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A Review on Flower Image Recognition

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***Abstract*—** There is a large number of flowers available in the world, and it is hard to remember all names and types of flowers, but for identification and recognition of flower species in environments such as forests, mountains, and dense regions is necessary to know about their existence. So the system which is developed for identification of flower type is useful. This identification and recognition of a particular flower among millions of flower types is a very heavy task. So Automated flower species recognition has been studied for many years. Differences between these studies come from features that were extracted from the flower image and the recognition algorithm that was used to recognize the flower species. For selecting the feature from flower images, the three most important attributes to be considered are color, texture, and shape. For these individual class of feature variety of feature extraction methods are present, and for recognition, the different classification model is present such as ANN, kNN, SVM, CNN, etc. This paper discusses, and well us reviews the algorithms and the technologies which are available for segmentation, feature extraction, classifying, detecting and counting of flowers from the flower images from different standardized dataset like Oxford 17, Oxford 102, etc and analyzing several research papers.

Keywords— *Segmentation,feature extraction,classification ,SVM, shape, texture, color*

I. INTRODUCTION

Flowers and the ability to identify them have been fascinating humans for hundreds of years. The taxonomy originally contained approximately 8000 plants but has since been extended to encompass more than 250,000 named species of flowering plants present in the world. Every day, we can see many blooming flowers on the roadside, garden, park, mountain path, wild field, etc. Generally, experienced taxonomists or botanists can identify plants according to their flowers. However, most people do know nothing about these wildflowers, even their names. To know the names or characteristics of the plants, we usually have to consult flower guide books or browse any relevant web pages on the Internet through keywords searching [7,16]. But, such a keyword searching approach is very much restricted and not practical for most people, which is the crux of the matter, and Botanists use keys, where a series of questions need to be answered in order to classify flowers. In most cases, some of the questions are related to internal structure that can only be made visible by dissecting the flower.which is not possible by simple human visual object classification [12].

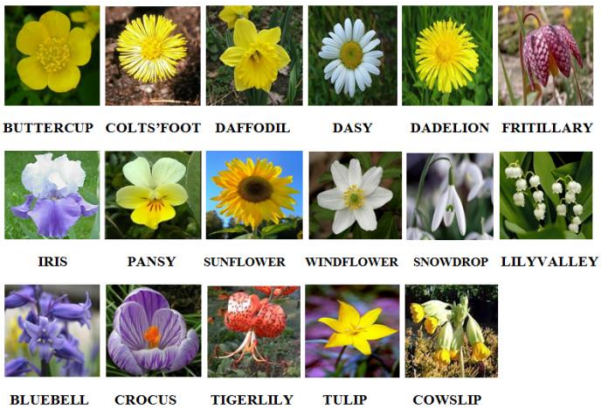

Fig1.1: Different type of flower present in Oxford17 dataset

So for these all, we need a model or a system that able to process and memories these large amounts of flower species data and can be trained easily and through which these above problems can be solved. We can develop these models with the help of image processing, where content-based image indexing techniques are used to analyze and describe images based on their visual content and appearance. Those techniques can provide the necessary tools, such as color, shape, and texture features, describing the visual appearance of flowers [10]. But it is a very much challenging computer vision problem because of the large similarity between

flower classes. Indeed, flowers from different species may seem similar, for example, Dandelion and Colt's Foot, as shown in Figure 1.2.a. Furthermore, flowers from the same species may have different appearances, for example, the Pansy flower in Figure 1.2.b[10].

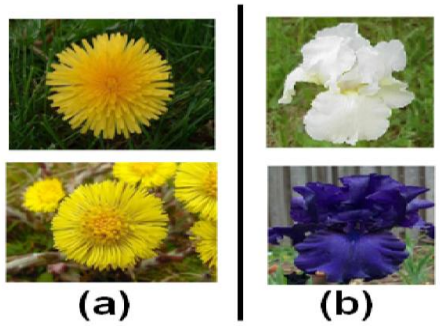

Fig1.2 : (a)Two visually dissimilar flowers from the same species.(b)Two visually similar flowers from different species[10]

Classifying flowers is a difficult task even for humans–certainly harder than discriminating a car from a bicycle from a human. As can be seen from the examples in figure 2, in typical flower images, there are huge variations in viewpoint and scale, illumination, partial occlusions, multiple instances, etc. The cluttered backgrounds also make the problem difficult as we risk classifying background content rather than the flower itself. Perhaps the greatest challenge arises from the intra-class vs. inter-class variability, i.e., there is a smaller variation between images of different classes than within a class itself, and yet subtle differences between flowers determine their classification. In figure 1, for example, two of the flower s belong to the same category. But it difficult to identify[12].

