# AN AUTOMATED LEAF RECOGNITION SYSTEM FOR HERBS IDENTIFICATION USING DEEP LEARNING TECHNIQUES

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***ABSTRACT*— *Leaf recognition is very important in agriculture for the management of plant species whereas botanists can use this application for Medical, Cooking, Cosmetics purposes and this project describes the herb detection and classification of leaves. Herbs identification via a vision system is beneficial since the pharmacist and Botanist need not collect them through traditional ways. Texture feature and color feature is used for recognizing the leaf types and its property. Leaves of different plants have different characteristics which can be used to classify them. In the existing system, they use two classifiers, namely Support Vector Machine (SVM) and Deep Learning Neural Network (DLNN) are used to recognize the herbs. The two models have been tested on our dataset, which contains 1000 leaves. The experimental results showed that SVM achieved 74.63% recognition accuracy, and DLNN achieved 93% recognition accuracy. The Processing time was 10 seconds for SVM and 15 seconds for the DLNN classifier and features are analyzed during the classification. These features are then used to find the most suitable match for the herbs every time an image is uploaded into the SVM database. The Proposed system employed the latest generation of Multilayer convolutional neural networks (MCNNs) has achieved impressive results in the field of image classification and also the mobile application can be fully developed using some Java codes along with the python codes in order to do the packaging for the Android mobile app and upload it in Google play to work in an android platform. Furthermore, the processing time will be improved.***

**Keywords— Herbs Classification, Deep Learning, SVM, Feature Extraction, Neural Networks.**

## I.INTRODUCTION

When we are leaving a town and entering the suburbs, we may find many kinds of trees. We could even be able to identify those trees that always grow on urban streets. However, most of the trees and plants found in city suburbs are getting to be unknown to the majority folks. There are approximately 120,000 species of trees on earth, which account for about 25% of all plants. Many of the trees are in tropical regions, and since only limited botanical research has been administered in these areas, it's believed that there are many undiscovered species [1]. it's clear that identifying large numbers of such leaves could also be a posh process. There are many leaves within the natural ecosystem, and it's often very difficult to differentiate between them. Botanists and other people who study plants, however, are able to identify the type of leaves at a glance by using the characteristics of the leaves.[3]. Machine learning is used to automatically classify leaf types. Studied extensively in 2012, this is often a rapidly growing field supported by deep learning. Deep learning is itself a self-learning technique used on large amounts of data , and up-to-date developments in hardware and enormous data have made this technique more practical. We propose how to classify leaves using the MCNN (Multilayer Convolutional Neural Networks) model, which is typically used when applying deep learning to image processing [4]. Generally use, herbs are plants with savory or aromatic properties that are used for flavoring and garnish food, for medicinal purposes, or for fragrances. we'll classify the type of herb according to their usage of herb types. according to the usage, the herbs are classified into four parts: Medicinal herbs, culinary herbs, Aromatic herbs, Ornamental herbs. It converted a color input image into a binarized image to extract the outline, and thus the two-dimensional features were then extracted using the

outline image. These features were grouped using the Move Median Centers (MMC) classifier.

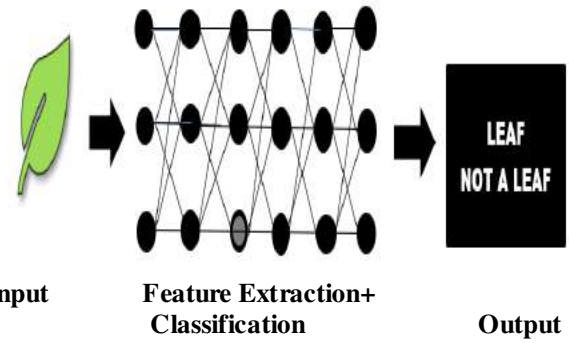



**Figure 1: Deep Learning Architecture**

This study showed faster execution speeds than those of previous studies, and generated accurate results using the combination of the characteristics. However, the recognition rate was only approximately 90%. The system proposed in this paper is constructed as shown in Figure 2.

- The method proposes to improve classification performance by using a MCNN that extracts and learns feature points.
- We examine existing leaf recognition research.
- We describe Google Net, a MCNN that imitates human visual systems.
- It explains the leaf recognition system.
- Describes the experiment and analyzes the results.
- Concludes the paper.

