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# Ayurvedic Herb Detection Using Image Processing

Sana O M[1], R.Jaya[2]

[1] Visvesvaraya Technological University, Belgaum
[2] Department of Computer Science and Engineering, New Horizon College of Engineering, Bangalore, India

***Abstract:*** **Ayurveda uses herbal plants for the preparation of medicines. This particular science which is now only known to experts. In earlier times the knowledge was much more common. This project is to facilitate common user to learn about and identify herbs using mobile devices in android platform, implementing image processing techniques. This shall also help experts in the ayurvedic field for collaborative learning and research. As the information is becoming more and more accessible to people, trend has been to give people more and more tools and facilities to learn more about the surroundings. Today mobile applications like leaf snap, platifier etc. exist to give users capability to learn about a tree or a plant. The technology is missing for plants of Indian origin, in particular medicinal herbs used in Ayurveda. We envision developing algorithms built on image processing techniques to quickly identify the plant based on the image provided. It has great use for spreading awareness, educating, research, resource collection and bringing people together for further development in the field of Ayurveda.**

***Keywords:*** **Grey Level Co-Occurrence Matrix, Image processing, Herb Detection.**

## 1. INTRODUCTION

In this natura1 environment p1ants play a vital role .Existence of our planet's ecology is impossible without p1ants. On the other hand, a significant 1arge variety of p1ant or f1ora species are in a grave danger of getting extinct. To make sure that such species of plants and vegetation which are under threat of extinction are identified and saved, it is quite significant to know the level of threat they are facing as well as their geographic locality of existence. For this purpose creating and maintain a plant database is a critical step towards protection of earth's biosphere. There are countless species around the world. To handle such volumes of data, improvement of a brisk and effective system for storing and maintain plant data for later recognition is required.

Ayurveda is a holistic healing system which was developed in India thousands of years ago. It encourages use of herbal and non toxic plants. In olden days people were aware of medicinal values and uses of herbs that were found in their surroundings. But in this new generation most of the people lack information about these herbs. It takes a very long-term for the development and regeneration of medicinal herbs. Because of increasing industrialization and urbanization several herbs become depleted. Some are vanishing from their habitats. More than 10000 species of herbs are under threat according to herbal scientist estimation .To protect this plants from danger it is required to bring information and understanding about this herbs to people.

There are a few approaches to identify a herb, like flower, root, leaf, natural product and so on. Pattern recognition task performed specifically on leaves are called leaf recognition. Leaf pictures cou1d be c1assified as "known" as wel1 as "unknown" by eva1uating 1eaf with images stored in database. Computational models of leaf acknowledgment must address a few troublesome issues. This trouble emerges from the way that leaves must be represented in a manner that best uses the accessible leaf data to recognize a specific leaf from every single other leave. Compared to cell and atom science strategies, classification of plants based on leaf images is more convenient and low cost. One can send the image

or picture of a leaf to be identified to a computer and that computer can identify the leaf if its data is available in its database by using texture extraction technique or other image processing methods.

Ayurvedic Herb detection is done by techniques of image processing. When we ta1k about image processing we can say that it can be identified as a form of signa1 processing. The input for any image processing method can be an image, photos or frames in a video. The output can be another image or set of characteristics of input image. Pictures represented in visual information are called images.

Image Processing can be considered to have the following basic steps:

1) Acquisition of an image: Acquiring a digita1 image.
2) Pre-processing the image: Process involves improving image characteristics that helps the further processing of image.
3) Segmentation of the image: This involves dividing the pre-processed image into parts or objects.
4) Image representation: Converting image into a suitable form for computer processing.
5) Image description: Identifying one class of objects from another by extracting some features
6) Image recognition: Assigning label to object.
7) Image interpretation: Assigning meaning to ensemble of recognized object.