Fig 1.3. Three images from two different categories.

The left and right images are both dandelions. The middle one is a colts' foot. The intra-class variation between the two images of dandelions is greater than the inter-class variation between the left dandelion and the colts' foot image [12].

So it is also important to take the different feature carefully of flower that strengthening the model to make distinction among flower with respect to these above problems. Some basic feature used in many paper for classification of flower are color shape and texture.

II. BASIC STEPS OF FLOWER RECOGNITION

As depicted on the figure below the process or the system model of predicting flower based on the class type must follow some general step and we can take it as waterfall model because here the output of current step is used as input for the next step. Each step of this model has some reason and specific task to do for a specific purpose. So let us discuss about those in brief according to its flow of execution in sequence.

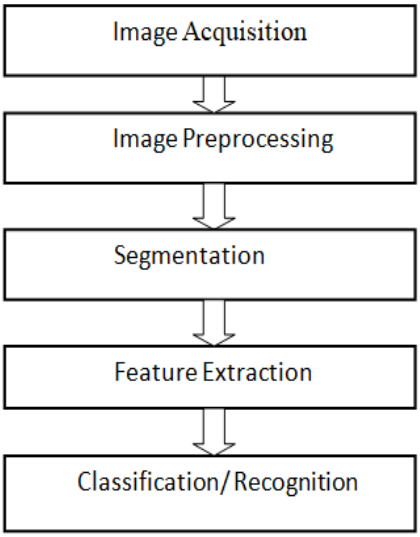

Fig2.1. Block Diagram for Recognition of flower

These first two operation image acquisition and preprocessing is same for all the dataset, after this for classification, model is divided into two parts one is training phase and other one is testing phase, where data set is divided in to two(training and testing set) or three(training, validation and testing set) parts depends on the requirement of the model. For better understanding of these all we have taken a figure as given below(Fig 2.2) from paper [10].

Training Part:

The training phase aims to build a model based on a subset of images from standard dataset called training images. First, those images are segmented and the features are extracted. Then we need to develop a database with feature preparation of sample images or trained images.And in final we need to develop an classification algorithm for deciding class[10].

Testing Part:

In testing the goal of the phase is to identify the class of the flower contained in this image.Here select any flower sample image or query image from testing image dataset. Which will also undergoes processes like segmentation and Feature

extraction and classification for recognize the type of the flower present in the query image.

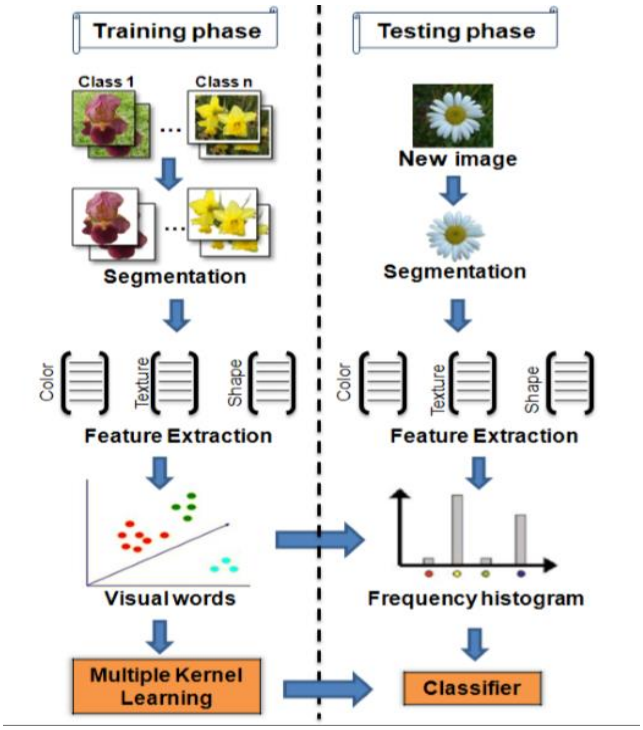

Fig 2.2: Schema of the classification method [10]

2.1 Image Acquisition:

The general aim of Image Acquisition is to transform an optical image (Real World Data) into an array of numerical data which could be later manipulated on a computer, before any video or image processing can commence an image must be captured by camera and converted into a manageable entity [17]. The Image Acquisition process consists of three steps:

1. Optical system which focuses the energy

2. Energy reflected from the object of interest

3. A sensor which measure the amount of energy.

Image Acquisition is achieved by suitable camera. We use different cameras for different application. If we need an x-ray image, we use a camera (film) that is sensitive to x-ray. If we want infra red image, we use camera which are sensitive to infrared radiation. For normal images (family pictures etc) we use cameras which are sensitive

2.2 Image preprocessing:

Preprocessing indicates that the same tissue type may have a different scale of signal intensities for different images. Preprocessing functions involve those operations that are normally required prior to the main data analysis and extraction of information and are generally grouped as radiometric or geometric corrections. Radiometric corrections include correcting the data for sensor irregularities and unwanted sensor or atmospheric noise, removal of non-brain vowels and converting the data so they accurately represent the reflected or emitted radiation to find out a transformation between two images precisely. The preprocessed images will have some noise which should be removed for the further processing of the image. Image noise is most apparent in image regions with low signal level such as shadow regions or under exposed images. There are so many types of noise like salt and pepper noise, film grains .All these noise are removed by using algorithms.