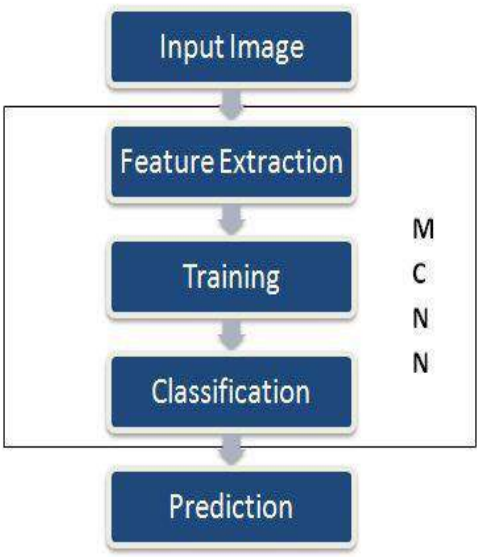



**Figure 2: System Composition**

## II. LITERATURE SURVEY

Amgad Muneer and Suliman Mohamed [1] promoted SVM and DLNN classifiers and perform a data set and they achieved a recognition accuracy for both. The proposed algorithm achieved the highest accuracy in the FLAVIA dataset. But every time we need to update data in the SVM database. While coming to packaging in mobile application it was unsuccessful.

S. Prasad, and P. S. Kumar[2] provided a review of NN mechanisms, types, models, and classifiers that use different algorithms to process hyperspectral data. Then we highlight the current state of imaging and non-imaging hyperspectral data for early disease detection. The accuracy of image detection was low and efficiency is also low.

To perform Bacterial foraging optimization (BFO) that further increases the speed and accuracy of the network to identify and classify the regions infected of different diseases on the plant leaf. Using segmentation process it find the diseases in plants verifying using a dataset. Speed is lower while resolution is bigger.[4]

T. Munisami *et.al.,*[8] promoted a recognition method for cucumber diseases using leaf symptom images based on a deep convolutional neural network. To conduct symptom-wise recognition of four cucumber diseases. The symptom images were segmented from cucumber leaf images captured under field conditions.

To perform plant disease detection and diagnosis using simple leaves images of healthy and diseased plants, through deep learning methodologies. They use some datasets for herbs identification, but every time they need to upload data in a dataset. Recognition of herbs was slow and it consumes more time to display an output. It causes complexity subsequent image processing tasks[5]

Analyzing the background and foreground images of the leaf, and propose a new Adaptive Thresholding algorithm that can segment single leaves in a leaf image extracted randomly from an online system. While identifying an image Speed is lower.[3]

Accurate detection and identification of crop diseases play an important role in effectively controlling and preventing diseases for sustainable agriculture and food security[11]. Plant disease management is an important factor in agriculture as it causes a significant yield loss in crops. Late Blight is the most devastating disease for Potatoes in most of the potato-growing regions in the world. Complexity in image processing tasks.[6]

Citrus canker, a bacterial disease of citrus tree leaves, causes significant damage to citrus production worldwide. While the segmentation process finds the bacteria and shows which type of disease occurred in the herb.[9]

A Survey Paper on Plant Disease Identification Using Machine Learning Approach. Agriculture plays an important role in a farmer's life. Sometimes manual identification of disease is time-consuming and the need for laborers is more.[7]

J. Chaki and R. Parekh [10], conducted recognition of four plant diseases, i.e., anthracnose, downy mildew, powdery mildew, and target leaf spots. The symptom images were segmented from cucumber leaf images captured under field conditions. Using segmentation and pre-processing task it shows the types and disease name using a dataset.

## III. PROPOSED SYSTEM

The proposed system is to identify the herbs types and classification based on texture feature and shape, color features. The color features for extracted from the RGB Color components GLCM algorithm is implemented for extracted the texture features extraction. Deep learning algorithm is implemented for recognize the plant features and types of plant. Multilayer convolutional neural network (MCNN) algorithm is used in proposed system to get better accuracy and using a mobile application and upload it google play. The proposed methodology is divided into different stages: Image acquisition, Image pre-processing, Segmentation, Feature extraction, and Classification. The following subsections are dedicated to discuss these stages.

