A Comparative Analysis on Machine Learning Models for Accurate Identification of Medical Plants

Prabhat Kumar Thella[1],V.Ulagamuthalvi[2]

***Abstract*—**In human life plants play an essential role, they provide oxygen, food, refuge, medication, fuel and protection of the environment. Many plants are richly having medicinal ingredients and contain medicinal active ingredients. The identification of these plants is immediately necessary because of the need for mass production. The manual identification of medicinal plants takes time and the assistance of plant identification experts is necessary. To solve this problem, it is essential for human beings to automatically recognize and classify medicinal plants. Automatically identified and classified medicinal plants are an active area of study in the field of image handling in modern times. The key steps in determining medicinal plants and classification processes, which affect the overall accuracy of the classification system, are feature extraction and classification. A good knowledge of plants is important in order to improve the balance of the environment in the process of identifying new or rare plant species. The match of the specimen plant to a known Taxon means that a specific plant is assigned by comparing those characteristics to a known taxonomy. The identification of plants that developed over centuries ago depends on the parameters and the method used. Since identification allows one to identify relevant facts for a specific type of application associated with different species, it is important to identify the plant. In this article, a comparative analysis is made on machine learning models for accurate identification of medical plants. This paper provides a brief analysis about image processing methods used to identify and classify medicinal plants, as well as the significance and advantages of medicinal plants in recent years. The paper presents a brief comparative analysis with results that indicate the proposed model performance levels that exhibits better performance levels.

***Keywords*—**Medical Plant Identification, Performance Analysis, Feature Extraction, Classification, Clustering, Image Processing.

I. INTRODUCTION

For the protection of natural resources, plants are of central importance. Identification of plant species offers important knowledge on the categorization and properties of plants. Manual analysis is not accurate as it requires the visual perception of the person. Sampling and taking digital photographs with texture features that help determine a certain pattern is easy. Venation and a leaf shape are the main characteristics to differentiate between plant types [1]. As IT progresses rapidly, techniques like image processing, pattern recognition, etc. are utilized in plant identification based on the definition of the leaf type and venation, which constitute the main concept for the identification process [2]. Over time, it is difficult to document various characteristics of the leaves [3]. A dataset must also be created for comparable analysis as a guide. Because of their attractive properties and availability throughout the year, leaves are used in most plant identification methods [4].

[1]Research Scholar, Department of Computer Science and Engineering. Sathyabama Institute of Science and Technology, Chennai, India;
e-mail:prabhat.thella@gmail.com , thellaprabhatkumar@gmail.com.

[2]Assoc.Professor, Department of Computer Science and Engineering. Sathyabama Institute of Science and Technology, Chennai, India

Ayurveda is an old medical system practised in India and has its origins around 5,000 years ago in the Vedic period. Plant leaves and other parts of plants including root, bark, etc. are the principal components of ayurvedic drugs [5]. More than 8000 Indian plants with medicinal value have been found. Combinations of a limited subset of 1500 such plants in various systems of India are used in herbal medicines. In particular, 500 of these plants are used in commercial medicine preparations [6]. More than 80 percent of plants in ayurvedic formulations are obtained from forests and wasteland while the rest is grown in farmland. In the ancient past, Ayurvedic doctors selected the medicines for their patients and packed the medicines for them. Most plants use their leaves to identify [7]. The usual steps for classifying plant leaves are Picture capturing, noise reduction and resize, feature extraction, use the technique suggested and ultimately classify or identify the plant.

Plants are disappearing and are uncommon, due to environmental factors and lack of knowledge of medicinal plants in humans. The biological features are used to classify medicinal plants [8]. This is a long process that takes longer to distinguish plants since a plant with another plant may have a similar type of morphology. Failure to identify medical plants would create a poor image and cause unintended human side effects. Therefore, it is very necessary to create an automated identification and classification system for the greater good of an individual to remember the names of each medicinal plant [9]. The objective of automated medicinal plant identification and classification is to educate common people and farmers and to provide them with proper information, which will contribute to increased plants cultivation. This system provides the manufacturers, officers, pharmacy students, pharmacy firms, research students, Ayurveda practitioners, herbal plant scientists, botanists and the cosmetics industry with medical specifics and a specific species database [10].

Plants are determined by the height, growth region and environmental factors of leaves, flowers, bark, seeds, fruits, root and stem, and others. Many authors consider only leaves of the plants for the identification of plants, because the leaves have a two-dimensional existence and are constantly available [11]. There is less study in identifying medicinal plants using flora and fruit/semes since they are three-dimensional in nature and are only available in some seasons [12]. This paper provides a brief comparative analysis on the identification and classification of medicinal plants using various technologies used in pre-processing, extraction and classification phases. The Figure 1 indicates various medical plant leaves.

Fig 1: Various Medical Plant Leaves

Smartphones and digital cameras are available and can be found abundantly in the age of the digital world. Digital images have become an indispensable factor in many fields as a result of this technological growth, including face recognition, plant recognition and computer health computing [13]. In addition, the processes of identification of species are automated in the technical advancement in the field of image processing and the toolboxes to introduce. The method of species identification has been successfully automated [14]. Despite every effort in the field of computer vision and machine learning, the automatic identification of plant species still faces a great number of challenges because plant species are very numerous and reflect form and color very closely [15].

Automatic plant identification usually consists of four steps: acquisition of pictures, image pre-processing, extraction of features and classification [16]. In our research, we proposed a system to identify plant images by extracting color and texture from the input. In this study, a system is created. We have also included the segmentation of images before function extraction to achieve better classification accuracy apart from the four basic steps listed above. Segmentation of images is a major step in image processing, but in previous research in this field it was not commonly employed. One of the world's oldest medical systems is Ayurvedic medicine. It was originally founded in India over 3000 years ago and is still a conventional health system in India. Its health and disease principles encourage the use of herbal compounds, special diets and other particular practises [17]. As the healing property, less toxic and less side effects have made ayurvedic medicines more common worldwide [18]. The majority of the world's population has been reported to have faith in conventional health care [19].