2.3 Segmentation:

Segmentation again fragment an image into its constituent region or object. On the basis of two properties discontinuity and similarity image segmentation methods are categorized [18]. According to this property image segmentation is categorized as Edged based segmentation and region based segmentation shown in Fig.2.3 .The segmentation methods those are based on a discontinuity property of pixels are grouped as boundary or edges based techniques.

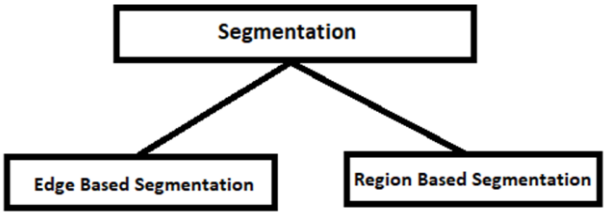

Fig 2.3 Segmentation Techniques

But we must keep in mind that when the segmentation result is inappropriate the information will be lost more. While in case of the flower images with complex background consisting of the weeds ,mud and leaves, even more factors such as the mutual projection between flowers and leaves under illumination, these all will reduce the segmentation accuracy of flower region[19].So for flower it is important to extract the foreground from the background.

2.3.1 Edge based segmentation The Edge based segmentation method attempts to resolve image segmentation by detecting the edges or pixels between different regions that have rapid transition in intensity and are extracted and linked to form closed object boundaries. The result is a binary image. Based on theory, there are two

main edge based segmentation methods, gray histogram based and gradient based method [20].

2.3.2 Region based segmentation Region based segmentation partitions an image into regions that are similar according to a set of predefined criteria. The region based segmentation is partitioning of an image into similar areas of connected pixels. Each of the pixels in a region is nearly similar with respect to some characteristic or Computed property such as color, intensity and/or texture [20]. There are different types of the Region based methods present[19].

1. Thresholding
2. Region growing
3. Region splitting
4. Merging

1. Thresholding: Thresholding is an important technique in image segmentation applications. The basic idea of thresholding is to select an optimal gray-level threshold value for separating objects of interest in an image from the background based on their gray-level distribution. Thresholding creates binary images from Gary-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one[19]. OTSU method is a type of global thresholding in which it depends only gray value of the image. Otsu method was proposed by Scholar Otsu in 1979. Otsu method is a global thresholding selection method, which is widely used because it is simple and effective [21]. Instead of applying the OTSU thresholding algorithm directly on the color image,First convert it to the Lab color space and then separate the three color components (L), (a) and (b) and segment, independently, each color component result better[11].so it is good to do some pre-processing before applying OTSU thresholding.

2. Region Growing: Region-growing approaches exploit the important fact that pixels which are close together have similar gray values. Region growing approach is the opposite of the split and merge approach. This method may not distinguish the shading of the real images[19]. This approach goes on like this: firstly, set a group of "seed" points in original image; then grow regions by appending each seed to those neighboring pixels that have similar properties of the seed (such as gray level or color)[20].

3.Region Splitting: Rather than choosing seed points, users can divide an image into a set of arbitrary, unconnected regions and then merge and/or split the regions in an attempt to satisfy the conditions of reasonable image segmentation[20]..This Region Splitting technique is a recursive approach of automatic multi-threshold Since the splitting technique depends upon homogeneity factor, some of the split regions may or may not split properly. It should be reduced through merging technique between the two adjacent regions to overcome the drawback of the splitting technique[19].

4. Merging: The result of region merging usually depends on the order in which regions are merged[19] .And mainly, in most cases merging is used after split algorithm.

2.4 Feature Extraction:

Feature contains information about the target and classification functions define in term of features. So it is obvious that we think more features means more information and better discriminative power or better classification power. But this may not hold always that just because we have more features does not mean we have more information or better classification performance.