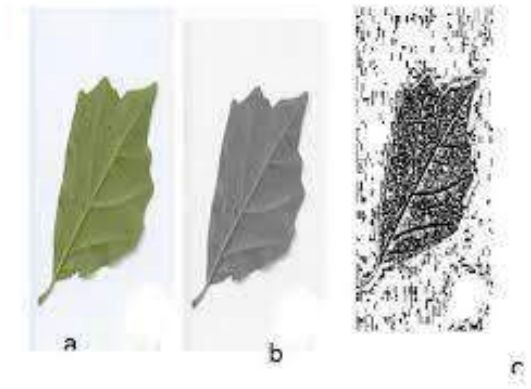



**Figure 3: Conversion of leaves using gray codes**

**BLOCK DIAGRAM**

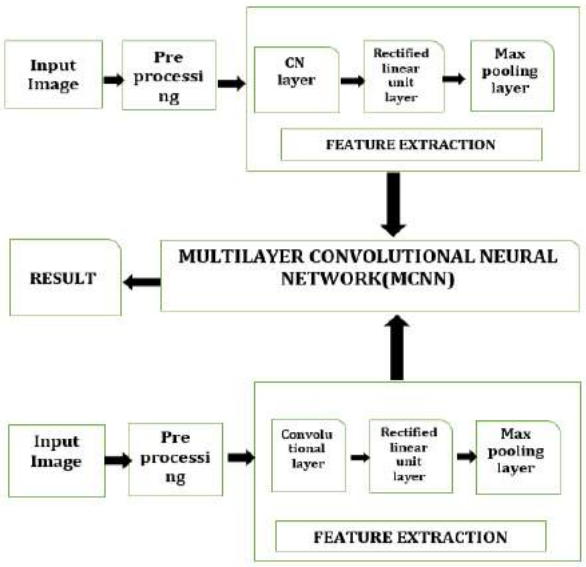



**Figure 4: Proposed block diagram**

## A. IMAGE ACQUISITION

Leaf images were taken using a portable webcam. When the herb sample is captured by webcam, the captured image is sent to open CV-python wirelessly and is shown directly in the GUI after the image push button in the proposed graphics interface is pressed.

## B. IMAGE PROCESSING

To remove noise in image or other object removal, pre-processing techniques is considered. Image clipping i.e, cropping of the leaf image to get the interested image region. Image smoothing is done using the smoothing filter. Image enhancement is carried out for increasing the contrast. The RGB images into the grey images using color conversion using equation(x) **=0.2989*R + 0.5870*G + 0.114*B.**

## C.SEGMENTATION

Segmentation of leaf image is important while processing image from that Segmentation means partitioning of image into various part of same features or having some similarity. The segmentation can be done using various methods like Otsu' method, CNN clustering.

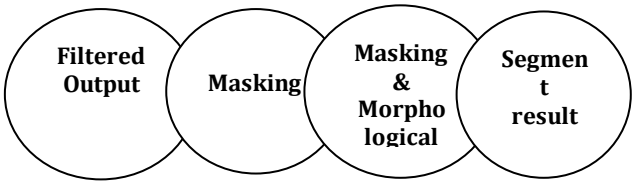



**Figure 5: Segmentation process**

## D. FEATURE EXTRACTION

Feature extraction plays an important role for classification of an image. In many application feature extraction of image is used. Color, texture, morphology, edges etc. are the features which can be used in plant disease classification, texture means how the color is distributed in the image, the roughness, hardness of the image. In this paper considers color, texture and morphology as a feature for disease detection. They have found that morphological result gives better result than the other features. It can use for identify the infected plant leaf of classification plant image.

**SHAPE FEATURES**

By using image moments, values like the herb area and centroid (in terms of x, y coordinates) can be computed. The two-dimensional Zernike moments, A(nm) of order n with repetition m, of an image

f (ρ , θ) are defined as,

$$V_{pq}(\rho, \theta) = R_{pq}(\rho) \exp(jm\theta) \text{----------(1)}$$

Where, n is a positive integer, m can be a positive or negative integer,

$$n - |m| \text{ is even, } |m| <= n$$

$$upq = X\, x^{*}X\, y\, (x - xc)\, p\, (y - y^{*}c)\, p\, I(x, y)\text{----(2)}$$

**TEXTURE FEATURES**

The 5 features are extracted and analyzed by using the Grey-Level Co-occurrence Matrix (GLCM) technique, using OpenCV-Python, which are Angular Second Moment (ASM), contrast, Inverse Different Moment (IDM), entropy, and correlation.

$$m(i, j) = 0, \log [m(i, j)] = 0.$$

## E. CLASSIFICATION

The two classifiers employed in this study are support vector machine RBF kernel and deep learning neural networks. The first approach used in this study is the deep learning neural network (Tensor flow).

