

A SUPERVISED LEARNING FOR PLANT SPECIES IDENTIFICATION

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Abstract: The plants are those which provide oxygen and are very important on this earth surface to survive. This paper identifies the species of plant based on the shape of leaf. Basically the shape is detected and are classified using the Curvelet Transform. The leaves are captured and the gray scale image, normalized image is also extracted. Edge detection is used to extract the morphological shape features of the leaf. The leaves are then trained with its features and are classified by the use of support vector machine. Then the leaves are tested and the plant species is identified.

Keywords: Support vector machine, Curvelet Transform, Edge Detection, Morphological shape features.

1. Introduction

Pattern recognition and Image processing techniques are the ones which are used enormously in the field of agriculture since a very long time. Their use is for determining the plants species, identifying, classifying. Before few decades, all these works are done manually and required a great man power which consumed so much time. When compared to the human vision done on plants which consumed lot of time on identifying, a computer vision has consumed less time with higher accuracy rates. This has emerged to the vast where the botany students have done most work for identifying and classifying the plant leaves into various species from the real world. An artificial expert system has emerged its use to the vast in the field of agriculture where it expands the agricultural research and improves the education system.

Leaf classification and identification is a problem that has been caused by the pattern recognition because the plant leaves are the entities of the real world, with observed changes in the physical appearance so we consider the shape, texture, color of the leaf for the classification and identification. The leaf shape is the one of the most important features for the classification into different species. The area, perimeter, mean of the leaf is obtained. The description of paper is followed by related work, methodology, extraction of features

using curvelet transform, the dataset and experimental results along with the conclusion and future work.

2. Related Work

For leaf shape identification of medicinal plants using curvilinear shape descriptor by Yeni herdiyeni[1], the purpose of this survey is helpful for pre processing of the image. The image is first converted into grayscale and the segmented image. Then the use of curvilinear shape descriptor for identifying the contours of the leaf. The contours are the salient points or the land marks where the most curves are noticed and classified. Haneen Altartouri [2], this paper introduces a new methodology to extract morphological and geometrical features from a plant with compound leaf. This was just helpful in identifying the shape of the leaf purpose Wu, et al [3] had defined as the ratio of area of leaf image and perimeter of leaf contour as the shape slimness, defined as ratio of length to width of leaves, defined as ratio of the internal area connection to valley points and the external area connection the top roundness and shape solidity, points. According to the Najjar and Zagrouba [4] used region based of the feature proposed method to classify the leaf. B. S. Harish [5] had proposed a research work for plant identification and classified the leaf using Zernike moments and morphological features. All of these analyzed Features in the research are very much independent of the growth of leaf. According to C. L.Lee,S.Y. Chen[6] in his past research in identifying objects that can be classified in two categories namely a region based and contour based approaches.

3. Methodology

Plant leaf shape identification is one of the most important features to identify and classify leaf to which species it belongs. The architecture is explained by RGB Image, normalization, Otsu thresholding, morphological operation, edge detection for shape features, classification using support vector machine, the result detects the species it belongs to.

RGB Image:

The input image is an RGB image where, R, G, B correspond to the red, green and blue color of the pixel respectively.

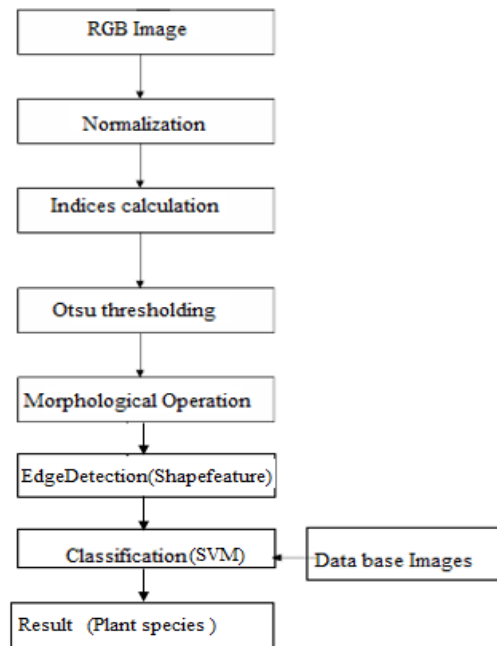


Figure 1. Feature extraction of shape identification

Normalization:

The RGB image is converted into a grayscale image. This image is normalized to increase the brightness and evenness of the image so it becomes easier to detect the shape.