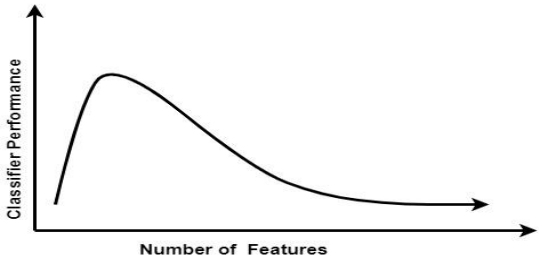

Fig 2.4 Classifier performance vs. feature graph

This above scenario happen when number of training example is fixed means not extremely large and here when we increase the number feature, initially the classifier performance may go up and then the classifier performance may decrease.

The reason is some feature can be irrelevant and some features are redundant. Irrelevant features can introduce noise that full the learning algorithm and redundant features do not contribute additional information they may lead to degrading performance of learning algorithm. So the irrelevant and redundant feature confuses the model when you have limited training example. And the use of large number of feature needs large search space means searching may take more time which also hamper the model.

So it is very much important to choose the right set of features for the particular problem based on the characteristic of the problem and training dataset. In digital image processing many techniques have been used to extract features from images. Some of the commonly used methods are as follows.

- Spatial features
- Transform features
- Color features

- Textures features
- Shape features
- Edge and boundary features

Among this all for classification of flower type color, texture and shape features are most important attributes[5].

2.4.1 Color Features:

Color is the first candidate used for feature extraction to identify flower type .Some of the most reliable and simple global feature descriptor for color is the color Histogram, HSV Histogram, color moment, auto correlogram etc. But color characteristics of an image alone is not sufficient to quantify flower because in our environment variety of flower are present. So two or more flower could be of same color. As an example Sunflower and Daffodil flower are of same color content[5].

2.4.2 Texture Features:

"Texture" is another important feature to be considered for identifying flower type. It observes consistency of patterns and colors in an image .GLCM (Gray Level Co-occurrence Matrix), wavelet transform, Gabor Wavelet etc are some common texture feature extraction technique.

2.4.3 Shape Feature:

When it comes to natural objects such as flowers, plants, trees etc are taken under consideration another important feature to quantify those objects in a particular image is the "shape". In flower the shape of individual petals, their configuration, and the overall shape of the flower can all be used to distinguish between flowers. In image processing research, Hu moments , Zernike moments,SHIFT,SURF are some method those widely used as shape descriptors[5][12].

2.5.Classification:

Image classification refers to the labelling of images into one of several predefined categories[22]. Primary classification techniques have been discussed in this section with their primary.

2.5.1 Decision Tree:

Induction Decision tree algorithms are the most commonly used algorithms in classification [23]. Decision tree provides an easily understandable modeling technique, and it also simplifies the process of classification [24]. The decision tree is a transparent mechanism it facilitates users to follow a tree structure more straightforward to see how the decision is made [25].

2.5.2 Bayesian Networks:

A Bayesian Network (BN) refers to a graphical model for probability associations among a set of variables [26]. BN structure S consist directed acyclic graph (DAG) and the nodes in S are in one-to-one communication with the X features. The arcs exemplify unexpected impacts between the nodes while the scarcity of possible arcs in S encodes conditional liberties [27]. Normally Bayesian Network learning tasks can isolate into two subtasks; (a) network DAG structure learning, (b) parameters determination.

2.5.3 K- Nearest Neighbor:

In K-nearest neighbor (KNN) technique, the nearest neighbor measured concerning the value of k, that define how many nearest neighbors need to be examined to describe the class of a sample data point [28]. The nearest neighbor technique is divided into two categories, i.e., structure-based KNN and structure less KNN. The structure-based method deals with the basic structure of the data where the fabric has less mechanism associated with training data samples [29]. In architecture, less technique entire data is categorized into sample data point and training data, distance is calculated between sample points and all training points and the point with the smallest range is known as the nearest neighbor [30]

2.5.4 Support Vector Machine:

Support Vector Machine (SVM) method is useful for actual classification. Support vector machines, also known as support vector networks, are supervised learning models in "machine learning". These learning models come with learning algorithms that analyze data used for classification and regression analysis.
Let us take an example, there are two predefined categories and some training examples, and we have to mark the examples to the category they belong to. What SVM algorithm does is it builds a model that assigns the new example to the category it belongs to. Thus we can call the model as a non-probabilistic binary linear classifier Model. The SVM model represent the examples as points in space, the points are made in such a way that the examples of different categories are divided by an apparent gap that is visibly wide enough to differentiate between the categories. Now when the new examples come in, they are also mapped in the same space, and then we can know it's category by observing on which side of the gap they are represented.SVM can perform not only linear classification but also non-linear classification, it implicitly maps the inputs to a high dimensional features spaces and this trick is known as kernel trick. Supervised learning is not possible if the data is not labeled so, we go for unsupervised learning approach. Unsupervised learning approach tries to find the natural clustering of the data to groups; it then maps the data to the formed groups. Support vector clustering is an improvement of support vector machines where the

clustering algorithm is used and is mostly used in industrial applications where the data are not labeled, or some data are labeled for pre-processing classification [31].