Traditional medicines, in particular ayurvedic medicines, are rising sharply in the developing world [20]. However, only ayurvedic practitioners and rural people know these medicinal plants. The proposed system used with a recognized leaf image database to identify and validate medical plants Manually, the plants can be classified with roots, barks, leaves, fruits etc. Many plants are more prominent in their identifying characteristics than all other organ flowers and leaves. The plant flowers are seasonal, but not seasonal with the leaves. The form of the flowers is known by human beings in three dimensions, but the form of the flowers is recognizable in two dimensions. The use of leaves in the plant identifying method is thus motivated. The various features such as geometrical structures, veins, textures, color and so forth can be used to identify leave. Leaves of various plants have various structures. Before extracting the functionality, the leaf query image must be processed. For de-noising the image, various filters can be used. Correct identification is an important prerequisite for the protection and efficacy of medicinal leaves.

II. LITERATURE SURVEY

The earlier plant identification method has been suggested by H. X. Kanet al.[1]. They developed their own dataset called Flavia, which was used as standard for their work by numerous other researchers. It comprises 1907 leaf pictures of 32 various species of plants. In the analysis, five basic geometrical and 12 digital morphological features were extracted from the leaf images based on the shape and structure of the veins. In addition, the principal component analysis (PCA) was used to minimize the input vector size to be fed for classification to the probabilistic neural network (PNN). They used a three-layer PNN that averaged 90.32 percent accuracy.

Riddhiet al.[2] have extracted a unique collection of "Leaf Width Factor" features using the Flavia dataset with a further 9 moral characteristics. These characteristics were then used as PNN inputs for leaf shape classification. The network trained a total of 1200 photographs and then tested PNN using 10-fold cross-validation, which reached a maximum accuracy of 94 percent at 8th fold. The average precision achieved was 91.41%.

Marco Seelandet al.[3] suggested a robust leaf image classification system, using both global and local characteristics. As global and local characteristics, they used shape context (SC) and SIFT (Scale Invariant feature transform). In order to classify ICL data, the K-nearest neighbour (k-NN) achieved an overall accuracy of 91.30 percent. D Venkataraman et al. [5] established the schema that generated 12 common digital morphology and vein characteristics derived from five basic features; both k-NN and SVM machines that were precisely tested on Flavia data sets attained a 78% and 94,5% accuracy.

The methodology for the precocious and precise identification of plant using the Artificial Neural Network (ANN) and various image processing techniques is proposed by Pushpa BRet al.[7]. Since the suggested approach is based on the ANN classifier and the Gabor filter extraction function, it produces better results by up to 91 percent. Medical Plant identification using a technique such as K-mean clustering, texture and color examination was performed in Malusdomestica. It uses the texture and color properties that normally occur in ordinary areas for distinct agriculture to be classified and recognized. The findings from standard multiple regression, neural grid, and support vector machines were compared by Sanaet al.[8].

Sandeep Kumar et al. [10] proposed a new texture-based feature descriptor which uses various color image channels for extraction of more meaningful features for improving classification efficiency, in order to automatically classify medical plants. Authors have trained the proposed method with various kernels including linear, polynomial and HI using the SVM classification. In addition, various function descriptors have been used to perform comparative analysis on our own dataset of medicinal plants with MCMLGP. The experiment is thorough. The method proposed increases in accuracy (96.11%) than other techniques and is important for exploration and development of the classification of medicinal plants.

A method for the extraction of leaf images and the formation of an Artificial Neural Class (ANN) classifier has been proposed by P. M. Kumar et.al [11] for the extraction of shape, color or texture features. The main question lies in selecting the right image input function to ensure high performance and less complex computing. They also tested network accuracy with various input function combinations. This approach provides 94.4% accuracy on the 63 photographs of the leaf with at least eight input features. For leaf identifying method, this approach is more prevalent, with minimum input and less computational time required. A database with 127 herbal leaves was developed by CheHussin et.al[14]. 11 texture parameters are considered for the development of a database. Sum of variance, inverse moment, aspect ratio, correlation, sum of entropy, mean and sum mean are the parameters. The GLCM matrix is used to define parameters such as entropy, homotheism, contrasts and energy.

One of the least discrepancies is recognized as the leaf and production. A system is built by Basavaraj et.al. [15], which would provide a solution for the identification and medical benefit of the plant, thereby contributing naturally to the cure of a number of conditions. This paper addresses the selection of data sets, the extraction of functions by texture and HOG and thus the classification based on the support vector machine algorithm. In order to detect Ayurvedic herbal plants, WarisaraPardee et al. [18] created a mobile application on the Android platform. Based on a given leaf picture, this system identifies medicinal plants. Gray-Level Matrices are used for the extraction of texture, and image processing methods are used for the classification of plant species. This device is free, saves time and costs and will not need any assistance from experts. It helps to classify and query information for plant species in botanical, medical and cosmetic industries.

III. PROPOSED MODEL

The steps taken to identify medicinal plants in the image processing technique are.

• Pictures of plants are taken by digital cameras, smartphones and the dataset for plants is developed. The images collected are known as the machine input image.

• Input picture is pre-processed before application of classification techniques to eliminate noise, improve section and filtrate, cut and resize pictures. In this stage, only interest sections of the image will be focused and irrelevant data will be eliminated from the image. The machine efficiency and computational speed are increased.

• Next step is to extract the characteristics from the pictures of original plant and to feed the classification to recognise them. Extraction and classification of features are achieved with several techniques of image processing.

• Many of the researchers in leaves, flowers and fruits / seeds in plant identification used, textures, shapes, colors and edge features. For identification purposes, various classifiers are used.

Since not all the leaves are flat, the capture of the picture will often cast a shadow under the leaf [21]. The shadow will disturb the identification of the borders because it contrasts greatly with the context and confuses algorithms with shadow-based boundaries instead of the edges. Thus, before image segmentation it should be disabled [22]. First, the image value RGB has been changed to HSV. Then the channel was chosen and used to mark the object border, with the clearest contrast between object and the shadow. Since the conversion of the HSV value changes the original color, the next step is to determine the RGB value sheet pictures rather than to produce a final picture for extraction of the features.

In previous steps, processed pictures were turned into a series of parameters that define the leaf characteristics. In this analysis, there are three groups of features: moral characteristics (shape), invariant characteristics, texture characteristics, and histograms with orientated gradients. These features have been explicitly selected to achieve significant features for image leaves and to achieve the numerical values to differentiate between various types of image leaves.

