Leaf Detection Application For Android Operating System

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Abstract: **The aim in this paper is to utilize the advancement in mobile technologies to foster knowledge on plant species around us. In this paper it is propose to develop an application to identify plant species on android platform. We use contour based edge detection for detecting the edges of the leaf from a plain white background, centroid classification is also done. The obtained feature vector should be irrespective to any scaling, rotation or translation of the contour. Usually these kind of applications in the past used Fourier descriptor to compare object contours and object silhouettes, we instead use Maximally Stable External Regions (MSER) detector and represent the external contour by FD's. With the great deal of improvements in technological aspects of the mobile phones. These advancements can be used for better understanding of plant species. The basic purpose of Plantopedia is to provide information about common plant species in a user friendly manner. These types of applications will be handy for taxonomists and botanists who study plant species and classify them frequently.**

***KeyTerms*—Image Segmentation, MSER, SIFT, APK, SDK.**

I. INTRODUCTION

Recognizing plant species from leaf characteristics is a very challenging and appealing task. The global shortage of expert taxonomists increases the demand for the software tools that recognize and characterize plants from images. Plantopedia is necessary under these circumstances not only for taxonomists but also for people to have better understanding on the plants around us. Recognition of plant species is done by contour comparison and matching aspect ratio. Future enhancements can be done to improve accuracy and include more leaves in the leaf dataset.

Plantopedia works in auto-recognition mode in which plant species are identified by analyzing the images and comparing it with available dataset and in manual-recognition mode where the user must specify leaf and node of the leaf are been characteristics for the application to identify the leaf that will Match the description and interoperability is also supported. The application was developed in android 2.3.3 and is compatible in any higher versions. This application features a simple and user-friendly interface and is faster when compared to the other applications because it avoids the basic point to point matching algorithms.

In case of a hierarchical structure of the relations, it might result in more number of classes and it leads to an more complicated structure. Therefore we are transforming the hierarchical relation structure to a simpler structure such as a earlier flat structure. It is easier to transform the already developed hierarchical model in to a bipartite, flat model which includes the classes and flat relations. The flat relations are more preferable at the design level for facing less complexity in the implementation phase. There is no uniqueness and functionality associated with a flat relation. A flat relation is related with the concept of entity relationship modeling and object oriented methods.

II. LITERATURE SURVEY

There have been many recent studies based on the plant identification, classification and recognition based on the components of a plant such as flowers, leaves and barks. And it is known that the exact way to extract the features of a plant includes recognition process based of the leaf images. The most common features used for the plant identification using the leaf image, are the color and shape of the leaf. In study related to the color, a similarity between two colors can be identified by comparing the color histogram of the involved images. In case of shape based study, it is classified in to two kinds one is the region based and contour based study. Most of the features used in the earlier studies were done in the time domain data. And most importantly in the previous study it was observed that the leaf color was affected by the seasons. Therefore, the performance of the system was limited. So the following observations are made for enhanced results.

Kue-Bum Lee and Kwang-Seok Hong proposed advanced leaf. Identification Based on the centroid and contour of the leaf for species classification.

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According to them preprocessing procedure on the plant leaf was necessary and important procedure to accurately identify the leaf contour for correct leaf feature extraction. Extraction using Geometric and Morphological Features were also discussed.According to james S.copea, and David Comey one of the most familiar method applied to recognize the leaves is the Elliptic Fourier Descriptors (EFds, or Elliptic Fourier Analysis; EFA). In this technique the shape of the leaf is analysed in the frequency domain, instead of the spatial domain. In order to define the outline, a set of Fourier harmonics are calculated, and each of the set has four coefficients. This collection of coefficients forms the Fourier descriptor, with more number of harmonics providing more simplified descriptions. And a principal component analysis (PCA) is being applied to the descriptor in order to reduce the dimensionality. And White et al discovered that EFA is superior to the landmark measures, moment invariants when characterizing the leaf outlines.