Indices Computation:

Indexing the values into a matrix is the way to get its elements, rows or columns. A matrix is generally an array of numbers in rectangular form. In this process RGB is taken and perform normalization on that each plane of the color image. Indices computation also calculated, Excess green, Excess blue, Excess red will be calculated.

Otsu Thresholding:

In this thresholding is applied to the indices images. Based on this background and foreground is extracted. Mean intensity mask also calculated. In this threshold is fixed based on the value green area is segmented.

Based on these the images are converted into binary images

Morphological Operation:

The extracted images are taken and the morphological features like area, perimeter and mean values are taken.

Edge Detection:

The edges are calculated based on the shape of the leaf and detects the species it belongs to.

Classification:

Features are given to the SVM training and it can be trained. After we give leaf images to test the shape of leaf and the shape is detected. Based on the features extracted to classify the leaf into an infected or a healthy one.

Data Base Images:

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- The Images are trained and each type of leaf has different dataset images which define the shape of the leaf contained in the dataset of different leaf species.

Result(Plant Species):

The final result is that the leaf shape is identified of the different leaf dataset images and also the Leaf is healthy or unhealthy is detected.

4. Extraction of leaf features using Curvelet Transform

The performance of any recognition system totally depends on the features extracted from the source images, in this case, it is a leaf image. The extracted features should have very low inter similarity and a high ratio of intra similarity. For the natural image many algorithms are proposed for its feature extraction. One of them is a wavelet transform. Wavelet transform is a multi-scale extraction technique of a feature, enabling the time-frequency representation of the signal. The disadvantage of this is data redundancy and higher usage of memory and also it has direction dependent feature whereas a curvelet transform works in a multi directional feature which is helpful for pattern recognition and processing image. This proposed paper is on curvelet transform.

The natural image of the leaf is taken, a colored one. Basically, in image processing, this is a three dimensional image which constitutes to red, green, blue and their value to a range of 0-255. Firstly, this image has to be converted to a gray scale image which is 2-D. But, before conversion the leaf image has to be preprocessed. In the process of preprocessing the red

and green features of the leaf are extracted and then are normalized. They are resized to 250x250. Then it is converted to the grayscale image.

Basically, for the segmentation this process is done. Normally, there are some unwanted areas in the leaf which has no importance, so these parts are ignored.

For the data set that is taken, the feature vector matrix is created for the data set and is saved to a common one. This vector with the features is then used for training and testing with the support vector machine.

1. First is pre-processing leaf image, such as removing the noise, enhancing the image, normalizing and then converting into the gray image

2. Resize the leaf image of size 250x250.

3. Apply otsu thresholding to convert the image into a binary image that can be easily used for getting the shape.

4. Use the structural elements for getting the shape with the help of pixels.

5. With the help of the region properties we consider morphological features like area, perimeter and mean values.

6. Apply curvelet transform to each image for classifying the leaf as an infected or a healthy one.

7. For the conversion from the coefficients matrix to a feature vector the coefficients are applied with Mean and the Standard Deviation.

