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Comparison of Segmentation Techniques Used for Classification of Ayurvedic Medicinal Leaf

Poonam. B.Bhopale[1], Radhika.S.Ghat[2] ,Rasika.S.Ladage[3]

[1]Faculty, DKTE's Yashwantrao Chavan Polytechnic, Ichalkaranji, India

[2]Faculty, DKTE's Yashwantrao Chavan Polytechnic, Ichalkaranji, India

[3]Faculty, DKTE's Yashwantrao Chavan Polytechnic, Ichalkaranji, India

Abstract - This paper introduces a method for segmentation of images of medicinal plants. The tribal people in India classify plants according to their medicinal values. In the system of medicine called Ayurveda, identification of medicinal plants is considered an important activity in the preparation of herbal medicines. Ayurvedic medicines have become alternate for allopathic medicine. Hence, leveraging technology in automatic identification and classification of medicinal plants has become essential. Plant species belonging to different classes such as Ajwain, Betal, Curry, Methi, Milkweed, Neem and Tulsi are considered in this work.
Clustering is an unsupervised technique is used for organizing the data for efficient retrieval. This is mainly used in pattern reorganization and data analysis. Today many cluster analysis techniques are used for data analysis and have proven to be very useful in segmentation. Performance of these algorithms is data dependent. In this paper K-Means and Fuzzy C-Means are implemented for segmenting the Ayurvedic medicinal leaf. The proposed research work compares the computing performance and clustering accuracy of K-Means clustering with FCM clustering algorithm. Experimental results showed that higher performance is achieved by K-Means clustering when compared with FCM.

Keywords - Medicinal Plants leaf, Image processing, color Segmentation, Classification

I. INTRODUCTION

In the domain of Indian Science Medicinal Herbs are treated as one of the extent assets called Ayurveda. The herbs are utilized in a variety of industrial appliances, for example herbs, ingredients in biofuels, biomass, pharmaceuticals etc. Individuals have been utilizing some plant as a conventional medicine.

These medicinal herbs are regularly develop in our backyards or the ones that available along roadsides. As the days passes it is hard for the individual to identify existence of the medicinal herbs and to remember the names of every medicinal herb. Thus it is required to construct system of an automatic recognition and classification for greater advantage. The reason for this proposed strategy is to provide accurate knowledge to people and farmers, which serves to develop the culture of medicinal herbs. This proposed system also provides details of medicinal herbs and database to suppliers, pharmacy students, research students, agents, pharmaceutical companies.

We can classify Ayurvedic medicinal leaf using image segmentation. Image segmentation is the process of dividing images into different parts based on similarity. Clustering is the analysis aimed to classify the objects into categories on the basis of their similarities.
K-Means randomly select k initial number of centroids (centers), where k is the total number clusters that is defined by the user. Then each point is assigned to a closest cluster center. According to points in the cluster the centroid gets updated. The process continues till points stop changing their clusters. Fuzzy C-Means allows one point to belong to two or more clusters. Sum of membership of each data point should be equal to one. Basically in this work we focus on performance of k-means by comparing the result with FCM. Ayurvedic medicinal leaf data set is created and segmentation is done by using above clustering techniques to highlight the infected part of the leaf.

II. METHODOLOGY

Segmentation of Ayurvedic leaf:

- Input Dataset
- Image Pre-Processing
- Color Segmentation

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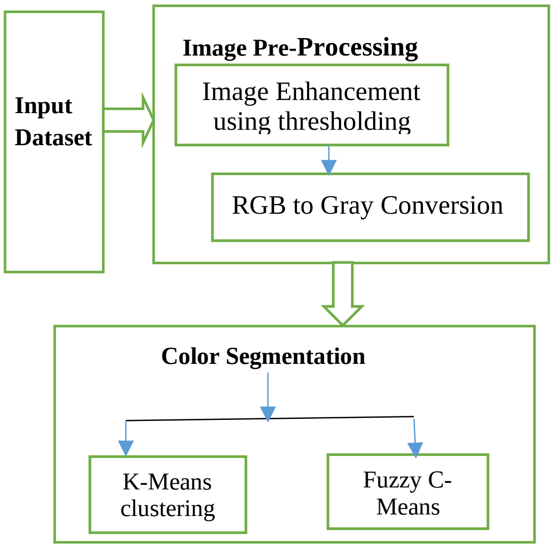


