A Review on Computer Aided Identification of Medicinal Plant Leaves

Afsal K[1] Sainul Abideen[2] Dr. V. Kabeer[3]
[1,2]Student [3]Assistant Professor
[1,2,3]Department of Computer Science
[1,2,3]Farook College, Calicut, India

Abstract— Identify or recognise a medical plant from a set of plants is a kind of task which needs high professionalism and expertise. Here we conduct a study and investigation about the various possibilities of automated identification of medicinal plants. Detecting or recognising the plant by the image of the leaf is actually a challenging task. We study and evaluate the present techniques used for plant identification. We also discuss relevant issues such as data collection, evaluation, benchmarking, etc. After analysing present methods we conclude with promising directions for the future.

Key words: Leaf Identification, Pattern Recognition, Automated Medicinal Plant Identification

I. INTRODUCTION

Medicines are the second most essential requisite after food for mankind. For medicines, medicinal plants are the important sources of raw drugs. Ac-cording to WHO report, over 80% of the world population relies on traditional medicine largely on plants based for their primary health care needs.

Identifying a medicinal plant and its medicinal value by looking at its leaves is actually a challenging task, which requires some specialised knowledge. Most of the people may be unfamiliar with the medicinal plants and hence they cannot identify most of the medicinal plants even if some of these plants are present in their nearby localities. To manually recognise a medicinal plant from a set of plants, some may need a good amount and knowledge and experience.

An efficient automated system for medical plant identification will be very much useful for recognising the presence of medicinal plants. This may be very much helpful for botanical researchers, medical field, and even for those who study about plant taxonomy. This may even lead to the identification of new species of plants because any non-professionals can also start identify and classify the plants by taking the images of leaves, which in turn gives a wide reach.

II. REVIEW OF LITERATURE

Leaf image recognition methods has recently received a good importance among the re-searchers of pattern recognition and computer vision. There are several methods proposed and many of them having high accuracy in the testing environment. But it is still have scope for more research and innovation as its having huge demand and most of the methods are not working accurately in the real world scenarios.

A. Geometric Features

Many of them are making use of the geo-metrical measurements. A major line of such work includes those measuring geometric features. For instance, Wu et al. [1] used aspect ratio, rectangularity and narrow factor as features, and employed Neural Network as the classifier. They achieved up to 90.3% recognition rate on a 10-species dataset. Pahalawatta et al. [2] used a different set of features – stem-to- blade ratio and compactness. A common downfall of these approaches is that the geometric features are difficult to be accurately extracted un-der imperfect measurements, and weighting between them is also problematic. Therefore, they cannot differentiate a large number of species.

B. Shape Description

Another line of work makes use of shape descriptors. Soderkvist [3] combined Curvature Scale Space, Fourier descriptor and Hu's moments in building a tree-structured classification system, and tested on the Swedish dataset including 15 species. Very recently, several researchers realized the un-suitability of using shape-matching for leaf image recognition, and proposed to use curvature histograms [4] and linear subspaces [5]. However, these methods either needed special treatment of leaf petiole or could not achieve good results.

C. Combination of Visual features

Several efforts have also been found using flowers [6] for plant recognition. Their method combined many visual features together, and was able to classify 102 categories with a recognition rate up to 72.8%.

Computer-Aided Plant Species Identification Technique (CAPSI) [7] method is proposed for fruit tree recognition using the chain code method. Based on the image matching technique of leaf shape, It identifies different biometric features like width factor, diameter, major axis, minor axis, area, perimeter and aspect ratio of the leaf image are extracted.

D. Statistical Parameters

Recognition by using statistical parameter [8] in leaf images, methodology achieved 93.75% accuracy. The three major phases are pre-processing, feature extraction and classification. Pre-processing highlights the relevant features as well as to reduce unwanted noise from the input image, which reduces the chance of getting optimal feature values. In feature extraction phase, different morphologic features such as mean, standard deviation, convex hull ratio, isoperimetric quotient, eccentricity and entropy are extracted from the pre-processed leaf image.

Vijay Satti et.al [9] describes how features are extracted after pre-processing. The procedure involved are pre-processing, RGB to Gray scale and then Gray scale to binary followed by smoothing and filtering. Finally the colour shape and geometric features are extracted. The paper deals with the dis-ease detection in paddy leaves by the approach of histogram processing mechanism. The original dis-ease free leaf is stored in the database and whenever a disease affected leaf image is given as input to the system, it predicts the amount of disease infected in the leaf by analyzing the histogram.

Ji-Xiang Du et.al [10] proposed a new classification method called Move Median Centres (MMC) hyper sphere classifier. From the experimental results of this paper, the methodology save both storage space and reduces the classification time. From the above review of literature it is very clear that no effective methods were proposed for Ayurvedic plant species recognition and hence this proposed system addresses the Ayurvedic plant recognition

E. Other Methods

Abdul Kadir et.al [11] proposed a method to identify the plants and various features like texture, vein, shape and colour of the leaves are extracted. The vein feature is extracted using the morphological opening operation and probabilistic neural network is used for classification. The paper limits in achieving reliability with respect to color feature.