The same data was used for two versions. Thus, the performance of the proposed models was assessed and compared by three accepted criteria: precision, ROC and Area Under the Curve (AUC). In order to show forecasted outcomes compared to labelled groups, the confusion matrix has been designed. Precision refers to the percentage of the values that are accurate and constant. The confusion matrix can be extracted and is defined as the formula below:

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{FP} + \text{TN} + \text{FN}},$$

TN indicates true negative, FP indicates false positive and FN indicates false negative, where TP indicates true positive.

The ROC value indicates the output and the threshold of discrimination of the binary classifier scheme. It is a sensitive or genuine, graphic plot toward a false positivity. This plot is then used in the trapezoidal rule calculation of AUC. AUC ranges from 0 to 1, with >0.9 showing excellent discrimination, 0.8 to 0.9 are excellent and >0.7 appropriate.

The leaf has a number of characteristics, including forms, textures, veins, odour, etc. In general, people can recognize a leaf by their form, texture, and smell. Also a characteristic of the leaf is a vein pattern. However, it is not possible to identify a vein pattern leaf as it is too isolated from the same branch of a specific plant for many leaves. Light and water supplies also influence the overall leaf structure as a result of environmental factors. The researchers who worked in the ayurvedic area are familiar with ayurvedic leaves widely used. The identification in this work is focused on how users identify leaves in the real world. The block scheme of the method is shown in Figure 2.

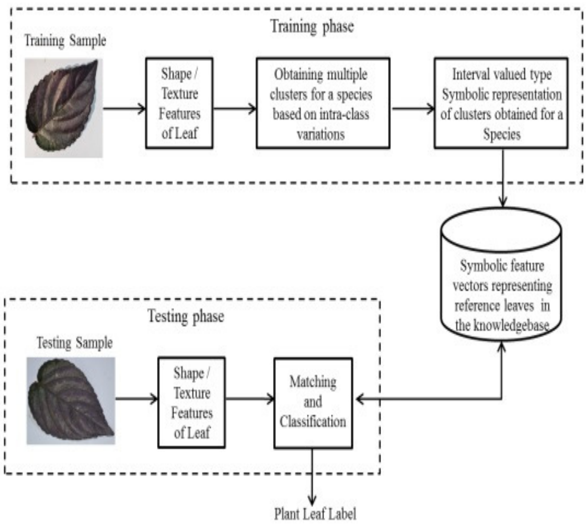

Fig 2: Proposed machine block diagram

The identification is performed by comparing the leaf with the characteristics of the sheets in the dataset. The first step is the development of a learning base and the next is images and recognition. This process involves two phases. The feature extraction will be carried out once the pre-processing is completed. Outline is considered one of the most important geometric characteristics. The shapes can be described simply as a curve, with the same color or strength, connecting all continual points. The leaf border detection is indicated in Figure 3.

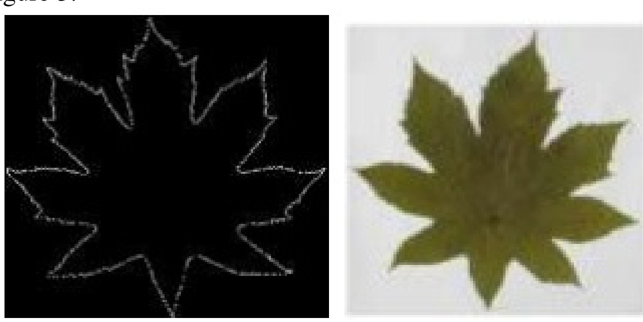

Fig 3: Shape of Castor oil leaf

The residual characteristics are determined based on the shape removed.

a) Area:
   Area is a leaf region that represents number of pixels. The two-pronged shape of the image is black and white in the region of the sheet. Number of white pixels is the area of the sheet.
b) Major Axis: A line between apex and the base of the leaf is shown in the major axis.
c) Minor axis: small leaf axis with the second central standard axis of the leaf region.
d) Image moment: a single weighted average image pixel intensities (moment) are an image moment.
e) Centroid: is the centre of the uniform density object's mass.
f) Perimeter: the perimeter is the leaf border width.
g) Convex Hull: convex hull is the smallest convex polygon in which the leaf area is embedded.

Digital image processing transforms an image and performs tasks including development, processing and enhancement of quality. Core stages in digital image processing include image acquisition, enhancement and restore, morphological processing, segmentation, definition and object recognition. The segmentation of images is the fundamental part of the image processing that separates an image into significant areas based on characteristics such as grey, spectrum, texture and color. The medicinal plant characteristics are very significant. Some methodologies use input and output in photos. The inputs and outputs in the segmentation methods are attributes extracted from these images.

Photos are divided into separate areas or sections that do not overlap between subjects and background areas. The main segmentation stages are unnecessary data exclusion, topic identification and characteristics identification. Segmented images are characterized by areas, boundaries, region, perimeter, statistics and entropy. The area pixels are divided in terms of color, intensity or texture. The methods of segmentation are divided into two principal categories: methods for layer segmentation and blocks. For accurate results the proposed models take only into account the form of block segmentation. This segmentation method uses the following two characteristics, similarity and discontinuity. The approach to the partitioning of similarities of an image in areas where a partitioned image splits into borders based on sudden changes in pixel strength. For better evaluation of the medicinal plant species, the proposed model divides the leaf images into several partitions. The proposed segmentation model framework is depicted in Figure 4.