Rongxiang Hu, Wen jia and Deshuang Huang proposed the Multiscale Distance Matrix (MDM), which is a countour-based shape descriptor. It is used to capture the whole geometric structure of a shape irrespective to the translation, scaling, rotation and bilateral symmetry. MDM was considered as a most effective method since it avoided the use of DP to build the point wise correspondence. MDM is considered as flexible in the underlying building distance, and MDM also allowed the use of Euclidean distance to calculate the difference between two shapes Moreover, they have also applied dimensionality reduction methods to MDM in order to extract the discriminate information, which further helped in improving the accuracy and efficiency of the proposed method. When compared with the other contour based approaches like SC and IDSC, MDM has the capability to achieve the comparable recognition performance in a faster environment.

. Yu meng and Dr.Bemard Tiddeman proposed The Scale Invariant Feature Transform (SIFT) algorithm, which is capable of transforming an image into a collection of local feature vectors. And each of these feature vectors are supposed to be invariant and distinctive to any form such as scaling, translation or rotation of the image. In the actual implementation, these are used to find the different objects in distinct images and the transform can also be extended to match the leaves in the images.

III. EXISTING SYSTEM

In the existing system a typical contour based shape recognition approach is being followed. Those methods are transforming sensitive and produce inaccurate results. Using those algorithms in android platform is a complex task. Hence, android applications to identify plant species are either in preliminary stage or unsuccessful until now.

IV. PROPOSED WORK

In our paper we propose to develop an application to identify plant species on android platform. We use contour based edge detection for detecting the edges of the leaf from a plain white background, centroid classification is also done. The feature vector should be distinguishable and irrespective to any kind of scaling, translation or rotation of the contour. The Fourier descriptors are used to make a comparison between the object contours and object silhouettes, but rather we use the Maximally Stable External Regions (MSER) detector and FD's are used to represent the external contour.

4. A TECHNOLOGIES USED

ANDROID

Android is more a software stack rather than an operating system for mobile devices, the software stack Constitute of an middle ware, OS and applications key applications. The Android SDK provides the APIs and tools necessary to initiate the Developing the applications on android using java.

FEATURES OF ANDROID

Application framework enabling reuse and replacement of components .dalvik virtual machine optimized for mobile devices integrated browser based on the open source web kit engine optimized graphics powered by a custom 2d graphics library; 3d graphics based on the opengl es 1.0 specification (hardware acceleration optional.).sqlite for structured data storage. media support for common audio, video, and still image formats (mpeg4, h.264, mp3, aac, amr, jpg, png, gif).gsmtelephony (hardware dependent).Bluetooth, edge, 3g, and wifi (hardware dependent).camera, gps, compass, and accelerometer (hardware dependent).

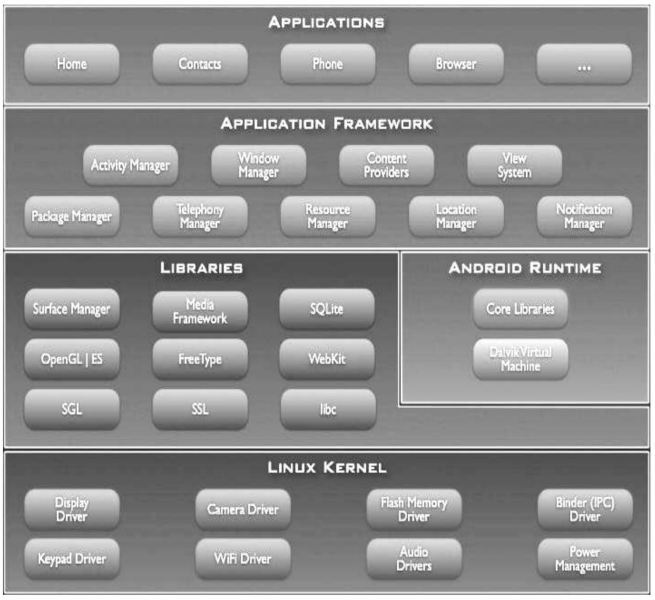


Fig 1. Android Architecture

4. B.SYSTEM DESIGN

The following are the modules which are being used in the design of the system they are given as 1.Designing User Interface 2.Leaf Identification 3.Contour edge detection 4.Scale Invariance Feature Transform 5.Contour

comparison 6.Plant species Recognition. The architecture diagram is given below.