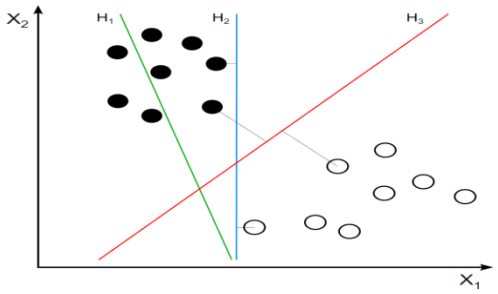

Fig 2.5 Example of separation of classes

According to the figure2.5, H3 separates the classes with the maximum margin H2 does it with a smaller margin, but H1 does not differentiate the classes. In machine learning, classifying data is a common task like we have some given data points and two classes, and we have to decide which point belongs to which class. In SVM, the point is represented as an m-dimensional vector, which is a list of m numbers, and the linear classifier separates the points with m-1 dimensional hyperplanes. There would be many hyperplanes that might classify the data, but the best hyperplane is that which separates the classes with the largest margin between two classes. The hyperplane is chosen in a way that distance from its nearest data point on each side is maximum. If such a hyperplane present, it is called as the maximum margin hyperplane. And the linear classifier it defines is called as maximum margin classifier and also known as the perception of optimal stability. A support vector machine generates a hyperplane or a set of hyperplanes in a high or infinite-dimensional space, which is used for classification, regression, or other tasks. Basically, a good separation is acquired by the hyperplane that has the largest distance to the nearest training data point of any class, and we can say the larger the margin, the lower the generalization error of the classifier [31].

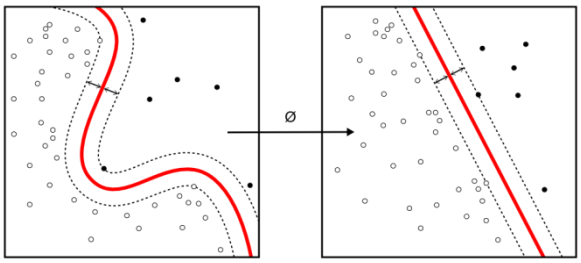

Fig 2.6 kernel machine

III. RELATED WORK

1. Automated Flower Species Detection and Recognition from Digital Images, 2017

Aalaa Albadarneh and Ashraf Ahmad[1], In this paper they used features combinely . Like color features as RGB and HSV were extracted. The change in illumination was reduced by using HSV color space. Both GLCM and Wavelet transform as textural features, GLCM provides the system with advantage of rotation invariant, while using four scales in Wavelet transform make the proposed system invariant for different scales. HOG and SIFT as shape features provides the system with global and local shape descriptors, in addition by using SIFT key points the proposed system became more scale invariant. And in this process they got a recognition accuracy for their new own Dataset is 92% and they achieved a class average recognition accuracy of 83.52% on Oxfoed17 Dataset.

2. A Flower Recognition System Based On Image Processing And Neural Networks ,2018

Huthaifa Almogdady, Dr. Saher Manaseer and Dr.Hazem Hiary[2] proposed a methodology through which this paper is divided into 4 main steps; starting with image enhancement, cropping of images used to modify dataset images to create more suitable dataset for next stage. Then image segmentation introduced to separate the foreground (the flower object) from the background (rest of image) where chan-vese active contour has been used, and for the features extraction, all of color, texture and shape have been used, (HSV as color descriptor, Gray Level Co-occurrence Matrix (GLCM) as texture descriptor, and Invariant Moments (IM) as a shape descriptor). Finally; the classification process where Back-Propagation Artificial Neural Network (ANN) used. They have achieved (81.19%) as an accuracy rate.

3. Literature Review on Flower Classification,2015

Chaku Gamit, Prof. Prashant B. Swadas and Prof. Nilesh B. Prajapati[3] , In this paper they have present literature survey of various techniques used for flower classification. They conclude that supervised classification gives higher accuracy as compared to unsupervised classification algorithms. MLP gives better result as compare to logistic regression, kNN, pNN and SVM.

4. Flower Recognition System Based on Image Processing,2014

Tanakorn Tiay, Pipimphorn Benyaphaichit, and Panomkhawn Riyamongkol [4],In the proposed system, the original flower image is resized for faster processing. To obtain only flower in the image, the graph cut algorithm and RGB to grayscale conversion is used. After the system receives edge characteristics by Hu's seven-moment algorithm and color characteristics such as Red, green, blue, hue, and saturation are derived from histogram, K-nearest neighbor is used to classify flowers. This system shows the

most nearest 3 flower images with matching flower information of the first nearest flower image. The accuracy of this system is more than 80%.