The DLNN takes a vector x = (x1, x2) as the input. The values (units) in the first hidden layer are computed as a non-linear function of a weighted linear combination of the inputs, e.g. h1(1) = max (0, w1(1),1 × 1 + w1(1), 2×2+ b1(1)). In the Tensor Board visualization, this equation is expressed as h1(1) = max (0, w (1) x + b (1)) in terms of matrices (tensors). The so-called rectifier function, then Relu (x) = max(0, x), is the nonlinearity used reach. Analogously, the second secret layer is computed. Consider that, in reality, with several thousand units each, neural networks may consist of several layers of different types (such as convolutional or pooling layers). The graph structure visualization in is interactive, allowing the underlying computations to be represented both compactly and in detail. Details of the computation in the first hidden layer are seen at this stage, while the computation details in the other layers or functions are compressed and shown as single nodes. It illustrates the proposed typical DLNN approach that employed in this study using TensorFlow.

## IV. EXPERIMENTAL APPROACH:

### 1.TRAINING SET

Every herb class has 50 samples. Out of 50 herbal leaf samples, 30 herbal samples were used for training, and 20 herbal leaf samples were utilized for testing. The 20 sets of images used for the test were different from those used for the classification training.

### 2.REAL-LIFE TESTING

The DLNN classification was tested with 20 samples per class in real-life. A total of 8 classes achieved 100% accuracy and satisfactory performance for the majority of classes. Thus, as presented in Table 4, among 400 samples tested there were only 28 failures. In fact, 100% accuracy in all classes is challenging to achieve, as certain herbs are very similar together in terms of their respective characteristics. Finally, the accuracy of the classifier has fallen, as a result of the evolving environmental luminosity and the conditions of herbs, from 98% in the training test to 93% in the real-life testing.

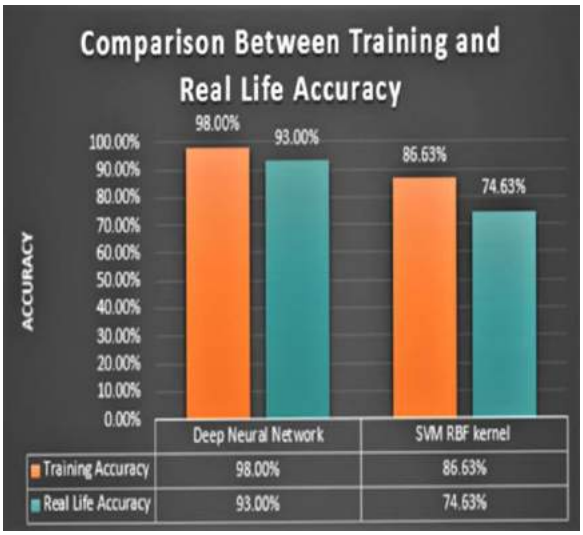


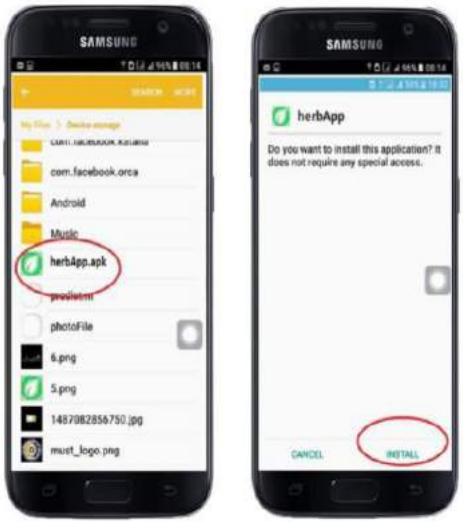

**Figure 6: Accuracy between training and Real life**

**Figure 7: Data set collection**

## 3. MOBILE APP TESTING:

The DLNN classifier has been tested in using the mobile packaging in kivy platform in windows version with 20 samples per class. A total of 8 classes achieved 100% accuracy and satisfactory performance for the majority of classes. There are just 28 failures out of 400 samples tested. In fact, it is difficult to obtain 100% accuracy in all classes because some herbs are very close to each other in terms of features. Based on the experiments, the achieved accuracy of the classifier was 93% of mobile app are tested.