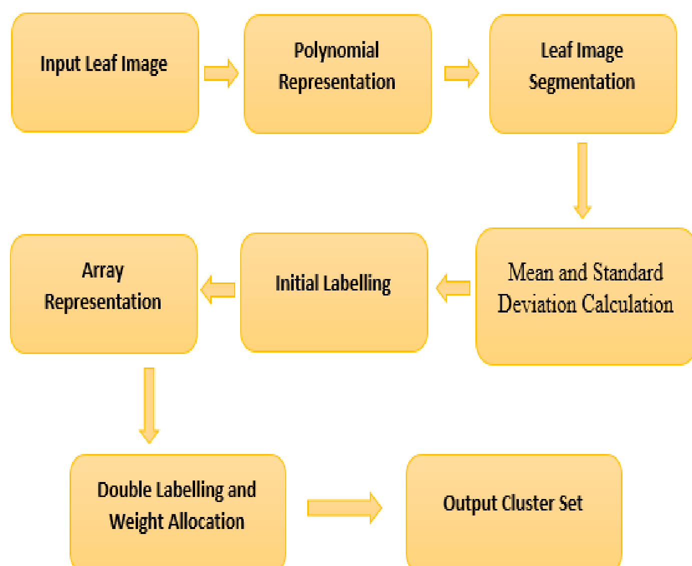

Fig 4: Proposed Segmentation Process

Medicinal products are made of plant leaves or root powder. If the herbal medication to powder is reduced, additional expertise in determining the medicine through pharmacognosis is required. Inaccurate plants can cause severe health problems for patients. The correct identification of the powder shape of medical plants is essential for the standardization and quality control of medicinal products. Currently, medicinal plants are categorized through a biological assessment and physical evaluation based on chemical leafs. The required medicinal plants for the preparation of a medicines are very significant in the medicine

industry. The shape, color and texture of leaves are important characteristics to identify a medicinal plant.
The color and texture on both sides of the leaf include deterministic species recognition parameters. A database of medicinal plants leaves is created from scanned images from the front and back of the leaves of commonly used medicinal plants. The leaves are classified according to the same combination of characteristics. In order to analyze intra-class shifts, several examples of leaves of plants are taken and categorized by hierarchical clustering techniques. The coefficient of inconsistency is used to produce natural clusters in hierarchical clustering technology. The number of clusters obtained for plant species is shown to differentiate within the class. For a single cluster representation, the sum of the corresponding vectors of each sample is determined. The proposed cluster group linking is performed in Figure 5.

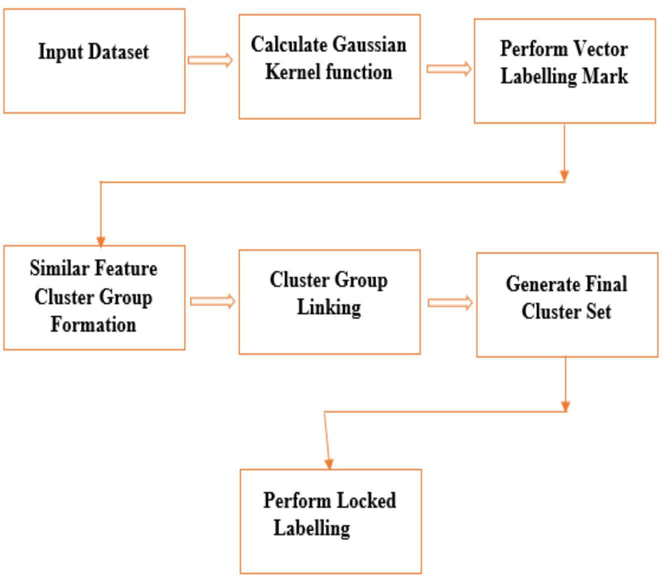

Fig 5: Proposed model architecture

Plants identification is very difficult in biology and agriculture in terms of discovering new plant discoveries and computerizing the management of plant species and thus becoming even more common. Likewise, by classifying the plants in order to help farmers disperse waste, a plant must also be viewed. The identification is a process in which every plant dips similar plants in terms of its common features. The automatic classification systems rely on a wide range of applications, including environmental protection, plant resources surveys and learning. The main challenge is to decide which group is part of a particular plant. Several studies were conducted to enable this challenging automated categorization undertaking to take place when the sample image is given as an input.
Forms are the best feature for identification of the leaf. Any plant recognition algorithm can also be used to process the image using a highly developed form. The texture is the other feature to identify the leaf. It is an important regional descriptor that contributes to the recovery process. Color is a good identification parameter, as the various species' leaves change color. However, when chlorophyll is used as a feature, it can change as a result of loss. Leaves are essential organ plants. It is flat and easy to use as inputs for a computer. Hundreds and thousands of photographs of leaf specimens for the identification of unusual plants have recently been released online in natural history museums. Despite the huge number of image databases for leaves, the task of identifying a plant with a leaf specimen is currently essential to know its name first. The process of medical plant recognition is clearly explained in Figure 6.

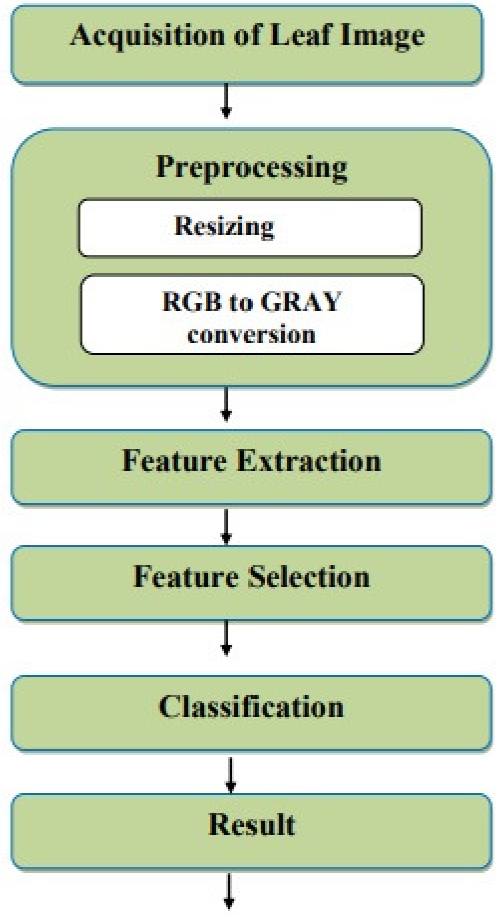

Fig 6: Medical Plant Recognition Process

The proposed work focuses on the automation of the identification of leaves. A fully automated technique to detect medicinal plants with computer vision and machine learning was suggested. Many features have been extracted from each leaf, such as longitudinal, distance, periphery, area, number of vertices, color and hull surface. Different derived attributes were determined for these attributes. The exponential growth of genomic data has led to the selection techniques becoming a game change that can minimize data complexity dramatically and thus facilitate interpretation and conversion into useful information.