5. Flower Species Recognition System using Convolution Neural Networks and Transfer Learning,2017

I.Gogul, V.Sathiesh Kumar[5],In this proposed research work, a Deep learning approach using Convolutional Neural Networks (CNN) is used to recognize flower species with high accuracy. Images of the plant species are acquired using the built-in camera module of a mobile phone. Feature extraction of flower images is performed using a Transfer Learning approach (i.e. extraction of complex features from a pre-trained network). A machine learning classifier such as Logistic Regression or Random Forest is used on top of it to yield a higher accuracy rate. This approach helps in minimizing the hardware requirement needed to perform the computationally intensive task of training a CNN. This CNN combined with Transfer Learning approach yields impressive Rank-1 accuracies of 73.05%, 93.41% and 90.60% using OverFeat, Inception-v3 and Xception architectures, respectively as Feature Extractors on FLOWERS102 dataset.

6. Flower Detection and Counting Using Morphological and Segmentation Technique,2015

Balvant V. Biradar, Santosh P. Shrikhande[6], This paper discuses the prominent and efficient method for detecting and counting the number of flowers from the flower images captured by digital camera. The proposed method uses Gaussian low-pass filter and morphological operations for pre-processing the flower images to remove the non flower region and enhancement of fine details. The flower region from input image is segmented using global threshoding technique using OTSU's algorithm. The proposed method for automatic detection and counting of marigold flowers is an efficient and robust with accuracy of 92%.

7. Retrieval of Flower Based on Sketches,2015

Y H Sharath Kumara, D S Gurub[7], In this paper, they propose a model for representation and indexing of flower images for the purpose of retrieving flowers of interest based a query sketch. In this work,They have used Kd-tree based indexing approach to index a huge dataset of flowers for given input sketch. In the proposed method they represent each flower by shape descriptors of SIFT, HOG, EOH. Experimentations are conducted on Category- 127 dataset and Flower Sketch dataset to assess the advantage of using indexing technology. From this model they understand that the combination of all the features descriptors achieves a good accuracy with indexing approach.

8. Textural features in flower classification,2010

D.S.Guru,Y.H.SharathKumar,S.Manjunath[8], In this work, they investigate the effect of texture features for the classification of flower images. In this paper, they have proposed a probabilistic neural network-based flower classification method with the use of texture features. Suitable texture features such as CTMs, GLCM, and Gabor responses are explored for the purpose of flower classification.They observed that using the proposed textural features one can achieve relatively a good classification accuracy when compared to any other available features.They have created our own database of flowers of 35 classes,each containing 50 flower images, and their results show that the combination of multiple features vastly improves the performance, from 35% for the best single feature to 79% for the combination of all features.

9. Counting Flowers in Digital Image:A Review,2016

Kriti Sharma, Anoop Singhal[9],This paper discuses and well us reviews the algorithms and the technologies which are available for detecting and counting the number of flowers from the flower images captured by digital camera from a green house. Here in their conclusion section they give a statement that, the farmer and agents can use this application to count and verify the number of flowers available in the greenhouse easily and quickly with affordable cost.

10. Image Flower Recognition based on a New Method for Color Feature Extraction ,2014

Amira Ben Mabrouk, Asma Najjar and Ezzeddine Zagrouba [10],In this paper, they proposed a new method to extract color features based on SURF interest points and combined different features using a multiple kernel framework with a SVM classifier. The experimental results have proved that combining features perform better than using a single feature for classification. Moreover, they have proved that their method has achieved better results within shorter execution-time than their implementation of the method proposed in (Nilsback and Zisserman, 2008).

11. Flower image segmentation based on color analysis and a supervised evaluation,2012

Asma Najjar and Ezzeddine Zagrouba[11],Here they proposed a flower segmentation schema which overcomes some limits of previous works(The method proposed by Nilsback and Zisserman) based on OTSU thresholding technique and Lab color space . The thresholding was performed, separately, on the three component L, a and b, and the best result is selected relatively to the ground truth. In fact, even some results are not accurate due to the failure of the OTSU algorithm in some cases But,the experimentation of the proposed method, performed using the dataset from the Oxford flower collection, make better

the results, while consuming less CPU time, than the method proposed by Nilsback and Zisserman.

