b to remove the chroma layer, andclassification accuracy is as high as 97.30%. Its main disadvantage is that it is used only for small crops.[2] Public Relations R othe and R. V. Kshirsagar presented "Cotton Disease Detection Using KnowledgeBased Techniques" u sing snake segmentation where they used Search time as a unique feature. The contour model is used to constrain the potential path in the affected region, and the BPNN classifier solves many classification pr oblems. The average distribution rate is 85.52%.[3] Aakanksha Rastogi, Ritika Arora and Shanu Sharm a, "Page detection and classification using computer vision techniques and fuzzy logic." Kmeans integra tion was used to classify negative regions; GLCM was used to extract aesthetic features and fuzzy logic was used to classify organisms. They use Artificial Neural Network (ANN) as a classifier that often hel ps in the analysis of leaf lesions.[4] Godliver Owomugisha, John A. Quinn, Ernest Mwebaze and James Lwasa suggested - Automatic detection of banana wilt disease and black leaf - Extract color histograms and convert them to HSV and RGB to L Convert from* a*b. The tallest trees were created using the pea k material using five beautiful faces, and the area under the curve focused on the distribution. They use nearest neighbor, decision tree, random forest, giant tree, negative Bayes, and SV classifier. Among the seven classifications, random tree scores are very high, providing real-time information and flexibility for applications.

GLCM takes 7 invariant moments as shape parameters. They used SVM classifier with MCS for offline detection of diseases in rice.

III. Recommendations

To find out whether the leaves are infected or healthy, some steps need to be followed. That is, pre-processing, feature extraction, classifier training and classification. Image preprocessing is the reduction of the size of all images to the same size. Then, the features of the front image are extracted with the he lp of HOG. HoG [6] is a unique identifier for object detection. In this property descriptor, the appearanc e of objects and the outlines of images are defined through the use of gradients. One of the advantages o f HoG feature extraction is that it works on the cells it creates. No conversion will affect this.

We use three definitions here.

Call duration: Image duration contains the basic characteristics of image pixels and helps identify the ob ject. Look for time help here to describe specific pages. Call time is calculated on one channel only. The first step is to convert RGB to grayscale and then calculate the Search time. This step provides a graphi cal explanation.

Haralick Texture: Most of the leaves are healthy and diseased. Here we use Haralick texture features to distinguish the tissues of healthy and diseased leaves. It is based on the difference matrix that stores the

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position (I, J). Texture [7] is calculated as the frequency of pixel I, which holds the position of pixel J. T o calculate the Haralick texture, the image must be converted to grayscale.

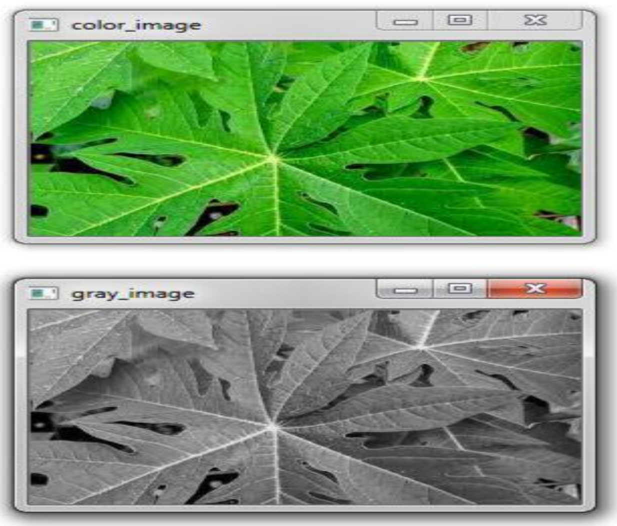

Fig.1. RGB to Gray scale conversion of a leaf.

Color Histogram: Color histogram provides the representation of colors in the image. First convert RGB to HSV color space and calculate its histogram. Since the HSV standard is similar to the way the huma n eye perceives color images, RGB images must be converted to HSV. Histograms [8] provide a descrip tion of the number of pixels contained in a particular color.