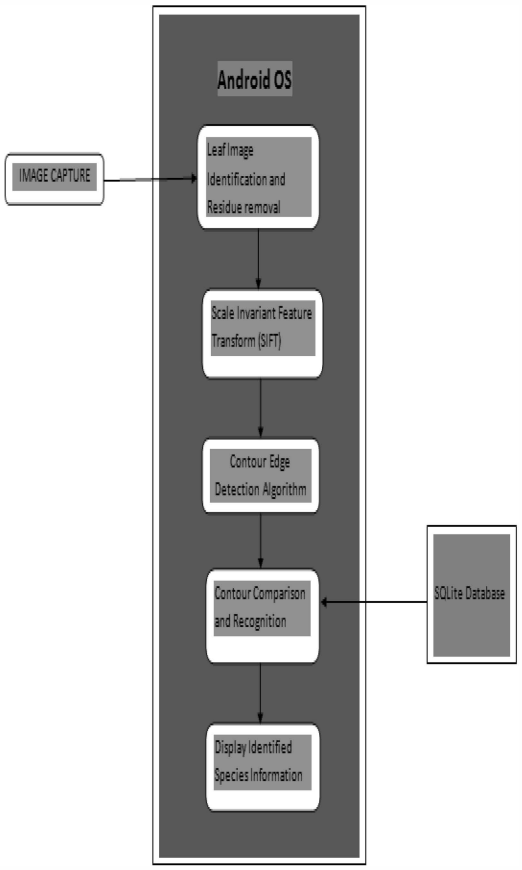


Fig.2 System Architecture Diagram

4 .C. Designing User Interface

User Interface of the application is designed to be simple and easy to use. The interface was designed in Eclipse IDE such that it fills the screen of any android device in which it is used.

User Interface was designed to work in 3 modes.

Mode 1: Auto-Recognition Mode
Mode 2: Manual-Recognition Mode
Mode 3: Recognize Later

4. C.1 Auto-Recognition Mode

It is highly impossible for any botanist to identify more than a very little of the total number of the named plant species, which makes him difficult to proceed further on his research over plants. Segmentation is used for partitioning a digital image or assigning a label to all the pixels in an image in to multiple numbers of segments. The ultimate aim of segmentation is to make the representation of an image simpler to understand and analyze. And it is used to identify the objects and boundaries in images. In other words the segmentation is the process of assigning a label to every pixel in an image and since the pixels with same label share some of the visual characteristics. Separating the green colored leaves from an overall floral environment seems to be a much tougher issue, and there are also algorithms to overcome such difficulties causing by the natural background. Teng kuo and chen used 3D point reconstruction from a various number of images to perform a 2D/3D joint segmentation by using the 3D distance and the color similarity and Wang proposed and implemented an automatic marker watershed segmentation. After a threshold erosion process. All the above explained methods are very complex and it seems to be unreachable for a simple mobile application. Consider a weed leaf, it has a complex structure even though good results have been obtained with a minor overlaps. Mei-yan jin et al. presented a method of recognition that generates vertical and horizontal lines, therefore the objects passing through the images selects four certain points in the boundary such that vertical and horizontal lines meet the background of the objects. Boundary surfaces are continually observed and monitored from each of the four points for the detection.

