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# A Novel Approach for Plant Species Recognition Using Mobile Phone

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**Abstract**-This paper highlights plant species identification by leaf image using mobile phone. The classification problem deals with associating given input pattern with one of the distinct classes. Plant leaf classification is a technique, where leaf is classified based on its different morphological features. In this paper, k-Nearest Neighbor classifier used for classification. Plant leaf classifications have wide applications in various fields such as Botany, Ayurveda, Agriculture, etc.

**Index Terms** - Image Processing, Leaf Classification, Plant Identification.

## 1. INTRODUCTION

Plant recognition or classification has a broad application prospective in agriculture and medicine [1-4]. Plant leaf classification can be used in various fields like Botany, Cotton and other similar industries. Plants are vitally important for environmental protection [5]. However, it is an important and difficult task to recognize plant species on earth. Every plant carries significant unique information. It is very necessary to set up a database for plant. The first step is to teach a computer how to classify plants. Plants are basically identified based on flowers, fruits and leaf [6, 7, 8]. However, fruits and flowers are three dimensional objects and increases complexity. Plant identification based on flowers and fruits require morphological features such as number of stamens in flower and number of ovaries in fruits. Identifying plants using flowers and fruits are very time consuming task. Leaves also play an important role in plant identification. Moreover, leaves can be easily found and collected everywhere at all seasons; while flowers can only be obtained at blooming season. Shape of plant leaves is one of the most important features for characterizing various plants visually. Plant leaves have two-dimensional nature and thus they are most suitable for machine processing. Before classification can be done on basis of leaf, some pre-processing is needed and most important step prior classification is feature extraction. For classification, different methods are available, namely, k-Nearest Neighbor (KNN), Probabilistic Neural Network (PNN) and Genetic algorithm (GA).

## 2. PROPOSED METHODOLOGY

The present work facilitates user to provide the image of the leaf as the input taken by the mobile phone. The system applies algorithm to derive vital parameters related to the properties of the leaf. It then compares these parameters with ones stored against a leaf entry in the database. On successful match of the parameters, the application displays species of plant.

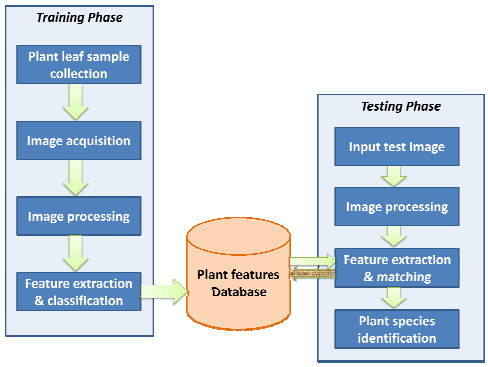


Figure 1: Block Diagram for Plant Species Recognition

The algorithm of our system for classifying plant species proceeds as follows.

### *2.1. Image Acquisition*

The input to our algorithm is a photograph of a leaf of unknown species taken with the mobile phone's camera. Because the user has an interest in taking a picture which will provide useful information, it is reasonable to assume a certain degree of uniformity in the acquired images, i.e. the picture will be takenat a reasonable distance, in decent lighting, roughly normal to the surface, and against a background which provides sufficient contrast.

### *2.2. Preprocessing*

After leaf image is obtained, some pre-processing is needed. This stage includes are (i) Grayscale conversion: agrayscale or grey-scale digital image is an image in which the value of each pixel is a single sample, that is, itcarries only intensity

information. Images of this sort, also known as black-and-white, are composed exclusivelyof shades of gray, varying from black at the weakest intensity to white at the strongest. (ii) Image segmentation:In computer vision, image segmentation is the process of partitioning a digital image into multiple segments(Sets of pixels, also known as super-pixels). The goal of segmentation is to simplify and/or change therepresentation of an image into something that is more meaningful and easier to analyze. Image segmentation istypically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same labelshare certain visual characteristics. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. (iii) Binary conversion: A binary image is a digital image that has only two possible values for each pixel. Typically the two colors used for a binary image are black and white can be used. The color used for the object in the image is the fore ground color while the rest of the image is the background color. In the document scanning industry this is often referred to as bi-tonal. Binary images are also called bi-level or. (iv)Image smoothing: Computer vision operates on images that usually come in the form of arrays of pixel values. These values are invariably affected by noise, soit is useful to clean the images somewhat by an operation, called smoothing, that replaces each pixel by a linearcombination of some of its neighbors. Smoothing reduces the effects of noise, but sometimes blurs the image.

