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Supervised Learning Approach for Flower Images using Color, Shape and Texture Features

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Abstract- This Paper presents an effective Supervised Learning Approach for flower classification using machine learning algorithms. In this method Artificial Neural Network (ANN) is used as Classifier. The proposed approach includes three phases: Pre-processing, Feature extraction, and Classification. The flower image is preprocessed and resized for image quality. Segmentation was done by using threshold. Feature extraction phase was done using color, textures and shape features. Color moments and Color histogram was used in color feature, whereas Gray level co-occurrence matrix (GLCM) and Invarient moment (IM) was used for texture and shape feature. Classification was done by using ANN. The proposed system is able to classify flower images with an average accuracy of 96.0 %.

Key words: **Image processing, Feature extraction, Color feature, Shape feature, Texture feature, GLCM, IM, Neural network, Flower detection, Classification.**

1. Introduction

Image processing plays an important role in extracting useful information from images. Flower image classification is based on the low-level features such as colour and texture to define and describe the image content. Now a day's it is very Essential to identify Particular flowers or flower species and recognise its type. As Many flower species have many colours such as Roses. It is hard to remember all flower names and their information. As there are various fields such as Farming, Floriculture, Gardening, botany research, Ayurvadic treatment etc. So the main objective of different models is to automatically classify flower image according to its features..

Colour is an important property in flower image classification because it is useful for human and machine vision and gives additional information for segmentation and recognition. On the other hand, texture carries information about the distribution of the grey levels of a connected set of pixels, which occurs repeatedly in an image region. Shape is another important feature for perceptual object recognition of images. Shape descriptor is a set of numbers that are produced to represent a given shape feature.

2. Literature Review

The development of the Supervised Learning Approach for Classification of flowers is initiated by the review of various techniques used for Identification of Flower Species. Fadzilah Siraj, Hawa Mohd Ekhsan and Abdul Nasir Zulkifli [1] proposed a technique for Image Classification Using Neural Network. In this paper they present neural networks (NNs) Which are employed for flower classification. For predictive analysis they used three phases namely the image capturing, image processing and NN phases. They uses a set of flower images which are collected from different places. some flowers are from the same types but having different colours as colour is one of the characteristics under investigation. They includes 4 steps of image processing, which are image filtering, image segmentation, region detection, and feature extraction. By using RGB to HSV conversion formula they normalized to get the appropriate value with normalized color features. GLCM is used to calculate the image texture and they get approximate image properties in the object's surface by measuring the intensity of the pixels in the selected region of the surface. However Some categories of flowers (including noise) are tested with NN, they got the test accuracy between 20 to 30 percent only. However after performing series of experiment they combined Different flowers regardless of their colours the classification accuracy was affected by the number of images in the dataset some training accuracies got merely 60%. Some got 100% by creating more flower images for each flower.

Avishikta Lodh and Ranjan Parekh [2] proposed a technique for Flower Recognition System based on Color and GIST Features. In this system they proposed segmentation method for separating flower images from the background. This method extracts statistical values from an HSV image in order to determine a threshold which is later used to create a binary mask that separates the foreground from the background. They also proposed A classification model based on Support Vector Machine (SVM). This model takes statistical color and global GIST features as input and then tries to

predict the class for unknown flower images. In this system Natural images are pre-processed to separate the background and segment out only the foreground that consists of the flower, and color and GIST features are extracted and combined together. They include dataset which contains both inter-class similarities and intraclass differences. This makes the classification process difficult. Some of the inter-class similarities between flower images. In this test have been conducted where images are represented combining texture features computed using gray-level co-occurrence matrix, and color features. Accuracy of this approach they got is 85.93%.

Amira Ben Mabrouk, Asma Najjar and Ezzeddine Zagrouba [3] proposed a technique for Image Flower Recognition based on a New Method for Color Feature Extraction. This method includes two phases which are the training phase and the testing phase. Histograms are used as an input to the SVM classifier. They include different subsections like Segmentation, Feature Extraction, Speed up Robust Feature and gives Comparison between SURF and SIFT. They come to know SURF is faster and more robust against image transformations than SIFT. They have tested lab values and performance measures. They experiment the performances of classification method using a single feature at once and then combine all the features. They have reached a recognition performance of 88, 07 %. Riddhi H. Shaparia, Dr. Narendra M. Patel and Prof. Zankhana H. Shah [4] proposed a technique for Flower Classification using Texture and Color Features. In this system they used texture and color features for flower classification. They applied noise removal and segmentation for elimination of background on input images. They extract Texture and color features from the segmented images. They use GLCM (Gray Level Co-occurrence Matrix) method to extract Texture feature, and Color moment to extract color feature. Neural network classifier is used for classification. They tested 5 flower class and 40 images from each class. By the end 200 images were used for classification. They found 30 neurons in hidden layer. The input original flower image is resized in processing. To acquire flower part in the image they used threshold for segmentation. The accuracy of this flower classification system is 95.0 %. Tanakorn Tiay, Pipimphorn Benyaphaichit, and Panomkhawn Riyamongkol[5] proposed a technique for Flower Recognition System Based on Image Processing. In this system they used edge and color characteristics of flower images to classify flowers. Hu's seven moment algorithm is applied to acquire edge characteristics. Red, green, blue, hue, and saturation characteristics are derived from histograms. K-nearest neighbour is used to classify flowers. They tested this system for 10 flower species. Overall 50 test images for each species. Original flower image is resized for faster processing. RGB to grays cale conversion is used in this to obtain only flower in the image. The system receives edge characteristics by Hu's seven-moment algorithm and color characteristics, K-nearest neighbor is used to classify flowers. Accuracy of the system they got is more than 80%.