8. All the features are fused into a single matrix which are then ready to be trained and test the system.

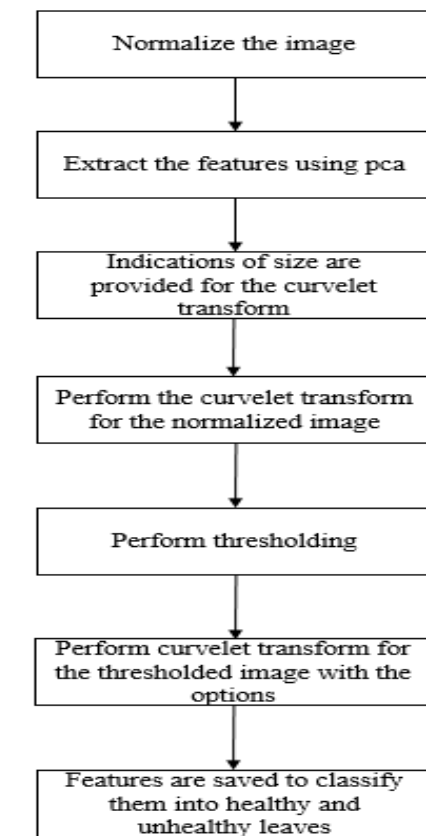


Figure 2. Algorithm for feature extraction using curvelet transform

Classification of an image analysis the various properties of features of the particular given image. Forming the complete images in a cluster size based on the same type characteristics. Training and testing is known as classification. One of the best tools used in recent times is the multi svm classifier which helps to

recognize the problems of the pattern recognition. The images which are used basically as datasets are trained before they are tested. The information from the angle of leaf is obtained from a set of discrete edge pixel positions. In the feature extraction leaf there are three parameters which are area, perimeter and mean of the leaf. For which the corresponding label values are present. Thus becomes easier to classify the leaf on the

basis of its shape which is mostly used in the case of agricultural applications.

5. Experiments and Results

The various images of leaves are collected and different shapes are obtained of each leaf . In the figure 3 firstly the input leaf is taken and the image is converted to grayscale image then to normalized then excess green image where the green part of the leaf is detected. Thresholding is applied then the image is converted into grayscale image by filling holes with the no of Pixels by using structural elements. The edges of the leaf are identified and dilate the image to increase the width of the leaf using structural elements and the values like area, perimeter, mean are taken and are trained to the database using support vector machine and are ready for the testing which loads of the features of the trained leaves and compares and classifies them into the species of which belongs to.

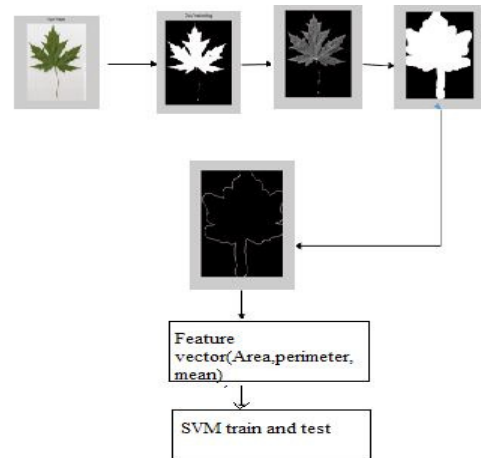


Figure 3. Procedure of feature extraction in the working system

The Figure 4 explains about the each leaf description and the shape of leaf also the area and perimeter of the particular leaf is obtained. For each leaf type there are images more than 50 which are datasets trained in the system so that the identification of the shape is explained

Image	Scientific name	perimeter	shape	area	Data sets
	Acer_tataricum	679.06	cordate	2500	50
	Actinidia_arguta	1.3098e+0.003	oblong	2264	60
	Acer_saccharinum	321	orbicluar	2548	55
	Wisteria_sinensis	1.4555e+0.03	ovate	2522	60
	Zelkova_serrata	722.99	reniform	2534	57
				Total	282

Figure 4. Table of leaf Identification shape

The Figure 5 depicts the Infection identification of the leaf by using Random Forest Classification to categorize the Leaf is Healthy or Unhealthy.

<i>Leaves</i>	<i>Healthy or unhealthy</i>
	<i>Healthy</i>
	<i>Unhealthy</i>

Figure 5. Infection detection of the leaf

6. Conclusion and Future Work

The above paper gives us the feature extraction from a natural plant leaf image where the automated species recognition is obtained. The curvelet transform is used for the leaf image to shape identification. The final output of this project is that the leaf is healthy or unhealthy is identified from the normalized leaf image. Future the type of disease to each leaf can be identified and also the infected part of the leaf.

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