This following picture represents some sample screen shots of the herb App application. The process starts by installing our herb App application and connecting to the server's IP address as presented.



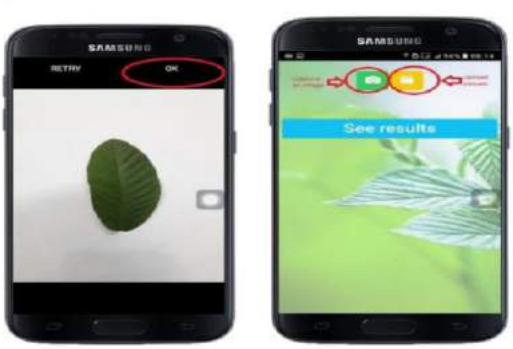

**Step 1** **Step 2**


**Step 3**

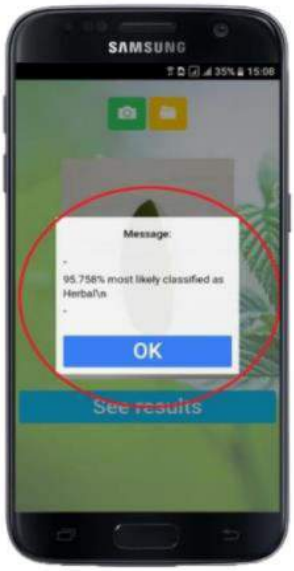
**Sample Screen Shots of Herbs application Installation Process**

Once, installed and the application is ready to use, the user has an option, either to take an image one at a time by choosing "Take a snap" button and see the results immediately or take multiple images ("Take a multiple snap button"), save or upload them for processing later shows some samples of screen shots. When the user click "Take a snap button", it will lead him to a window to take an image one at a time then see the result immediately or take multiple images and upload them. That is, the user can either

capture a leaf image (i.e., to press the button with a camera icon) or upload a leaf photo from his gallery (i.e., to press the button with a folder icon). When the user chooses the other option which is to "capture an image" button, it will lead him directly to his camera's phone and clicks OK if it's good to go and Retry to capture again.




**Step 4** **Step 5**




**Step 6**

**Sample Screen Shots of Herbs application Herbal Leaf Recognition**

A loading icon will then appear, and when processing is done, a message alert will then appear showing the leaf classification as evaluated by the system. When a user presses the "Take multiple snap" button, it will lead you to an interface. With this, the user can capture a leaf image (i.e.; by pressing the button with a camera icon). The user may click "OK" if it's good to go and "RETRY" to capture again.


**Step 7** **Step 8**

**Sample Screen Shots of Herb app's Leaf Recognition Using Multiple Uploads**

The user has an option either to press the "Upload" to send the images to the server for processing or "See the Results" button to get the classification result.

## V. CONCLUSION AND FUTURE WORK

By controlling the biotic factors causing severe losses within the crop yield, we will enhance the productivity and quality of the plants and its products. Computer vision with machine learning methodologies has outperformed in solving variety of plant leaves disease problems including pattern recognition, classification, object extraction etc. Therefore, the mobile app is fully developed within the Android platform using python and java codes. The mobile app is developed in windows platform, and it works perfectly while coming to Packaging is additionally successful. employing a deep learning techniques it shows a high accuracy while recognizing a herb.

However, in future, we'll improve the accuracy employing a classifier called Multilayer Convolutional Neural Network [MCNN]. Then, the BJFU100 database are going to be expanded by more plant species at different phases of life cycle and more detailed annotations. The deep learning model are going to be extended from classification task to yield prediction, insect detection, disease segmentation, and so on. it'll be interesting to develop an entire cloud-based architecture, where smart devices are often wont to identify the plant species during a real-time environment. Therefore, which will reflect positively on the standard of plants for future generations.