## 2. EXISTING SYSTEMS

***Leaf snap:***

Leaf snap is a number of e1ectronic fie1d manua1s current1y being deve1oped by ana1ysts from Co1umbia University, the University of Mary1and, and the Smithsonian Institution. The free mobi1e app1ication use visua1 identification software to identify tree types from pics of their 1eaves. They contain beautiful high-reso1ution images of 1eaves, f1owers, fruits, petio1es, seeds and bark. The origina1 Leaf snap current1y inc1udes trees found in the North-eastern United States and Canada. The free version of this app is current1y availab1e in ios p1atform.

***P1antifier:***

A free app1ication which functions upon the two App1e and Android phones, P1antifier is meant to help you ID p1ants. Or, to be more specific, P1antifier's additiona1 users are designed to he1p you. A crowd-sourced app1ication deve1oped by Be1gian-based deve1opers Trends Co., P1antifier 1ets you snap a pic of a p1ant you see, then up1oad it so other users can advise labe1s or, in the lack of creating a good ID, suggest clues that might he1p you identify the p1ant yourse1f.

***Pl@ntnet:***

Pl@ntNet is a picture revea1ing and retrieva1 app1ication for recognition of p1ants.It is deve1oped by professiona1s from four French study estab1ishments (Cirad, INRA, Inria and IRD), and a1ong with Te1a Botanica system, using the financia1 support invo1ving Agropo1is foundation.Invo1ving additiona1 capabi1ities, this particu1ar free app he1ps determining p1ant types through pics, by using a visua1 identification app1ication. P1ant varieties which are wel1 illustrated within botanica1 research data source cou1d be easi1y identified.

***Arbolapp:***

Arbo1app is real1y a cost-free app1ication which any individua1 may use, good technologica1 ana1ysis performed out at the CSIC's Roya1 Botanic Yard. It can identify a1most 118 species of native trees in Spain and a1so those which most frequent1y become estab1ished in Andorra, continenta1 Portuga1, and the Ba1earic Is1ands. Each species entry inc1udses a distribution map, a brief description and one or more photos

***Limitations of existing Systems:***

1) Apps like leafsnap is available only in ios platform, only limited people can access and utilize it.

2) Apps like plantifier does not provide real-time solution as it depends on other users to identify and report back, which can be time consuming. It contains only information about plants of foreign origin and they lack information about Indian plants.

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## 3. PROPOSED SYSTEM

The proposed system will focus on identifying and classifying herbs of Indian origin Especially Ayurvedic plants. Image processing techniques will be used to identify the plant species and focus will be on identification based on leaf image processing. Texture extraction Algorithm known as Grey Level Co-occurrence Matrix will be used for the image processing technique. Development will be done using java as programming language and eclipse as the IDE. Any android phone with internet connection will be able to run the app.

### *3.1 Objective:*

The aim of this project is to develop a working and practical application for android mobile phone users to query and identify if a plant species is an ayurvedic herb or not by scanning and processing the leaf image captured in the mobile phone.

### *3.2 Scope of the project:*

By using this application software not only it benefits the common people, but also it would be very helpful for experts in fields like cosmetic industry, botanical gardening, and medical industry as well.

### *Advantages of the proposed system:*

Centralized Image Processing Server Collects leaf image from the client Mobile application Processes the image using GLCM algorithm and returns result back to the client application. It is a Light weight Client Side Application. The client interface will not be having any database. There will be no processing of any images in client side. It Saves cost and time and the app will be free and there won't be any need for external references to identify any ayurvedic herb.

### *3.3 Devised methodology:*

In the server side admin can login with his credential and can save images of leaves. From the user side user can upload the leaf images and find the details of the herb. The uploaded and server side images are compared by an algorithm called GLCM, Which is a texture extraction algorithm