Principal Component Analysis Algorithms (PCA) and Gray Level Co-occurrence Matrix (GLCM) given 78 percentage accuracy in texture feature extraction in leafs, by the study conducted by Abdolvahab Ehsanirad et.al [12]

Another methodology proposed by A.J. Pérezet.al [13] used the colour and shape feature of leaf. It deals with different shape features like ratio of the major axis length squared to the area, first invariant central moment, major axis length, ratio of the perimeter squared to the area, minor axis relation, distance to the crop row are used to discriminate soil and weeds. K-Nearest Neighbor (KNN), bayes rule and heuristic approaches are used in classifying the leaf image. An accuracy of 89.7% is acquired from the proposed method.

Another interesting innovation in the field is identification of leafs using contour in leaves. [14] both leaf teeth and global structure of leaf is calculated in this method. The leaf is identified using hierarchical method in classification.

Kue-Bum Lee et.al [15] proposed a Methodology to extract the features of the leaf vein. This work is carried out by finding the contour of the leaf. Firstly by converting the colour image into a gray scale and then to binary image and hence outline of the leaf is extracted. To extract the veins of the leaf, opening operation is done on the grayscale image and the difference in the final image and gray scale image is obtained to get the features extracted.

Sandeep Kumar. E[16] proposed a system with devised methodology which gives the identification of medicinal plants based on its edge features. The colour image is converted to its gray scale equivalent image. From this gray scale image edge histogram is calculated. Canny edge detection algorithm is implemented in this work. The process includes the stages of Image acquisition, feature ex-traction and comparing the image with those images that are previously stored on the database and the area of leaf is determined by taking one Rupee coin's area as the reference, which is comparatively effective since the photograph taken may vary from person to person. This work is limited to detect only the mature leaves since the tender leaves changes slightly when it became mature.

III. Conclusion

We should develop a digital database of images of leaves to promote the researchers in the process of automated identification of plant leaves are as follows. It actually includes collection of digital images of plant leaves. Then we should focus on developing good algorithms to detect the leaf and its boundary from the image, which includes preprocessing. This preprocessing will eliminate the noise in the images. The Feature extraction need to be per-formed. Researchers need to design and development methods for feature extraction based on neuro-fuzzy pattern recognition methods. A digital database of medicinal plant leaves will be very much helpful for the researchers for future use.

References

[1] S. Wu, F. Bao, E.Y. Xu, Y.X. Wang, Y.F. Chang, Q.L. Xiang, A leaf recognition algorithm for plant classification using probabilistic neural network, IEEE Int. Symp. Signal Process. Inf. Technol. (2007) 11–16.
[2] K.K. Pahalawatta, Plant Species Biometric Using Feature Hierarchies, Master thesis, University of Canterbury, 2008.
[3] O.J. Soderkvist, Computer Vision Classification of Leaves from Swedish Trees, Master Thesis, Linkoping University, 2001.
[4] N. Kumar, P.N. Belhumeur, A. Biswas, D.W. Jacobs, W.J. Kress, I. Lopez, J.V. B. Soares, Leafsnap: a computer vision system for automatic plant species identification, Eur. Conf. Comput. Vis. (2012) 502–516.
[5] R. Hu, W. Jia, H. Ling, D. Huang, Multiscale distance matrix for fast plant leaf recognition, IEEE Trans. Image Process. 21 (11) (2012) 4667–4672.
[6] M.E. Nilsback, A. Zisserman, Automated flower classification over a large number of classes, IEEE Conf. Comput. Vis. Pattern Recognit. (2008) 722–729.
[7] Vijayashree, T. and Gopal, A., 2015. Classification of Tulsi Leaves Based on Texture Analysis.
[8] Ayurvedic Plant Species Recognition using Statistical Parameters on Leaf Images. Push-pa BR, Anand C and Mithun Nambiar P. Department of Computer Science Amrita Vishwa Vidyapeetham, Mysuru Campus Amrita University, India.
[9] Satti, V., Satya, A. and Sharma, S., 2013. An automatic leaf recognition system for plant identification using machine vision technology. International Journal of Engineering Science and Technology, 5(4), p.874.
[10] 10. Du, J.X., Wang, X.F. and Zhang, G.J., 2007. Leaf shape based plant species recognition. Applied mathematics and computation, 185(2), pp.883-893.
[11] Kadir, A., Nugroho, L.E., Susanto, A. and Santosa, P.I., 2013. Leaf classification using shape, color, and texture features. arXiv pre-print arXiv:1401.4447.
[12] Ehsanirad, A. and Sharath Kumar, Y.H., 2010. Leaf recognition for plant classification using GLCM and PCA methods. Oriental Journal of Computer Science and Technology, 3(1), pp.31-36.
[13] Perez, A.J., Lopez, F., Benlloch, J.V. and Christensen, S., 2000. Colour and shape analysis techniques for weed detection in ce-real fields. Computers and electronics in agriculture, 25(3), pp.197-212.
[14] Im, C., Nishida, H. and Kunii, T.L., 1998, No-vember. A Hierarchical Method of Recognizing Plant Species by Leaf Shapes. In MVA (pp. 158-161).
[15] Lee, K.B. and Hong, K.S., 2013. An implementation of leaf recognition system using leaf vein and shape.

International Journal of Bio-Science and Bio-Technology, 5(2), pp.57-66.
[16] Kumar, S., 2012. E, "Leaf Color, Area and Edge features based approach for Identification of Indian Medicinal Plants". International Journal of Computer Science and Engineering, 3(3), pp.436- 442.