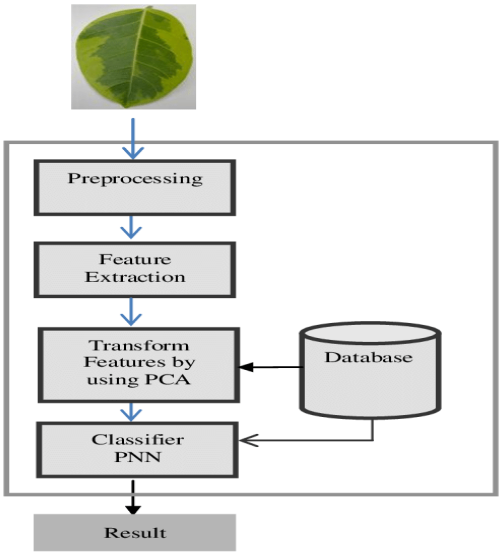



**Figure 8: Android Mobile App Approach**

## REFERENCES

[1] Amgad Muneer and Suliman Mohamed (senior member, IEEE) "Efficient and automated herbs classification approach based on shape and texture features using deep learning", November 10,2020

[2] S. Prasad, and P. S. Kumar, ''An efficient low vision plant leaf shape identification and disease identification system for smart phones,'' Multimedia Tools Appl., vol. 76, no.5, pp. 6915–6939, Mar. 2017.

[3] D. N. Duong, T. L. Le, and H. Vu, ''A Web-based plant identification application using multi-organ images query,'' in Proc. AUN/SEED-Net Regional Conf. Computer Inf. Eng., Vietnam, Oct. 2015.

[4] V. Sathya, A. Satya, and S. Sharma, ''An automatic leaf recognition system for plant identification using machine vision technology,'' Int. J. Eng. Sci. Technol., vol. 5, no. 4, p. 874, 2013.

[5] Baluamalai, S.S.Nandyal, and A. Govardhan, ''A combined color, texture and edge features based approach for identification and classification of Indian medicinal plants,'' Int. J. Computer. Appl., vol. 6, no. 12, pp. 45–51, Sep. 2010.

[6] M. F. A. Jabal, S. Hamid, S. Shuib, and I.Ahmad, ''Leaf features extraction and recognition approaches to classify plant,'' J. Computer Sci., vol. 9, no. 10, p. 1295, 2013.

[7] S. Ananthi and S. V. Varthini, ''Detection and classification of plant leaf diseases,'' Int. J. Res. Eng. Appl. Sci., vol. 2, no. 2, pp. 763–773, 2014.

[8] T. Munisami, M. Ramsurn, S. Kishnah, and S. Pudaruth, ''Plant leaf recognition using cucumber herb shape features and color histogram with K-nearest neighbor classifiers,'' Procedia Computer. Sci., vol.58, pp. 740–747, Jan. 2015.

[9] O. H. Babatunde, L. Armstrong, J. Leng,and D. Diepeveen, ''A survey of computer-based vision systems for automatic identification of plant species,'' J. Agricult. Informat., vol. 6, no. 1, pp. 61–71, Jan. 2015.

[10] J. Chaki and R. Parekh, ''Plant leaf recognition using shapes based features and neural network classifiers,'' Int. J. Adv. Comput. Sci. Appl., vol. 2, no. 10, pp. 41–47, 2011.

[11] Z. Zulkifli, P. Saad, and I. A. Mohtar, ''Plant leaf identification using moment invariants & general regression neural network,'' in Proc. 11th Int. Conf. Hybrid Intel. Syst. (HIS), 2011, pp. 430–435.

[12] N. Valliammal and S. N. Geethalakshmi, ''Automatic recognition system using preferential image segmentation for leaf and flower images,'' Computer Sci. Eng., Int. J., vol. 1, no. 4, pp. 13–25, 2011.

[13] A. Arora, A. Gupta, N. Bagmar, and S. Mishra, ''A plant identification system using shape and morphological features on segmented leaflets: Team IITK, CLEF 2012,'' in Proc. CLEF Online Working Notes/Labs/Workshop, 2012.

[14] K. David, P. James, and P. Mathew, ''Automatic plant leaf classification for a mobile field guide (an Android application),'' Dept. Elect. Eng., Stanford Univ., Stanford, CA, USA, Tech. Rep.,2012.[Online]. Available: https://stacks.stanford.edu/file/druid:rz261ds9725/Knight_Painter_Potter_PlantLeafClassification.pdf

[15] S. G. Wu, F. S. Bao, E. Y. Xu, Y.-X. Wang, Y.-F. Chang, and Q.-L. Xiang, ''A leaf recognition algorithm for plant classification using probabilistic neural network,'' in Proc. IEEE Int. Symp. Signal Process. Inf. Technol., Dec. 2007, pp. 11–16.