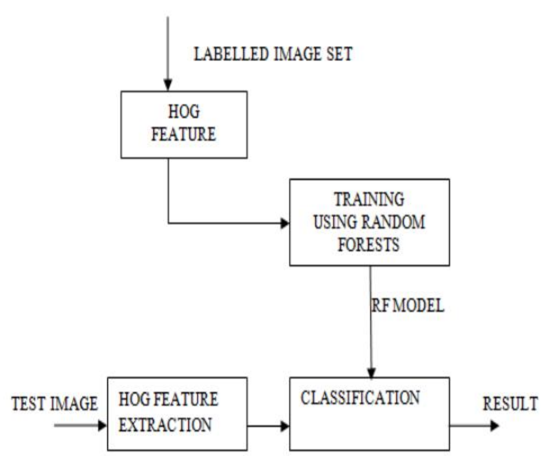

Fig.2. RGB to HSV conversion of leaf

Fig.4. Architecture of the proposed model

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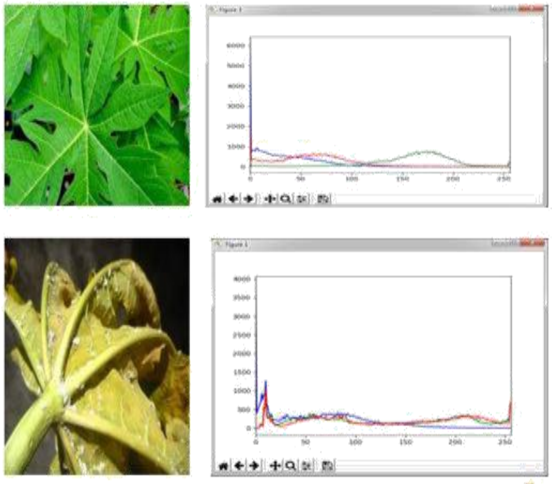

Fig.3. Histogram plot for healthy and diseased leaf.

IV. ALGORITHM DESCRIPTION

The algorithm here is based on random forest distribution. They adapt to the situation and can be used in both classification and regression techniques. Compared to other machine learning methods such as SVM, Gaussian Naive Bayes, logistic regression, linear discriminant analysis and other machine learning methods, random forests provide more with less image data. The figure below shows the design of our proposed algorithm

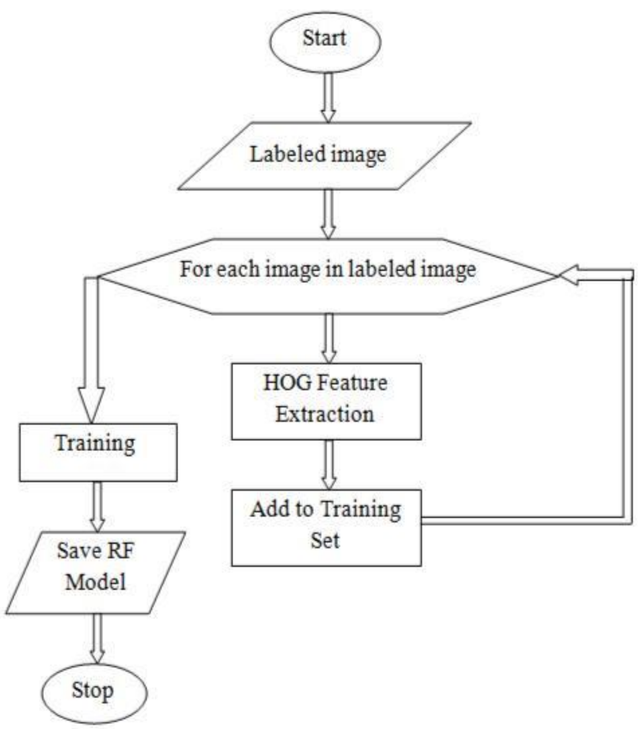

Fig.5. Flow chart for training.

Fig.6. Flow chart for classification

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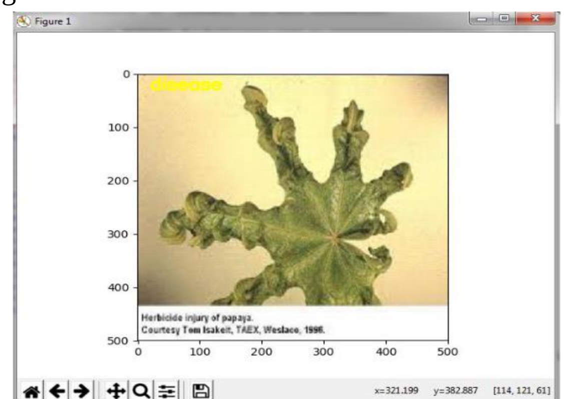
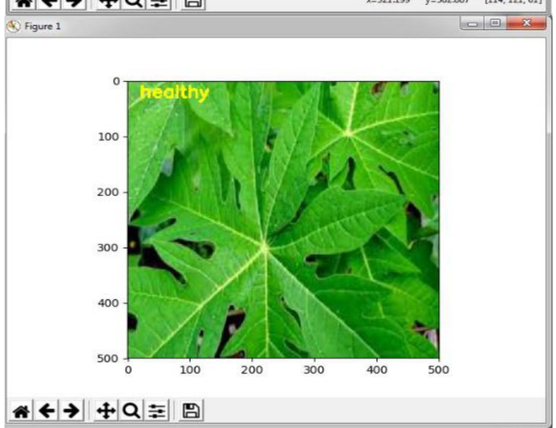
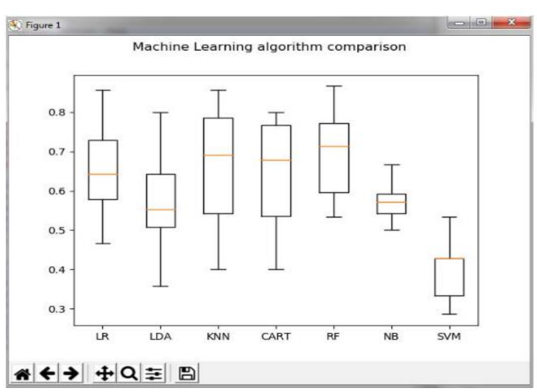
Recording data is divided into training data and test data. Use HoG feature extraction to generate vectors for the training dataset. The resulting feature vectors are trained on a random forest classifier. The feature vector of the test data generated by HoG feature extraction is added to the classifier for prediction, as shown in Figure 4.Change training data into feature vectors with Ø HoG feature extraction as shown in Figure 5. The extracted feature vectors are saved in the training file. Additionally, training feature vectors are trained on a random forest classifier [9, 10].As shown in Figure 6. Feature vectors are extracted for the test image using HoG feature extraction. These value vectors are assigned to the recorded product and trained to predict the value.