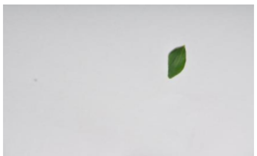
Fig.1. Block diagram for segmentation of Ayurvedic leaf

A] Input Dataset

Every system needs some precise and concise dataset that will perform the required function with increasing the system complexity. For experimentation purpose dataset is created of 7 samples of Ayurvedic medicinal leaf and 210 images. Images of Ayurvedic medicinal leaf are acquired using Nikon D3300 digital camera of 24.2mp DX format DSLR using 18 to 55mm range lenses. This database is very attractive since at least 30 images of the same category are present, which is essential for a good recognition at a large scale. There are different types of various Ayurvedic leaf shown below.


S1


S2


S3


S4


S5


S6


S7

Figure 2: Sample Images of medicinal plant (S1)Ajwain, (S2)Betal, (S3)Curry, (S4)Methi, (S5)Neem, (S6)Tulsi, (S7)Milkweed

B] Image Pre-processing

Image pre-processing aims to remove unwanted areas from image or image features improve which are helpful for processing of remaining steps and to perform analysis task. Image pre-processing do not influence to data matter of image.

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The leaves are considered as a dominant feature for identifying a plant type. The digital image of the leaf part of any plant is given as an input data. This image undergoes preprocessing steps in order to remove any kind of external noises present in an image. The main idea of preprocessing is to enhance the image details so that features are clearly found for further processing.

Image Enhancement

Enhancement covers different aspects of image correction such as saturation, sharpness, denoising, tonal adjustment, tonal balance, and contrast correction/ Enhancement.

Gamma correction which controls the overall brightness of a leaf image. Each pixel in an image has brightness level, called luminance. This value is between 0 to 1, where 0 means complete darkness (black), and 1 is brightest (white).

Different camera or video recorder devices do not correctly capture luminance. (They are not linear) Different display devices (monitor, phone screen, TV) do not display luminance correctly neither. So, one needs to correct them, therefore the gamma correction function. The luminance is a value between 0 to 1.Gamma correction function is used to correct image's luminance. Like this:

Output luminance = gammaCorrectionFunction [input luminance]

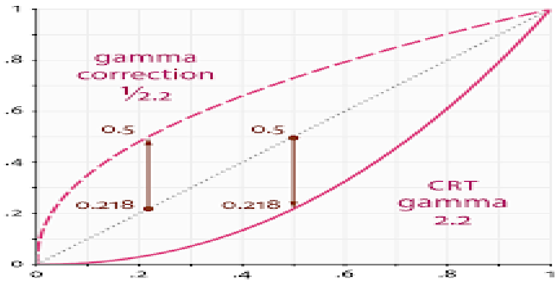

Figure 3: Gamma Correction for Images enhancement

X-axis is input gray level (r) and y-axis is output gray level(s).The solid red curve is typical CRT monitor's voltage and brightness ratio. The dashed red curve is its inverse function, the gamma correction function. The gray dotted line is the corrected result.

$$s=r^{\gamma} \quad (1)$$

Powers larger than 1 make the shadows darker, while powers smaller than 1 make dark regions lighter.

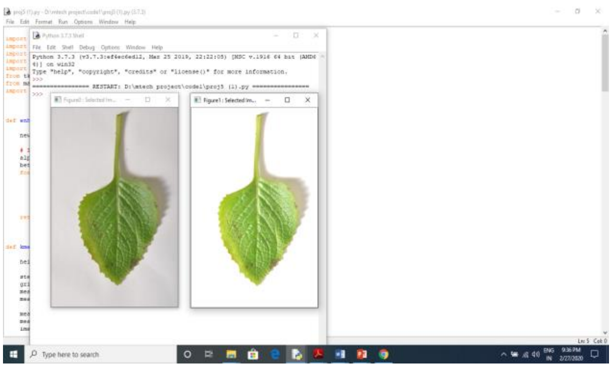

Figure 4: Result of image enhancement

RGB to Gray

The noise removed leaves are then converted from color to grayscale image which will be easy for feature extraction process. The contour of the leaf is then detected using the edge detectors.