IV. Results

The proposed image segmentation model is implemented in ANACONDA SPYDER and the leaf image dataset is considered from the link, https://data.mendeley.com/datasets/nnytj2v3n5/1. In order to improve consistency, the output of diverse image segmentation analysis was evaluated in all processing factors. In the processing stages, the selection of an image with corresponding problem is calculated to recognize disadvantages on each step, as well as to recommend, simulate and evaluate solutions for optimal and effective solutions. The proposed Double Labelling Image Segmentation Model (DLISM) is compared with the traditional Adaptive Dropout Depth Calculation (ADDC) method and the results show that the proposed model performance is better in terms of accuracy and time levels. The Figure 7 indicates the medical leaves extraction for accurate identification and Figure 8 indicates several medical leaf structures.

Fig 7: Medical Leaf Extraction

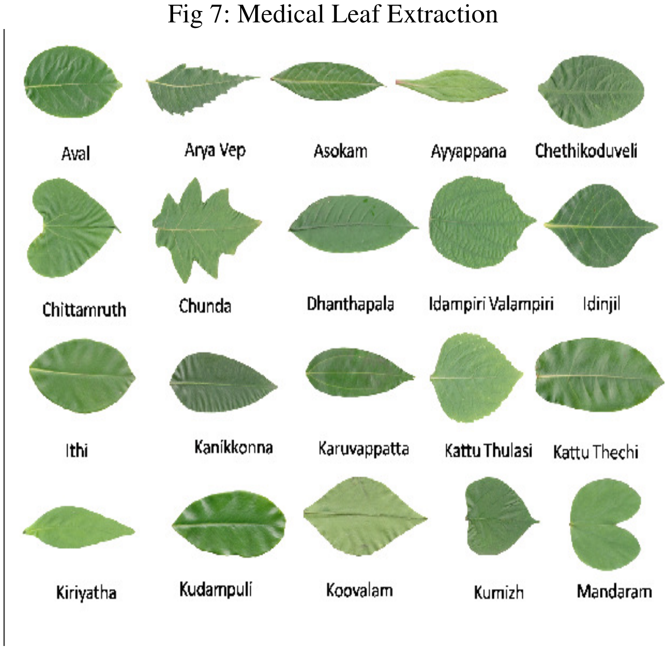

Fig 8: Medical Leaf Structures.

For further study, the primary objective of subdividing images into several parts is to get the only detail or a fragment. The dividing of images is based on some features such as color, texture, pixel strength, etc. Many techniques include thresholding, region-based approach, edge-based method, clustering method, etc. The Figure 9 shows the time levels of the image segmentation. Compared to traditional models, the suggested framework takes less time to segment the image.

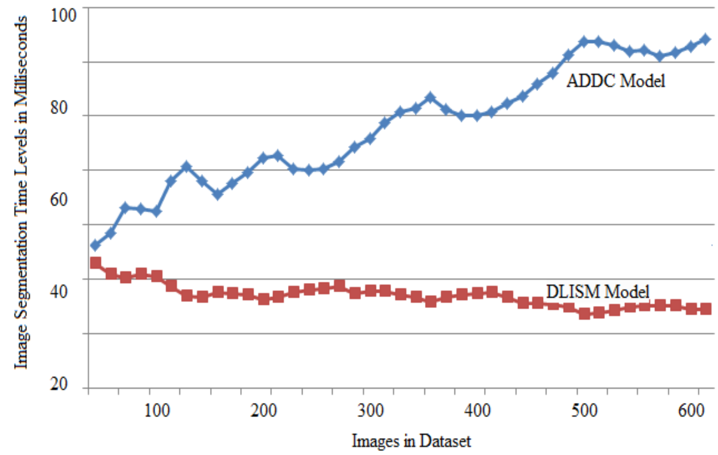

Fig 9: Image Segmentation Time levels

The segmentation of images is a major part of the image processing model and is used almost everywhere so that our model can see pixels inside the image. The image is divided into several segments or elements. The problem is how much the fraction of the image is supported. Segmentation must stop at this moment when an image object is separated. For relevant features only, the suggested framework performs pixel marking. Figure 10 illustrates the image labelling accuracy of the proposed methods and existing ones.

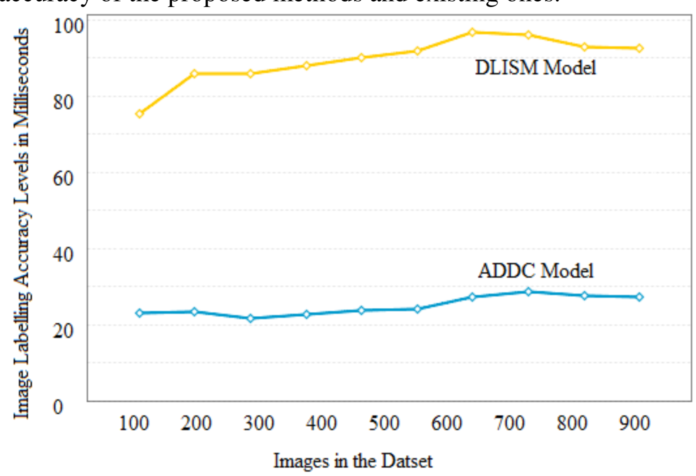

Fig 10: Image Labelling Accuracy Levels

Figure 11 clearly shows the time levels for image labelling of the proposed and existing versions. The role of pixel labelling in the proposed model is critical for image processing. After the operational data processing has been completed, it is easy to further process the division of the image into several chunks. Segmented object recognition improves image accuracy and decreases loss. The segmented pixels and extracted pixels are used to examine these pixels for the identification of medical plants.