V. Results

First of all, as with every image, we need to convert the RGB image to a gray image. This is only possible because Hu's rectangularlike descriptor and Haralick's features can only be computed in a single channel. Therefore, RGB needs to be converted to grayscale before calculating Search time and Haralick features. As shown in Figure 4.To calculate the histogram, first the image needs to be converted to HSV (hue, saturation and value), so we respectively convert the RGB image to an HSV image as shown in figure 5.Finally, the main purpose of our study is to determine whether the leaves are sick or healthy with the help of random forest classification, as shown in Figure 7.







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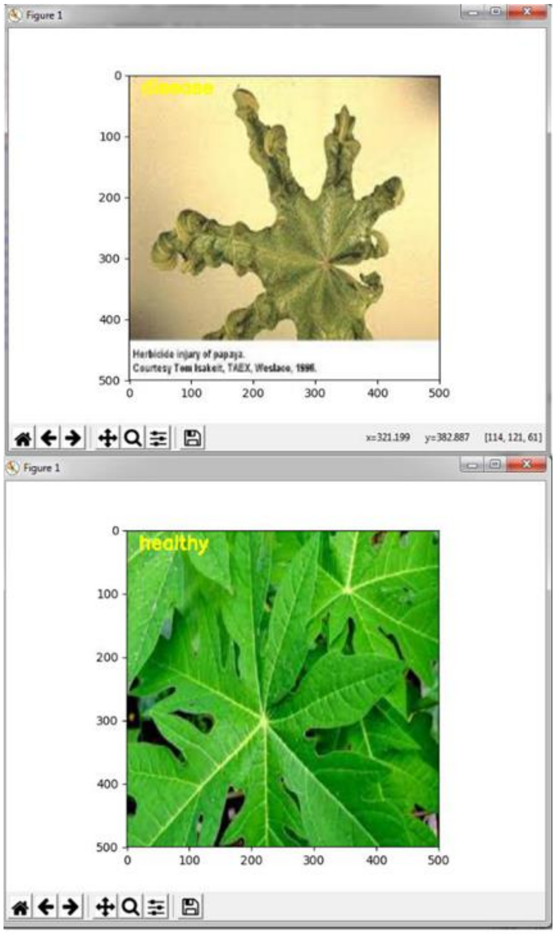

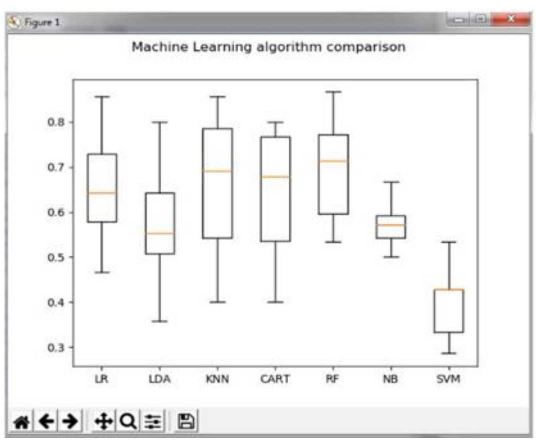

Fig.7. Final output of the classifier.

Fig.8. Comparison between different machine learning models.

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TABLE.1

Various Machine learning models	Accuracy(percent)
Logistic regression	65.33
Support vector machine	40.33
k- nearest neighbor	66.76
CART	64.66
Random Forests	70.14
Naïve Bayes	57.61

Fig .9. Table showing the comparison.

Result

The purpose of the algorithm is to detect negative formations occurring in plants in the green house or natural environment. Captured images are often shot in the background to eliminate artifacts. The accuracy of the algorithm is compared to other machine learning models. The m odel was trained using 160 papaya leaf images using a random forest classifier. The classifica tion accuracy of this model is approximately 70%. Accuracy can be improved when training with a large number of images and using other local and global features such as SIFT (Scale I nvariant Feature Transform), SURF (Accelerated Robust Features), and DENSE and BOVW (Bag of Suggestions).< br>
Below is a list of machine learning algorithms. comparison is given.

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