12. A Visual Vocabulary for Flower Classification,2006

Maria-Elena Nilsback, Andrew Zisserman[12],In this paper they developed and optimize a nearest neighbor classifier architecture that distinguish categories which have significant visual similarity or to overcome the ambiguities that exist between flower categories. The flower categories are chosen to be indistinguishable on colour alone (for example), and have considerable variation in shape, scale, and viewpoint.For these they demonstrate each vocabulary that explicitly represents the various aspects (colour,shape, and texture) individually which distinguish one flower from another and after that they demonstrate comibnely to make comparison among them .After comparison they conclude that in their larger dataset(OXFORD 17) color feature perform better than shape and texture and texture perform very poorly.

13. Delving into the Whorl of Flower Segmentation,2007

Maria-Elena Nilsback, Andrew Zisserman[13],They described an algorithm for automatically segmenting flowers in colour photographs The method couples two models – a colour model for foreground and background, and a generic shape model for the petal structure. This shape model is tolerant to viewpoint changes and petal deformations, and applicable across many different flower classes. The segmentations are produced using a MRF cost function optimized using graph cuts. The algorithm is tested on more than750 examples of 13flowerclasses out of total 17 classes of Oxford 17.because four classes have insufficient data required for their model.

14. Automated Flower Classification over a Large Number of Classes.2008

Maria-Elena Nilsback, Andrew Zisserman[14],In this work they investigate to what extent combinations of features can improve classification performance on a large dataset of similar classes. To this end they introduce a 103 class flower dataset. They compute four different features for the flowers, each describing different aspects, namely the local shape/texture, the shape of the boundary, the overall spatial distribution of petals, and the colour. They also combine the features using a multiple kernel framework with a SVM classifier. They have shown that by combining features in an optimized kernel framework we can improve the classification performance of a large dataset of very similar classes.Results show that learning the optimum kernel combination of multiple features vastly improves the performance, from 55.1% for the best single feature to 72.8% for the combination of all features.

15. An automatic visual Flora – segmentation and classification of flower images,2009

Maria-Elena Nilsback[15],This thesis investigates the problem of flower classification from images like changes in viewpoint,scale,illumination and natural deformation etc.They divide the problem into two challenges: segmentation and classification.Segmentation is done by iteratively fitting a geometric model and updating the colour model. The segmentation at each iteration is obtained by minimizing a Conditional Random Field using graphcuts.In classification, they combined different features, which are carefully honed to describe different aspects(color,texture and shape).In addition, They use the geometric model introduced for the segmentation to develop affine invariant geometric layout features.They used a SVM classifier and explored different linear weighted kernel combinations for better classification and found that combination of multiple feature with using a multiple kernel framework with a SVM classifier works good on Oxford 17 category and a 102 category flower database.

TABLE 1: Literature review of flower image Recognition

S.No.	Year	Paper Title	Authors	Methods used	Result
1	2017	"Flower Species Detection and Recognition from Digital Images"	Aalaa Albadarneh and Ashraf Ahmad	Region growing method is used for segmentation and different features are used combinely.Such as for color, RGB and HSV,for texture GLCM and Wavelet transform. For shape SIFT and HOG methods are used. SGD classifier is used for classification	They obtained the recognition accuracy result of 92% by using SGD classifier .
2	2018	"A Flower Recognition System Based On Image Processing And Neural Networks"	Huthaifa Almogdady, Dr. Saher Manaseer and Dr.Hazem Hiary	GLCM method is used for feature extraction.RGB and HSV used for colour extractionANN method is used for classification.	They have achieved 81.19% as an accuracy rate for classification.