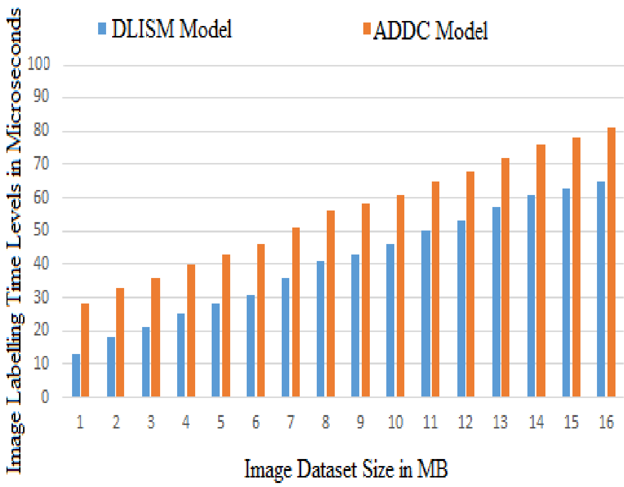

Fig 11: Image Labelling Time Levels

The extraction of pixels is part of the process of dimensional reduction by dividing and decreasing raw data in groups that can be controlled initially. These huge data sets have many variables as the main feature. Several computer resources are required to process these variables, so that pixel extraction can provide the best feature in such large data sets through the selection and combination of variables into the functions, effectively reducing databases. Figure 12 contains the pixel extraction times of the proposed and conventional models. When compared to existing ones, the proposed system pixel extraction times are lower.

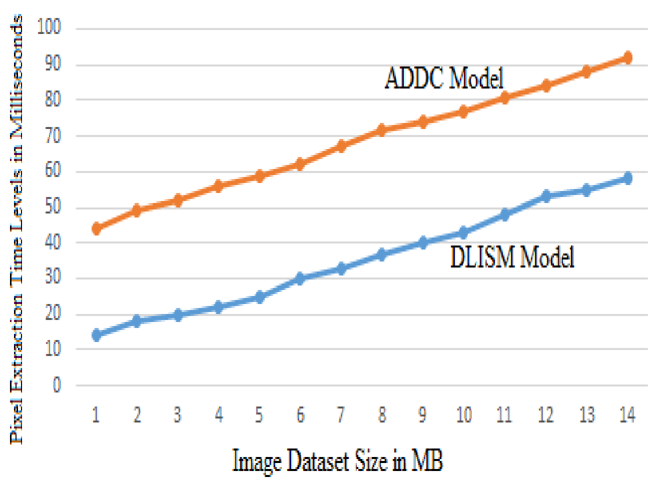

Fig 12: Pixel Extraction Time Levels

Picture segmentation is a complex and challenging operation, with irregularity affecting several factors, such as noise, low contrast, illumination and object limits. The proposed segmentation degree of precision is compared to the current model and the result is shown in the Figure 13.

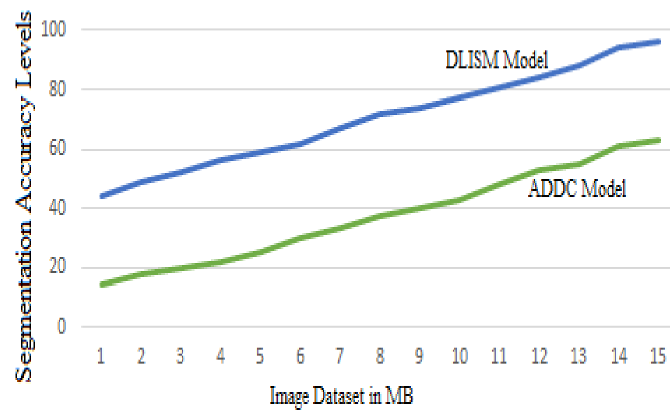

Fig 13: Segmentation Accuracy Levels

Cost-sensitive classification systems are tested according to an error intended to improve the accuracy of the classifier. The cost of misclassification is also an important parameter in many classification applications. The failure in classification is equally popular in all error-based classification methods, which is not the case in all real-life applications. The accuracy levels for classification of the proposed and conventional methods are shown in the figure 14. Compared to conventional methods, the proposed model classification accuracy is greater.

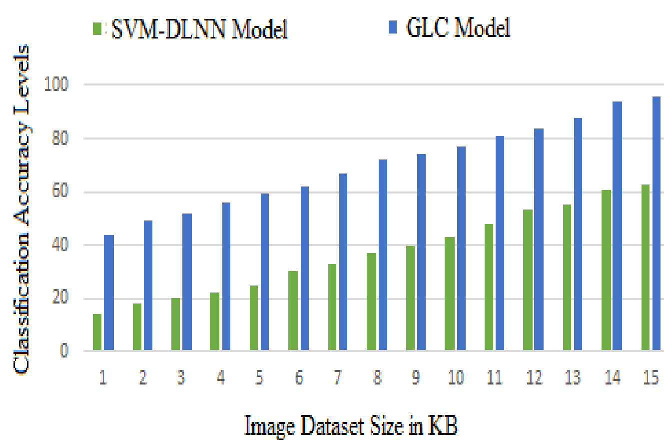

Fig 14: Classification Accuracy Levels

Classification is the forecast for a particular class because its features relate to data. One thing that must be recalled is that the measurement of ML helps to distinguish between classes and the generalization of information. Figure 15 clearly indicates the time stages of classification of the proposed and actual methods. The time levels for classification of the proposed model are less than the existing system.

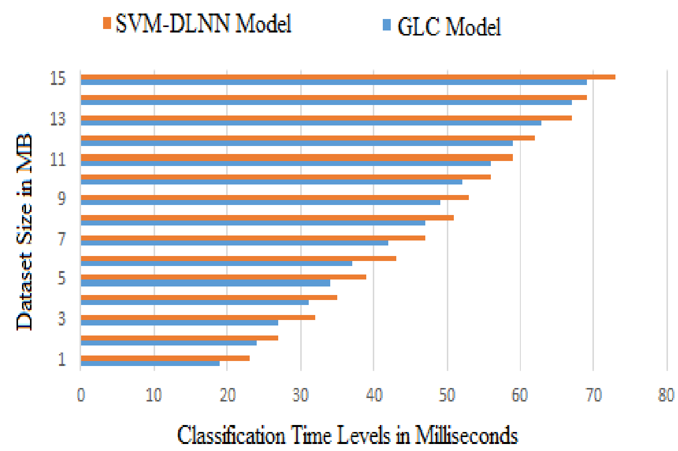

Fig 15: Classification Time Levels

The time intervals of the classification of both current and proposed models are shown in the Figure 16. The labelling mark time levels of the proposed model are lower than that of existing models which improve system efficiency.