Fig.3 manual recognition: leaf type

4. C.2 LEAF IDENTIFICATION

Leaf Identification module was implemented in Java script of the android application. The major function of this module is to identify the leaf from the captured camera image. For easy identification ‘Mark Head’ and ‘Mark Tail’ of the leaf is provided. Leaf and Non-Leaf classification is done. Untrained users initially try to take photos of leaves in-situ with multiple leaves present amid clutter, often with severe lighting and blur artifacts, resulting in images that we cannot handle (usually due to segmentation failures). In addition, many users also take photos of objects that are not leaves. We address both of these issues by first running a binary leaf/non-leaf

classifier on all input images. If this classifier detects that an input image is not valid - of a single leaf, placed on a light, un textured background with no other clutter - we inform the user of this fact and instruct them on how to take an appropriate image. We found this simple procedure very helpful for training users without the need for long tutorials or help pages, which often go unread. It also greatly reduces the computational load on our server, as images that fail this classification (about 37.1%) are discarded from further processing.

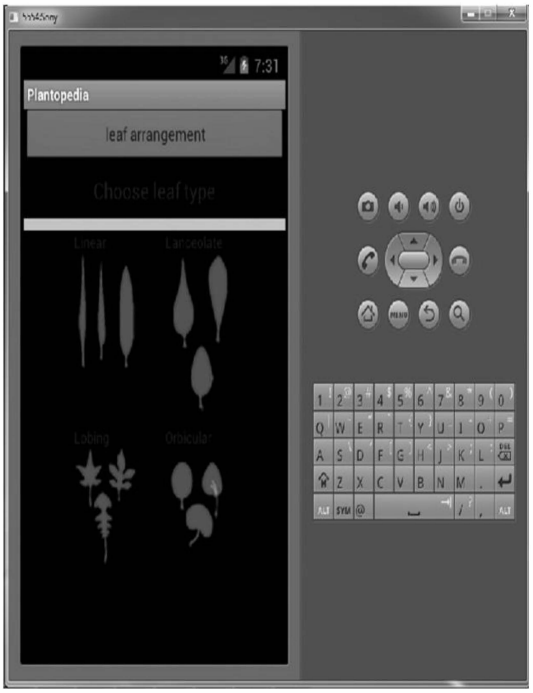


Fig 4: leaf identification

4. C.3.CONTOUR EDGE DETECTION

Contour edge detection is performed to find the leaf contour for skimming the features that are necessary to identify and analyze the plant species. The modified canny edge detection is used in this phase of the system. And these edge points of the four leaves will be taken as the starting and the terminating points of the tracing algorithm. After determining those four edge points, the rest of the contour is automatically traced by our application, we have constructed the cost function of IS that utilizes the operations of a color edge cost terms and canny edge cost terms. Every one of the four sets of edge points, (p1 p2),(p2 p3),(p3 p4) and (p4 p1) is served as the starting and terminating trace points. And after that we have selected the minimum energy with the shortest path cost to monitor the route. The major task of the IS algorithm is the construction of the cost function. In a neutral case, the system should contain all the image constituents that will have an impact on the position of the contour.

And we are using the canny edge cost terms and gradient magnitude terms rather than the traditional IS algorithm to construct the cost functions, since the edges of the petals having a sharp direction in our application.