3	2015	"Literature Review on Flower Classification"	Chaku Gamit, Prof. Prashant B. Swadas and Prof. Nilesh B. Prajapati	Presented a literature survey of various techniques used for flower classification.Such as MLP, logistic regression, kNN, pNN and SVM.	Gave a conclusion that MLP gives better result as compare to logistic regression, kNN, pNN and SVM.
4	2014	"Flower Recognition System Based on Image Processing"	Tanakorn Tiay, Pipimphorn Benyaphaichit, and Panomkhawn Riyamongkol	They used Hu's seven-moment algorithm for texture and color characteristics such as Red, green, blue, hue, and saturation are derived from histogram after that K-nearest neighbor is used to classify flowers.	The system shows the most nearest 3 flower images with matching flower information of the first nearest flower image. The accuracy of this system is more than 80%.
5	2017	"Flower Species Recognition System using Convolution Neural Networks and Transfer Learning"	I.Gogul, V.Sathiesh Kumar	A Deep learning approach using Convolutional Neural Networks (CNN) is used to recognize flower species and Feature extraction of flower images is performed using a Transfer Learning approach.	Yields impressive Rank-1 accuracies of 73.05%, 93.41% and 90.60% using OverFeat, Inception-v3 and exception architectures, respectively as Feature Extractors on FLOWERS102 dataset.
6	2015	"Flower Detection and Counting Using Morphological and Segmentation Technique"	Balvant V. Biradar, Santosh P. Shrikhande	Here Gaussian low-pass filter and morphological operations for pre-processing the flower images to remove the non flower region and enhancement of fine details. The flower region from input image is segmented using global thresholding technique using OTSU's algorithm	The proposed method for automatic detection and counting of marigold flowers is an efficient and robust with accuracy of 92%.
7	2015	"Retrieval of Flower Based on Sketches"	Y H Sharath Kumara, D S Gurub	They have used Kd-tree based indexing approach to index a huge dataset of flowers for given input sketch. In the proposed method they represent each flower by shape descriptors of SIFT,HOG,EOH.	From this model they conclude that the combination of all the features descriptors achieves a good accuracy with indexing approach.
8	2010	"Textural features in flower classification "	D.S.Guru,Y.H.SharathKumar,S.Manjunath	They have proposed a probabilistic neural network-based flower classification method with the use of texture feature such as CTMs, GLCM, and Gabor responses.	They observed that using the proposed textural features one can achieve relatively a good classification accuracy when compared to any other available features.35% for the best single feature to 79% for the combination of all features.
9	2016	"Counting Flowers in Digital Image:A Review"	Kriti Sharma, Anoop Singhal	This paper discuses and well us reviews the algorithms and the technologies which are available for detecting and counting the number of flowers from the flower images.	Result a quick overiew on different flower detecting and counting methodology.
10	2014	"Image Flower Recognition based on a New Method for Color Feature Extraction "	Amira Ben Mabrouk, Asma Najjar and Ezzeddine Zagrouba	SURF method is used for point feature extraction, for the color feature the authors used RGB and HSV method. They used SVM classification to recognize the flower image.	Results have proved that combining features perform better than using a single feature for classification
11	2012	"Flower image segmentation based on color analysis and a supervised evaluation"	Asma Najjar and Ezzeddine Zagrouba	Here they proposed a flower segmentation schema based on OTSU thresholding technique and Lab colour space.	Segmentation can be done with a small time consuming.

12	2006	"A Visual Vocabulary for Flower Classification"	Maria-Elena Nilsback, Andrew Zisserman	Developed and optimize a nearest neighbor classifier architecture that distinguish categories which have significant visual similarity or to overcome the ambiguities that exist between flower categories.	They conclude that in their larger dataset(OXFORD 17) color feature perform better than shape and texture and texture perform very poorly.
13	2007	"Delving into the Whorl of Flower Segmentation"	Maria-Elena Nilsback, Andrew Zisserman	Described an algorithm for automatically segmenting flowers in colour photographs using a colour model for foreground and background, and a generic shape model for the petal structure.	Reasults a good background substraction model for 13 classes of OXFORD 17 dataset.
14	2008	"Automated Flower Classification over a Large Number of Classes"	Maria-Elena Nilsback, Andrew Zisserman	They compute feature like local shape/texture, the shape of the boundary, the overall spatial distribution of petals, and the colour with SVM classifier on OXFORD 102.	An improvement on performance found, from 55.1% for the best single feature to 72.8% for the combination of all features.
15	2009	An automatic visual Flora – segmentation and classification of flower images	Maria-Elena Nilsback	For segmentation grabcut is used.In classification, they combined different features(color,texture and shape).and passed these feature set to SVM classifier for classification.	Found that combination of multiple feature with using a multiple kernel framework with a SVM classifier works good on Oxford 17 category and a 102 category flower database.

IV. CONCLUSION

In this work we have taken several papers under consideration for survey and describe a general model for flower recognition. By reading these various papers we got a list of different conclusion point from different papers like from [1], we got that Otsu's method achieved better segmentation results than threshold based on histogram and region growing work best among these all. From [23] we got that graph cuts with MRF is performed very well for background subtraction on flower images but it is very slow. And in [11] they mentioned foreground extraction using Otsu method is very fast but result may not be accurate for some images. So from these all we conclude that choosing the method for segmentation is totally depend on the problem doming and requirement of the research work.

For classification we notice that in many paper they took multiple feature attribute like shape, color, texture combinely with different feature extraction method and found improvement on performance by taking multiple feature than single feature .So here we conclude that It is good to take multiple feature but it also very much important to choose the right set of features for the particular problem based on the characteristic of the problem and training dataset. And we marked out that SVM classifier is good for classification of flower due to its simplicity and less time consumption than other classification methods like neural network method which takes a large amount of time for training.

V. FUTURE SCOPE

Based on the comparative result there are some future research directions such as we can apply the classification process on big data with the combination of parallel computing because with the increase of the size of the data set or training set we can achieve more accurate classification which can help to generate more accurate flower recognition result.

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