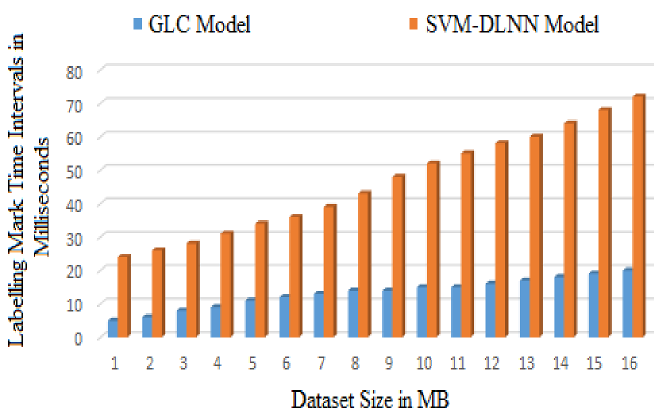

Fig 16: Labelling Mark Time Intervals

The identification of similarity values of the features are performed and the similarity identification accuracy values are indicated in Figure 17. The proposed model accuracy levels are high than the existing model.

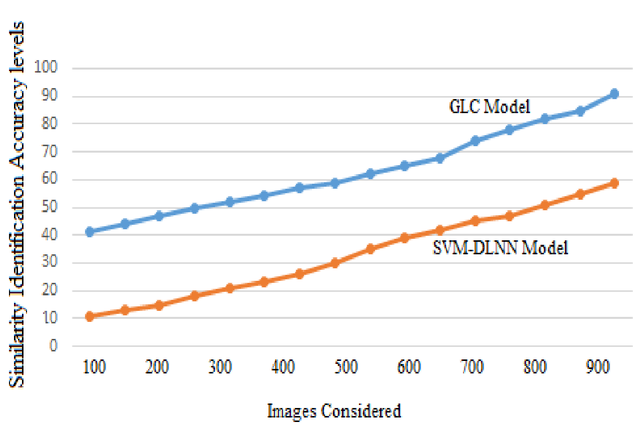

Fig 17: Similarity Identification Accuracy levels

The feature optimization is performed in the proposed model that reduces the cost and improves the performance levels. The optimization time levels of the proposed and existing models are indicated in Figure 18.

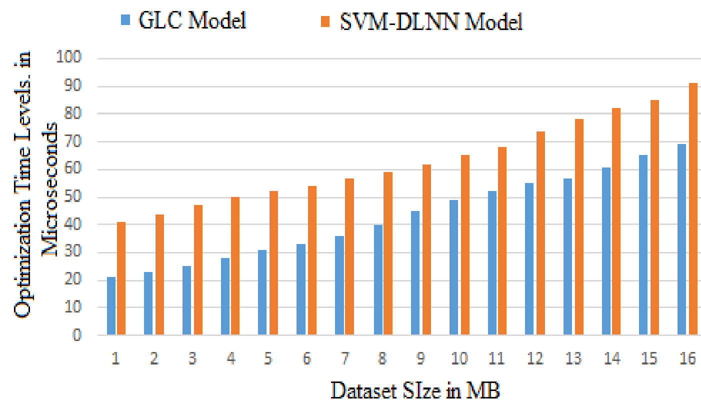

Fig 18: Optimization Time Levels.

The overall accuracy of the medical plant detection is shown in the figure 19. The detection rate of the proposed model is high than the existing scheme. Compared to existing methods that indicate high level of efficiency, the medical plant measurement accuracy of the proposed model is better.

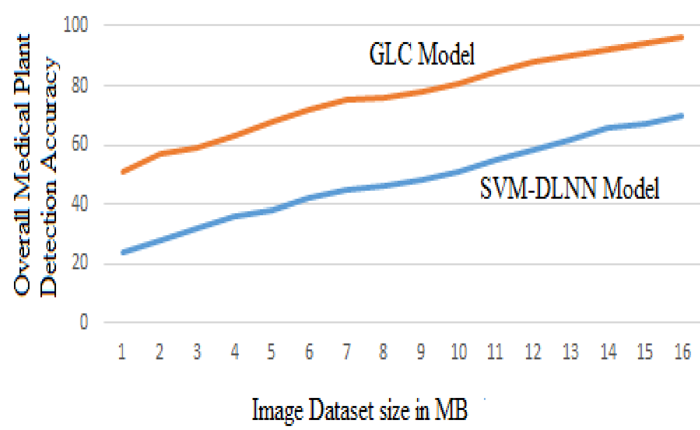

Fig 19: Overall Medical Plant Detection Accuracy

The Table 1 indicates the several parameters that shows the efficiency levels of the proposed model when contrasted with the existing methods.

Parameters	LTrP	ELTrP	Hybrid method, ELTrP with LBP
Correct rate	0.8723	0.9333	0.9556
Error rate	0.1277	0.0667	0.0444
LastCorrectRate	0.8723	0.9333	0.9556
LastErrorRate	0.1277	0.0667	0.0444
InconclusiveRate	0.0600	0.1000	0.1000
Classified Rate	0.9400	0.9500	0.9549
Sensitivity	1	1	1
Specificity	0.9388	0.9480	0.9490
PositivePredictiveValue	0.2500	0.1667	0.1667
NegativePredictiveValue	1	1	1
Prevalence	0.0200	0.0200	0.0200

The Table 2 indicates the training and accuracy levels of the proposed model with batch size of images considered. The proposed model accuracy rates are better that indicates the system performance levels.