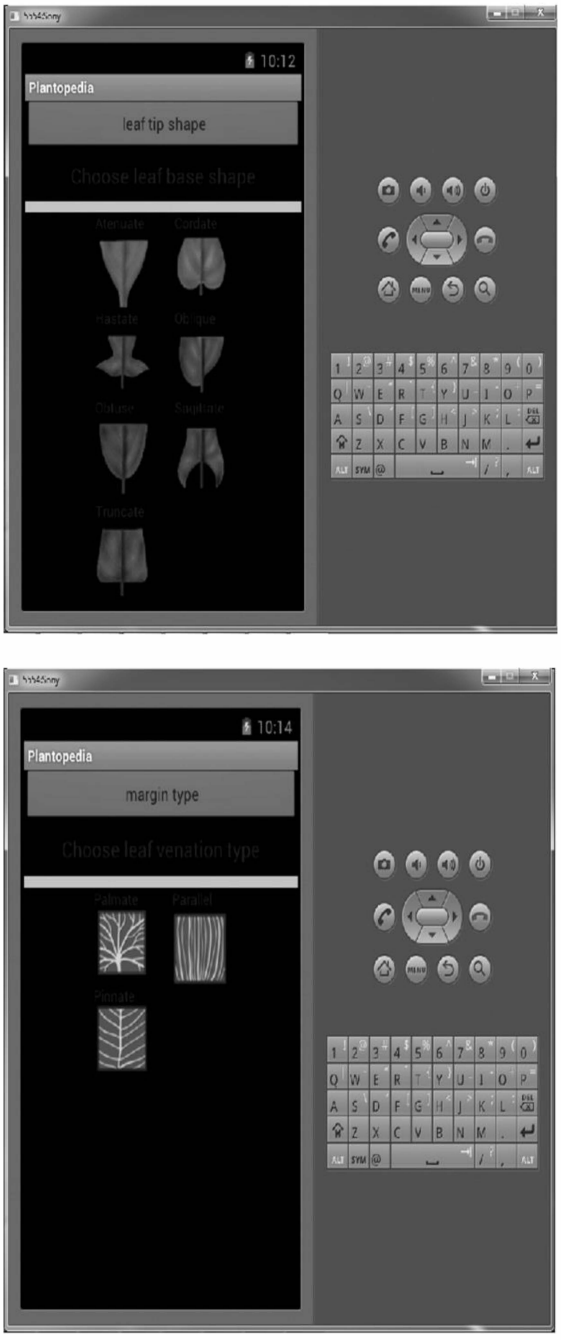


Fig 5: contour edge detection

4. C.4 SCALE INVARIANCE FEATURE TRANSFORM (SIFT):

Scale Invariant Feature Transform module not only serves its purpose of making the leaf contour scale invariant but also extracts certain features that add to more accuracy of leaf recognition.

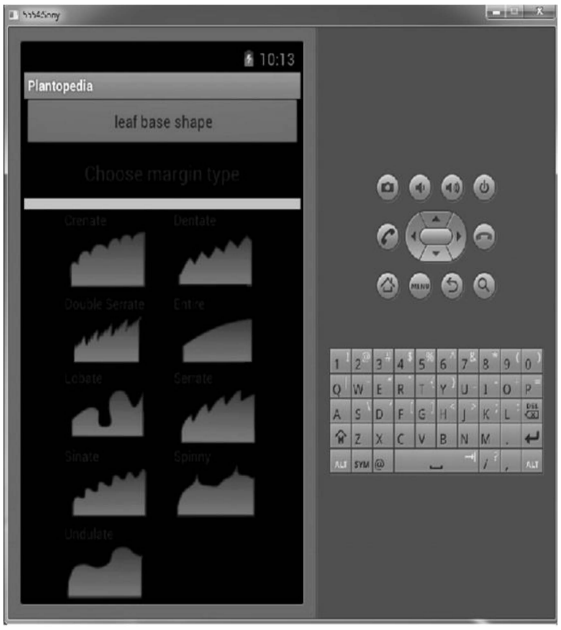


Fig 6:SHIF

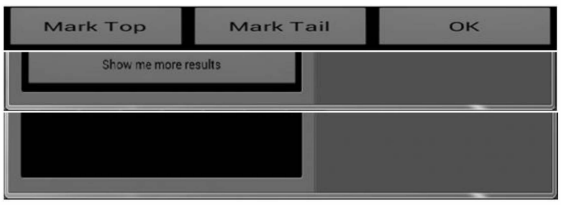
4. C.5 CONTOUR COMPARISON

The contour comparison module is further divided into two sub-modules for manual recognition and auto recognition. In manual recognition the contour comparison is done by comparing the features specified by the user with the values in the dataset and in auto recognition the contour comparison is done by extracting certain features from leaf image that can be compared to leaf dataset.