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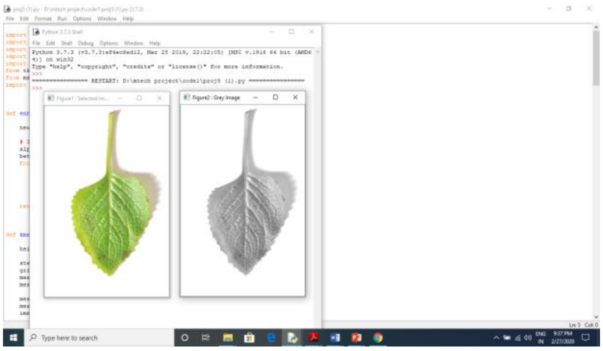

Figure 5: Result of RGB to Gray scale conversion

C] Segmentation

Image segmentation assembles homogeneous pixels in a regions depending on common similarities. Basic similarities may be in terms of pixel colors, texture etc. It's significant and must to rearrange the image so that, the analysis of image becomes easier and efficient, and this is done by making use of segmentation process. Segmentation makes indirectly separating objects and recognizing edges of objects in given image.

It takes only a specific area of image which is important and the rest can be discarded, segmenting the image into various regions is essential. The goal is to fragment color image in a computerized manner utilizing Fuzzy C Mean clustering. The clustering can be expressed as, "The process of rearranging objects into gatherings whose members are equivalent in some way".

Fuzzy C Mean clustering

FCM is a soft clustering technique in which each point has a degree of belonging to a cluster is based on fuzzy logic. This done by assigning membership to all data point with respect to each cluster center based on the distance. Euclidean distance is used to calculate the distance between cluster centroid and each data point. In this FCM the selection of cluster centroid takes place based on mean of all points in that cluster.

FCM is mainly based on the maximization of the below objective function

$$O_m=\sum_{i=1}^{N} \sum_{j=1}^{K} \mu_{ij}^{m}\|x_i-c_j\|^2 \qquad (2)$$

Where,
O - Objective function.
N - Total data points which represent the image.
K - Number of clusters defined by the user.
m - Partition matrix exponent used for controlling the degree of fuzzy overlap, with m>1.
Xi - Represent i^{th} data point.
C_j - Cluster centroid of the j^{th} cluster.
μ_{ij} - Degree of membership of xi in the j^{th} cluster.

During clustering following steps are performed:

1. The cluster membership value μij is initialized randomly.
2. The cluster center is calculated as:

$$C_j = \frac{\sum_{i=1}^{N} \mu_{ij}^{m} x_i}{\sum_{i=1}^{N} \mu_{ij}^{m}} \qquad (3)$$

3. μ_{ij} is updated according to following:

$$\mu_{ij} = \frac{1}{\sum_{h=1}^{k} \left(\frac{X_i-C_j}{X_i-C_h}\right)^{\frac{2}{m-1}}} \qquad (4)$$

4. The objective function Om is calculated.
5. Step 2 to 4 is repeated until Om improves up to

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minimum threshold or until it reaches a predefined maximum iteration.

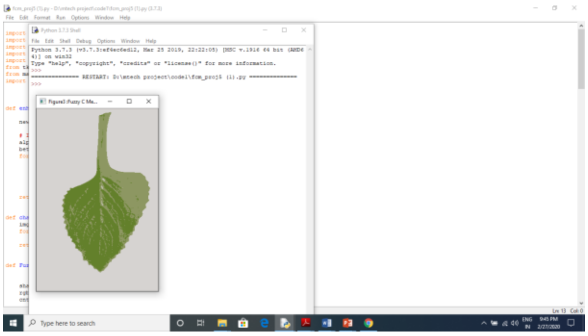

Figure 6: Result of Fuzzy C Means segmentation

K-means clustering

The k-means algorithm is an algorithm to cluster n objects based on attributes into k partitions, Where k>n. It is simplest partitioning method for clustering analysis.

The way k-means algorithm works is as follows:

1. Initialize the number of clusters i.e. K
2. Randomly N cluster centroids are chosen.
3. Distance between data points and cluster centroids are calculated.
4. Similar data points which is close to centroid move that particular cluster.
5. Obtain new cluster centers by averaging the observations (data points) in each cluster.
6. Steps 3 to 5 are repeated until cluster centroids do not change or maximum number of iterations is reached.