Training Parameters			Outputs	
Mini-Batch Size	Initial Learn Rate	Epochs	Accuracy(%)	Training Time (min)
5	0.0001	10	98.99	7.31
10	0.0001	10	98.14	6.88
15	**0.0001**	**10**	**98.82**	**6.70**
25	0.0001	10	98.31	6.73
15	0.0001	5	97.64	3.41
15	**0.0001**	**10**	**98.99**	**6.926**
15	0.0001	15	98.65	10.20
15	0.0001	25	98.31	13.76

V. CONCLUSION

Ayurvedic history says that each plant is medicinally sound, so that it is very important for human beings to identify which portion of the plant has medicinal value for which disease it would be used. Many disease diagnoses include medicinal herbs such as leaves, bark, nuts, berries, roots and stem. Botanists and herbalists classify the medicinal plants manually by these plants, which take a long time. The aim of this study is to reduce manual work and enhance productivity using imaging techniques through automatic identification of medicinal plants. Classification of Medicinal plants using leaf characteristics is performed and less research was conducted in the classification of medicinal plants using flowers and fruit and seeds. Our research is to increase the identify and classify medicinal plants as plants, shrubs and trees using flowers and fruits and seeds like leaf. Automatic medicinal plant identification and classification can provide common people and farmers with medicinal information that helps to boost the development of these critical plants. This scheme also supports the identification and classification of medicinal plants without any human assistance by botanists, users, forest services, taxonomists, pharmaceuticals companies and Ayurveda practitioners. The proposed model accuracy rates are high when compared to traditional methods in terms of accurate detection and time levels.

References

[1]. H. X. Kan, L. Jin, and F. L. Zhou," Classification of Medicinal Plant Leaf Image Based on Multi-Feature Extraction", Pattern Recognition and Image Analysis, Vol. 27, No. 3, 2017, pp. 581–587, 1054-6618. © Pleiades Publishing, Ltd.

[2]. 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, Volume 2, 2017, Pages 113–118.

[3]. Marco Seeland, Michael Rzanny, NedalAlaqraa, Jana Wa ̈ldchen, Patrick Ma ̈der, "Plant species classification using flower images—A comparative study of local feature representations", PLOS ONE | DOI:10.1371/journal.pone.0170629 February 24, 2017.

[4]. Pradeep kumarChoudhary, Rahul Khandekar, AakashBorkar, and PunitChotaliya, "Image processing algorithm for fruit identification", International Research Journal of Engineering and Technology (IRJET), Vol 4 Issue 3, e-ISSN: 2395 -0056, p-ISSN: 2395-0072, Mar -2017.

[5]. D Venkataraman and Mangayarkarasi N, "Computer Vision Based Feature Extraction of Leaves for Identification of Medicinal Values of Plants", IEEE International Conference on Computational Intelligence and Computing Research, 978-1-5090-0612-0/16/$31.00 ©2016 IEEE.

[6]. RuaaAdeebAbdulmunem Al-falluji, "Color ,Shape and Texture based Fruit Recognition System", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5, Issue 7, ISSN: 2278 – 1323 ,July 2016.

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

[8]. Sana O M1, R.Jaya2,"Ayurvedic Herb Detection Using Image Processing", International Journal of Computer Science and Information Technology Research, Vol. 3, Issue 4, pp: (134139), Month: October - December 2015.

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

[10]. Sandeep Kumar E,"Leaf color, area and edge features based approach for identification of Indian medicinal plants", Indian Journal of Computer Science and Engineering (IJCSE), Vol. 3 No.3 Jun-Jul 2012, 0976-5166.

[11]. P. M. Kumar, C. M. Surya and V. P. Gopi, "Identification of ayurvedic medicinal plants by image processing of leaf samples," 2017 Third International Conference on Research in Computational Intelligence and Communication Networks (ICRCICN), Kolkata, 2017, pp. 231-238. DOI: 10.1109/ICRCICN.2017.8234512.

[12]. H. A. ChathuraPriyankara and D. K. Withanage, "Computer assisted plant identification system for Android," 2015 Moratuwa Engineering Research Conference (MERCon), Moratuwa, 2015, pp. 148-153. DOI: 10.1109/MERCon.2015.7112336.

[13]. Rafael Rojas-Hernández and AsdrúbalLópez-Chau, "Plant identification using new geometric features with standard data mining methods", Networking Sensing and Control (ICNSC) 2016 IEEE 13th International Conference on, pp. 1-4, 2016.

[14]. CheHussin, N. A., Jamil, N., Nordin, S., &Awang, K. (2013). Plant species identification by using scale invariant feature transform (SIFT) and grid based color moment (GBCM). In 2013 IEEE Conference on Open Systems, ICOS 2013 (pp. 226-230). [6735079]

[15]. Basavaraj S. Anami, Suvarna S Nandyal, Govardhan. A, "Color and Edge Histograms Based Medicinal Plants' Image Retrieval", I.J. Image, Graphics and Signal Processing, 2012, 8, 24-35, 2074-9074.

[16]. 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 Plants", International Journal of Computer Applications, Vol 6– No.12, September 2010.

[17]. WarisaraPardee, PrawaranYusungnern, PeerayaSripian, "Flower Identification System by Image Processing", 3rd International Conference on Creative Technology CRETECH 2015,Vol: 1, August 2015.

[18]. Zaidah Ibrahim, NurbaitySabri, NurNabilah Abu Mangshor," Leaf Recognition using Texture Features for Herbal Plant Identification", Indonesian Journal of Electrical Engineering and Computer Science, Vol. 9, No. 1, January 2018, pp. 152~156.

[19]. A Gopal, S. Prudhveeswar Reddy and V. Gayatri, "Classification of Selected Medicinal Plants Leaf Using Image Processing", pp 978-1-4673-2322-2.

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

[21]. 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.

[22]. IyosKusmana, YeniHerdiyeni, "Fusion of Local Binary Patterns Features for Tropical Medicinal Plants Identification". 2013 International Conference on Advanced Computer Science and Information Systems (ICACSIS). pp. 353-357.

[23]. C.Ananthi, Azha.Periasamy and S.Muruganand ," Pattern Recognition Of Medicinal Leaves Using Image Processing Techniques Journal of Nano Science and Nano Technology, Vol 2, Issue 2 , Spring Edition, ISSN 2279 – 0381.

[24]. MohdShamrieSainin, Taqiyah Khadijah Ghazali and Rayner Alfred, "Malaysian Medicinal Plant Leaf Shape Identification and Classification", Knowledge Management International Conference (KMICe) 2014, 12 – 15 August 2014, Malaysia.

[25]. IyanMulyana, YeniHerdiyeni and Sony Hartono Wijeya "Identification of medicinal plant based on fractal by using clustering fuzzy c-means", International Conference on Information Technology and Business Application Palembang, Indonesia, 22-23 February 2013.