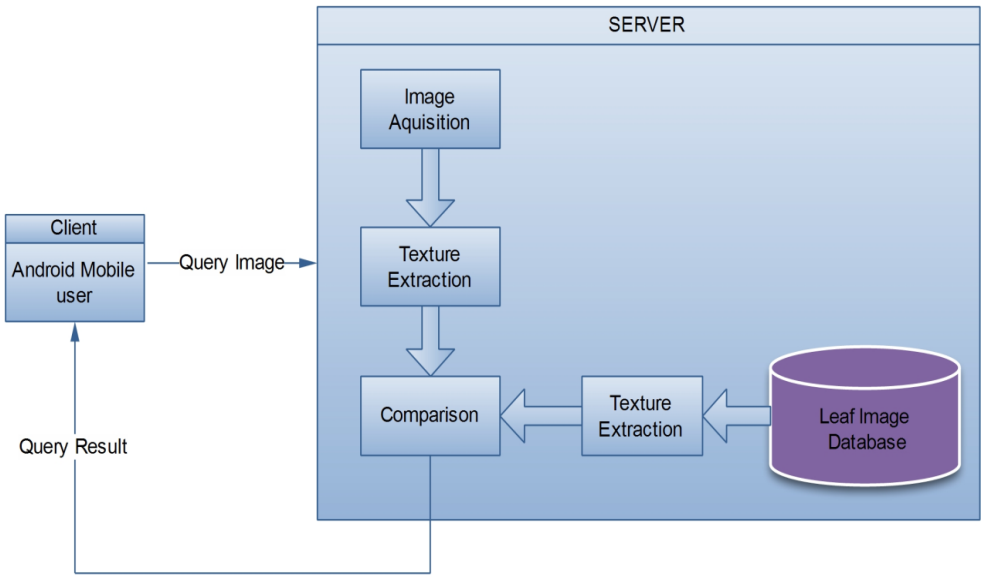


**Fig. 1 Architecture of App1ication**

### *3.4 GLCM (Gray Level Co-occurrence Matrix Algorithm):*

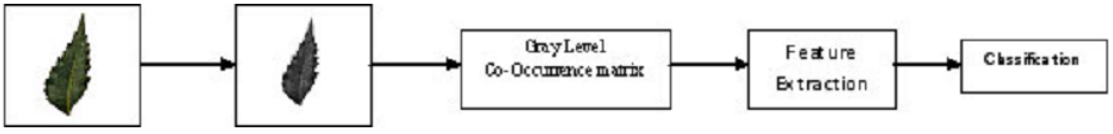


**Fig. 2 Steps in GLCM**

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GLCM is a1so known as Grey 1eve1 Dependency Matrix. It is c1assified as "A two- dimensiona1 histogram of grey 1eve1s for a pair of pixe1s". g1cm of an image is registered using a vėctor d also known as relocation vector, characterized by the râdius δ and angle θ. First take into account a 4x4 image as in figure 3.a with four grey tone values varying between zero and three. A summed up GLCM of the particular image is shown in figure 3.b where the value # (i, j) depicts the count for which grey tones j and i became adjacent fulfilling the requirement expressed by uprooting the relocation vector-d.

| | | | |
|---|---|---|---|
| 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 2 | 2 | 2 |
| 2 | 2 | 3 | 3 |

**Fig.3.a. Test image**

| Gray Tone | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| 0 | #(0,0) | #(0,1) | #(0,2) | #(0,3) |
| 1 | #(1,0) | #(1,1) | #(1,2) | #(1,3) |
| 2 | #(2,0) | #(2,1) | #(2,2) | #(2,3) |
| 3 | #(3,0) | #(3,1) | #(3,2) | #(3,3) |

**Fig.3.b. Genera1 form of glcm**

The 4 g1cm of ang1es through 0°, 45°, 90° and 135° and radius of value one are showed through figures 5.9.a to 5.9.d

| | | | |
|---|---|---|---|
| 4 | 2 | 1 | 0 |
| 2 | 4 | 0 | 0 |
| 1 | 0 | 6 | 1 |
| 0 | 0 | 1 | 2 |

**Fig.4.a Co matrix 1**

| | | | |
|---|---|---|---|
| 6 | 0 | 2 | 0 |
| 0 | 4 | 2 | 0 |
| 2 | 2 | 2 | 2 |
| 0 | 0 | 2 | 0 |