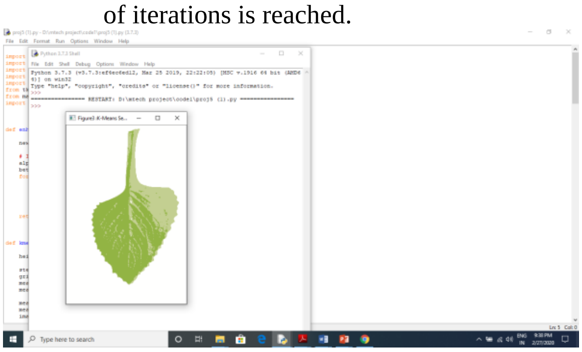

Figure 7: Result of K-Means segmentation

III. RESULTS AND DISCUSSION

The background and shadow of segmented image is evacuated using thresholding. Background evacuated from top, left, bottom and right without influencing leaf area.

Thresholding is the method in which object can be extracted from background by comparing pixel value with fixed threshold value T.

The simplest thresholding method replace each pixel in an image with black pixel if the image intensity $\mathbf{I}_{i,j}$ is less than some fixed constant T i.e. ($\mathbf{I}_{i,j}$ <T) or white pixel if image intensity is greater than that constant ($I_{i,j}$ >T).

Any point (x, y) for which f(x, y)>T is called an object point otherwise point is called as background point.

$$g(x,y) = \begin{cases} 1 & \text{if } f(x,y)>T \\ 0 & \text{if } f(x,y)<T \end{cases} \quad g(x,y) \qquad (5)$$

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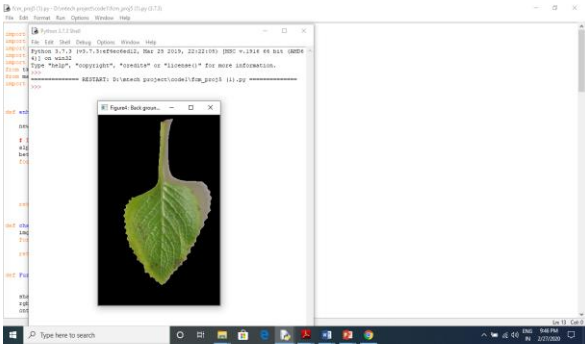

Figure 8: Result of background removed using Fuzzy c-means segmentation

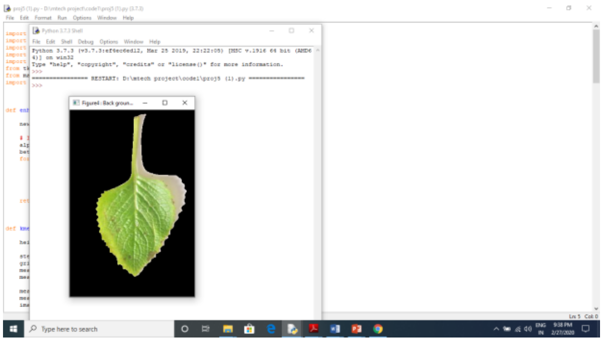

Figure 9: Result of background removed using K-means segmentation

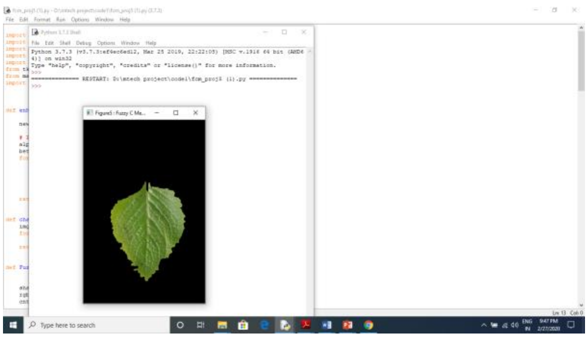

Figure 10: Result of shadow removed using Fuzzy c-means segmentation

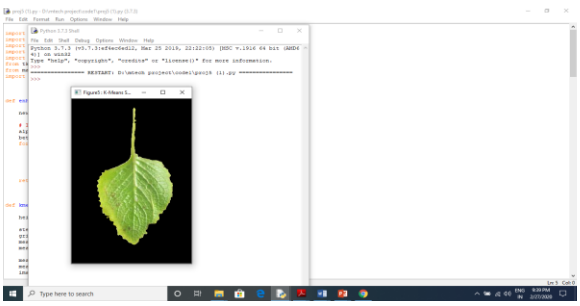

Figure 11: Result of shadow removed using K-means segmentation

IV. CONCLUSION

The proposed work gives comparative study of K-means and Fuzzy C-Means clustering techniques which are chosen for segmentation. From our experiments it is observed that most of the time K-means gives good and clear segmented result than FCM as well as it executes faster. So our set of data k-means is the best choice for segmentation than FCM.