Fig 7: contour comparison

4. C.6 PLANT SPECIES RECOGNITION

In the plant species recognition module, matching of the extracted value is done. For auto recognition method, error constant is introduced so that the value varies within a range of acceptable values whereas in manual recognition exact values of all features must be there to recognize the species.



AUTO-RECOGNITION IN PROGRESS

This figure which will explain about the auto-recognition in progress they are give below as.

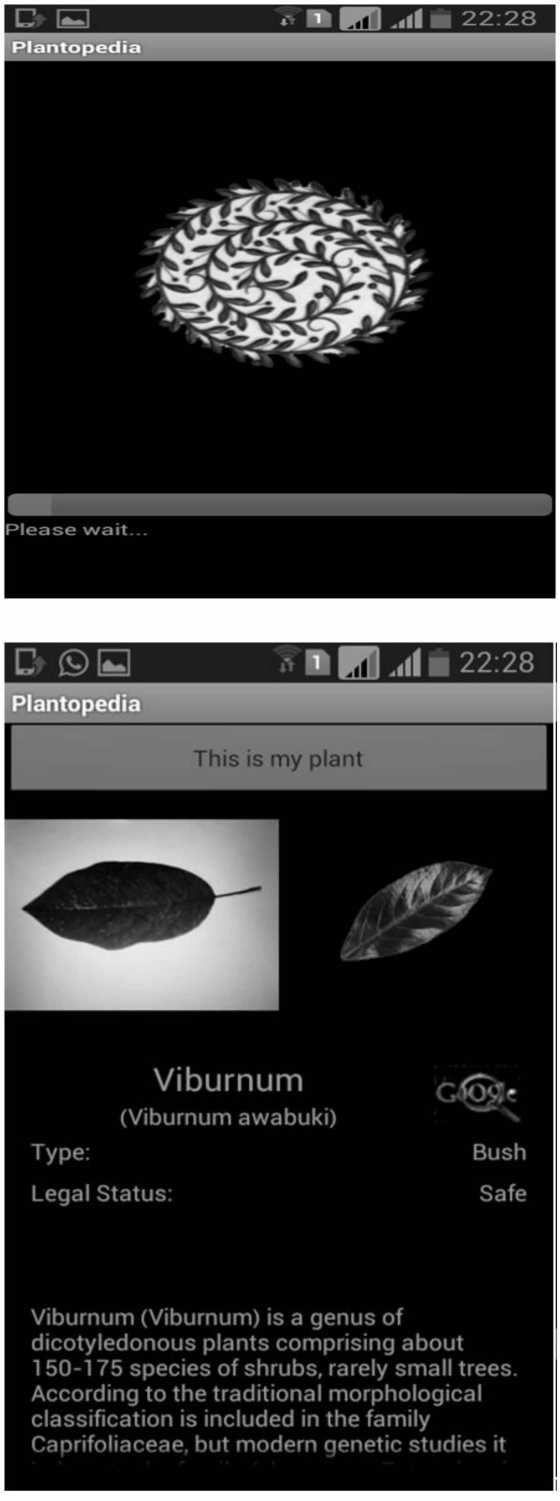


Fig 8: Auto-Recognition In Progress

V. CONCLUSION

In this paper, we investigated various methods for recognizing plant species and analyzed the importance of such an application to the taxonomists and botanists. We proposed a plant species recognition technique that is scale invariant, contour based, fast and efficient.

Our application relies on the underlying algorithms for several key aspects, including classifying images as leaves or not, obtaining leaf contour, extracting key features of the leaf, comparing it with the dataset and displaying the matching species. A high level engagement in this application may allow for many possible future directions. The application can be tuned to improve the accuracy and speed. The dataset can be provided through a spatial database for easy access and substantially decrease the application size. Finally, we would like to further explore the educational aspects of this project. This includes adding more collaborative features in the application. We believe that the area of our project has greater scope and further study is necessary to put computer vision systems to efficient use for the betterment of the society.

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