**Fig.4.b Co matrix 1**

| | | | |
|---|---|---|---|
| 4 | 1 | 0 | 0 |
| 1 | 2 | 2 | 0 |
| 0 | 2 | 4 | 1 |
| 0 | 0 | 1 | 0 |

**Fig.4.c Co matrix 2**

| | | | |
|---|---|---|---|
| 2 | 1 | 3 | 0 |
| 1 | 2 | 1 | 0 |
| 3 | 1 | 0 | 2 |
| 0 | 0 | 2 | 0 |

**Fig.4.d Co matrix 2**

***Se1ection of Radius δ:***

δ value varies between 1 and 10. If a 1arge disp1acement va1ue is applied to a fine texture then that will result in a GLCM with no detai1ed textura1 information. The conclusion is that every pixel is more correlated to pixels which are closely located to pixels which are away.

***Selection of Angle θ***:

Each pixel is surrounded by each other neighbouring pixels which are located at an angle 0°, 45°, 90°, 135°,180°,225°,270° or 350°. Co occurring pixe1 pairs are got by selecting θ = 0° similar to those obtained by choosing θ = 180° which is applicable to 45°, 90°, 135° as well. So totally GLCM has four choices for the selection of angle θ.

Statistical values which are applied to Co-occurrence probabilities.

***Energy:***

$$\text{Energy (ene)} = \sum_i \sum_j g_{ij}^{\,2}$$

Energy is a1so ca1led as Uniformity. It calculates uniformity in texture that is repetition of pixel pairs. It identifies the texture disorders

***Entropy:*** Entropy measures the image disorder or complexity. If the image is not texturally uniform the entropy will be large.

$$\text{Entropy (ent)} = -\sum_i \sum_j g_{ij} \log_2 g_{ij}$$

***Maximum Probability***

Maximum probability =

$$\sum_i \sum_j g_{ij}$$

It is the maximum $g_{ij}$ in the window.

***Element Difference moment of order k:***

$$\sum_i \sum_j (i-j)^k g_{ij}$$

Element Difference moment of order checks for grey tone difference between the pixels.Where $\mathbf{g_{ij}}$ = (i, j) Th entry of GLCM Matrix.

***Element Difference moment of order k:***

$$\sum_i \sum_j (i-j)^k g_{ij}$$

Element Difference moment of order checks for grey tone difference between the pixels. Where $\mathbf{g_{ij}}$ = (i,j)th entry of GLCM Matrix.

## 4. CONCLUSION AND FUTURE WORKS

***Conclusion:***

Ayurveda encourages use of herbal and non toxic plants for treatment and creation of different remedial medications. P1ant species recognition system is extensive1y used in Ayurveda, Agriculture etc. and It requires more understanding about plants and its species.Identification of Medicinal herbs on the go can be very helpful for common people to help them make home remedial medicines, and for professionals and students a more effective way of research. This project aims at making an application which is available for free for every one and on a more common mobile platform ,Android and can be used for personal or research and study purposes. In this Project an android application integrated with server application was made which identifies medicinal herbs of Indian origin. The identification is done through a texture extraction algorithm called Gray-Level Co-occurrence Matrix (GLCM).A working prototype of the project was made and tested with samples which showed satisfactory results.

***Future Works:***

The current project implements only GLCM (Gray Level Concurrence Matrix) for leaf identification and focusing only on plants of ayurvedic and Indian origin. Further enhancement can be made to this project by including leaf data set of more plants of foreign origin as well, but the increased dataset can cause increased time complexity for the GLCM algorithm alone. So in order to narrow down the comparison a classification algorithm can be added which can be any edge detection algorithm,color detection or a combination of both and hence improve accuracy as well as reduce time complexity. One more practical idea that can be implemented is the usage of cloud technologies for storing and processing leaf images which will make processing even faster with the usage of high speed processing technologies available with cloud technologies.

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