### *2.3. Morphological Feature Extraction*

After an extensive review of literature and experimentation with various combinations of digital morphological features, we decided to include the following features in our final algorithm:

- Centroid-contour Distance Curve
- Aspect Ratio
- Rectangularity
- Convex Area
- Convex Perimeter
- Sphericity
- Circularity
- Eccentricity
- Form Factor
- Regional Moments of Inertia
- Angle Code

### *2.4. Training, Classification and Matching*

Necessary input is fed to the system in the form of images of the leaf. The system applies necessary steps to extract values for vital parameters from the image. This image along with these parameters with their values and other essential information is stored in the database.

In our system we use KNN classifier for classification .The Euclidean or KNN classifier based on the distance is direct and simple. Special interest was given to KNN due to its Simplicity and Efficiency. It is one of the simplest classifiers with characteristics fitting our requirements. Its testing time, however, grows linearly with the size of the training set, limiting the scalability of the classifier. It is based on distance measures in feature space but instead of comparing to a class representative value, it compares it to all samples of the training. The selecting the first k closest ones dataset contains a total of 30 images of 3 different plant species. These images were used to train the classifier. For each type of plant in dataset, we selected 3 leaves from testing sets which are then used to test the efficiency of the proposed algorithm in terms of accuracy. After successful matching with the database stored in the system, the output will be given on the mobile screen by the system in form of written text i.e. species of the test plant leaf.

## 3. EXPERIMENTAL RESULTS

The proposed system trained with 15 images of each species namely Swastik, Jaswandi and Methi. Experiments were carried out for the classification of plant species. The obtained result showed in figure 2 and indicated 90% accuracy for the trained species. The failure was due to the light intensity, distance between mobile device and image capture, shadow while capturing the image of leaf. However, results can be improved by training system considering these influences. Figure 3 showing the screenshot of mobile screen while identifying of swastika leaf.

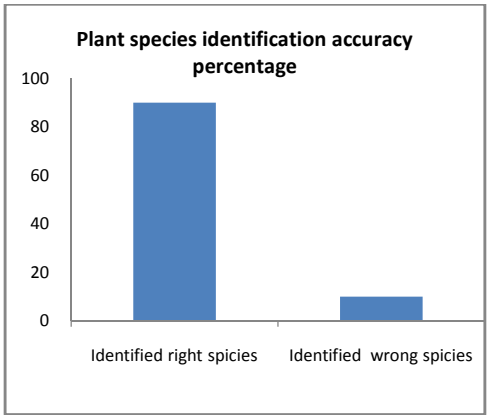


Figure 2: Plant species identification result

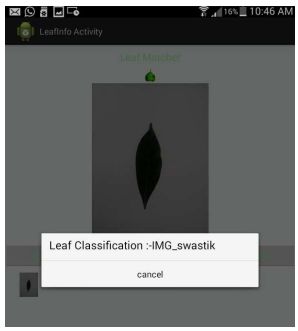


Figure 3: Screenshots of classification of Swastik leaf

## 4. CONCLUSION AND FUTURE SCOPE

In this paper, automatic recognition of plant species by plant leaf images with mobile phone was proposed and performed. We classify plant species based on the nearest neighbor distance of the query leaf's features from the median features of each species in the training set. Our method proved quite robust under reasonable conditions like, light intensity, distance between mobile device and image capture, shadow while capturing the image of leaf. Processing on server side makes application Slow.

This area can be further explored by considering noise factor to hence can reduce the mathematical operation as much as possible while maintaining the same accuracy. Future work also incorporate combination of color and texture feature along with the shape feature for better results.

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