IV. REFERENCES

[1] Dinesh Shitole, Faisal Tamboli, Krishna Motghare, Raj Kumar Raj,''Ayurvedic Herb Detection using Image Processing'', International Journal of Trend in Scientific Research and Development (IJTSRD) e-ISSN: 2456 - 6470Volume: 3 | Issue: 4 | May-Jun 2019.

[2] Tejas D. Dahigaonkar, and Rasika T. Kalyane,
" Identification of Ayurvedic Medicinal herbs by Image Processing of leaf samples", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056Volume: 05 Issue: 05 | May2018.

[3] Manojkumar P., Surya C. M., and Varun P. Gopi, "Identification of Ayurvedic Medicinal herbs by Image Processing of Leaf Samples", 2017 Third International Conference on Research in Computational Intelligence and Communication Networks (ICRCICN), pp 978-1-5386-1931-5.

[4] Mr. K.Nithiyanandhan and Prof.T. Bhaskara Reddy, "Analysis of the Medicinal Leaves by using Image Processing Techniques and ANN", Vol 8, No. 5, ISSN No. 0976-5697, May-June 2017.

[5] Adams Begue, Venitha Kowlessur, Fawzi Mahomoodally, Upasana Singh and Sameerchand, "Automatic Recognition of Medicinal herbs using Machine Learning Techniques", International Journal of Advanced Computer Science and Applications, Vol. 8, No. 4, 2017.

[6] Anilkumar.Muthevi and Dr. Ravi babu. Uppu, "Leaf Classification Using Completed Local Binary Pattern Of Textures", 2017 IEEE 7th International Advance Computing Conference, pp 978-1-5090-1560-3.

[7] C. H. Arun, W. R. Sam Emmanuel, and D. Christopher Duraira," Texture Feature Extraction for Identification of Medicinal herbs and Comparison of Different Classifiers", International Journal of Computer Applications, Vol62 - No.12, January 2013, 0975 - 8887.

[8] B.S.Harish, "Classification of plant leaves using Morphological features and Zernike moments", 978-1-4673-6217-7, 2013 IEEE.

[9] R Janani and A Gopal, "Identification of selected medicinal herbs leaves Using Image Features and ANN", 2013 International Conference on Advanced Electronic System (ICAES), pp 978-1-4799-1441-8.

[10] Shabari Shedthi B, Dr. Surendra Shetty,
" Implementation and Comparison of K-Means and Fuzzy C-Means Algorithms for Agricultural Data" International Conference on Inventive Communication and Computational Technologies,(ICICCT 2017).

[11] Roopashree S, and Anitha J,"Indian Herbal Leaf Identification using Artificial Intelligence Approach", International Journal of Science, Engineering and Technology, ISSN (O): 2348-4098, ISSN (P): 2395-4752, 2017.

[12] Pushpa BR, Anand C and Mithun Nambiar P," Ayurvedic Plant Species Recognition using Statistical Parameters on Leaf Images", International Journal of Applied Engineering Research, Volume 11, Number 7, 2016, 0973-4562.

[13] Riddhi H. Shaparia, Dr. Narendra M. Patel and Prof. Zankhana H. Shah," Flower Classification using Texture and Color Features", International Conference on Research and Innovations in Science, Engineering &Technology, Volume2, 2017, Pages 113–118.

[14] Basavaraj S. Anami, Suvarna S. Nandyal, and A. Govardhan,"A Combined Color, Texture and Edge Features Based Approach for Identification and Classification of Indian Medicinal herbs", International Journal of Computer Applications, Vol 6– No.12, September 2010.

[15] Wu, Stephen Gang, et al. "A leaf recognition algorithm for plant classification using probabilistic neural network", IEEE international symposium on signal processing and information technology, 2007.