3. Proposed Work

Based on the process flow shown in Fig.1, Mainly three phases involved in proposed system, namely the Preprocessing, Feature extraction, and Classification by ANN.

3.1 Database / Input Image

All the images taken for classification of flower are used from World Wide Web in addition to images from own database that can be found in and around the area. Also In this work our own database inspite of existence of other databases has been created. The images are rescaled to obtain the quality. Also segmentation was done by using threshold to obtain the flower part.

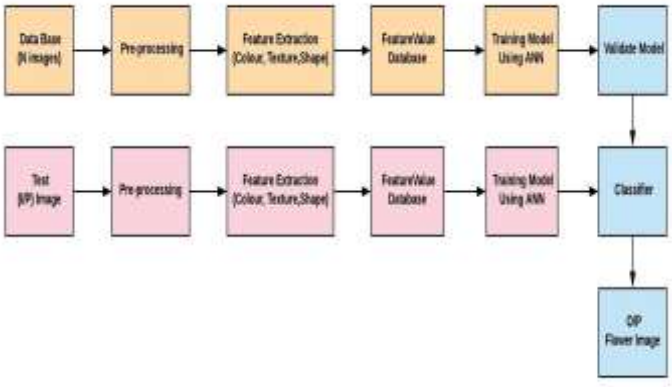

Fig- 1: Block diagram of the proposed work**.**

3.2 Pre-processing

Pre-processing an image is used to improve image quality. The query image and the images from the database are pre-processed and output is given to the next step. It helps to improve the quality of images and focus the main region of the image which will generate the better result.

3.3Feature Extraction

In features extraction step image features are computed by using different methods. These features are stored in database. This paper considering the main three features color, texture and shape for these features different methods are used.

3.3.1 Color Feature extraction

The color histograms can represent the color of the products more precisely. Product images in similar color with the query image can be given preferentially. The fuzzy histogram linking technique is applied to extract color feature. The color information is a 24-bin fuzzy linking histogram which is extracted in HSV color space. The image is separated into a preset number of blocks. Next, the values of H, S and V of every block are calculated and used as the inputs of the two fuzzy linking systems. The output values are added to the 24-bin fuzzy linking histogram. Color features can be extracted using Color Moment. Color moments are rotation and scaling invariant. Color moments give information about shape and color. It is computed for any color model like RGB, HSV, in color model, per channel, three color moments are computed. E.g. if color model is RGB then 9 moments and if color model is CMYK then 12 moments are computed.

3.3.2 Texture feature extraction

One of the simplest methods for describing texture is the statistical methods. Statistical methods analyse the spatial distribution of the gray values by computing local features at each point in the image, and deriving a set of statistical distribution of the local features. Co-occurrence matrix representation and statistical moments are the most common methods used for texture representation. It is important to take into account the relative position of pixels with respect to each other. One way to incorporate this information into texture analysis is to consider the distribution of intensities and the relative positions of pixels in an image. This can be achieved by the Gray-level Co-occurrence Matrix (GLCM). It measures the relative frequencies of occurrence of gray level contributions among pairs of pixels with a specific spatial relationship. Texture feature is extracted by using GLCM method. It is applied on gray scale image hence we have to convert the segmented color image into gray scale image. Texture feature calculations means to measure the variation in intensity at interested pixel in an image. After the calculation of these texture features, feature vector is constructed which is stored in database.

3.3.3 Shape feature extraction

Shape is one of the common image features that used to represent the image first, the image is converted from colored to gray scale image as there is no use of colors here. The canny edge operator is applied to detect edges of objects in an image. In image processing edges characterize boundaries. Edge detecting of image significantly reduces the amount of data and filters out useless information, though it preserves the important structural properties in an image finally moment is calculated as the moment is the feature for shape content the main region image is extracted from the original image using the image mask. Like this shape is extracted.

3.4 Classifier: ANN

An artificial neural network (or simply neural network) consists of an input layer of neurons (or nodes, units), one or two (or even three) hidden layers of neurons, and a final layer of output neurons. It receives, processes, and transmits information. Input layers receive inputs from sources external to the system under study. The output layers send signals out of the system, while the hidden layers are those whose input sends outputs are within the system. In this system we used ANN as classifier.

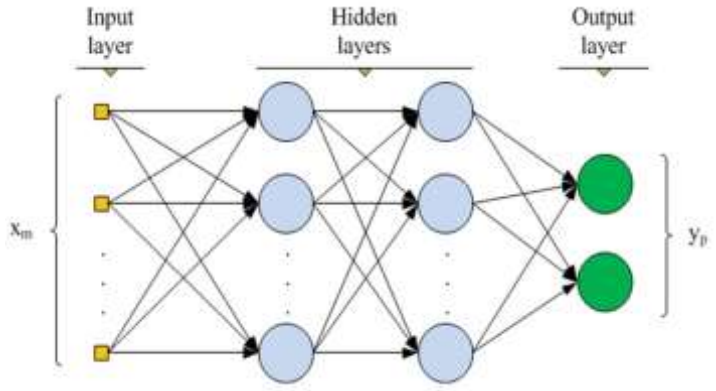

Fig- 2: Architecture of ANN

4. Results and Discussions

We have developed a Graphical User Interface in Matlab using GUIDE toolbox. The execution of proposed system is given by following steps

4.1 Neural Network Training Tool

First user will open Graphical User Interface in Matlab. User have to select flower image from database path. If user selects flower image from database then the database load window will appear. The extraction features of database are extracted by the tool. After the feature extraction process the database will loaded into the neural network training tool. The custom neural network view above shows hidden and output layer of input and output respectively. The algorithm will be processed in steps and after some iterations it will calculate the database in plots like performance, training state and regression. The gradients will be calculated until the minimum gradients reached. It will calculate the iterations with the respected time which is required to validate the model as shown in Screenshot.

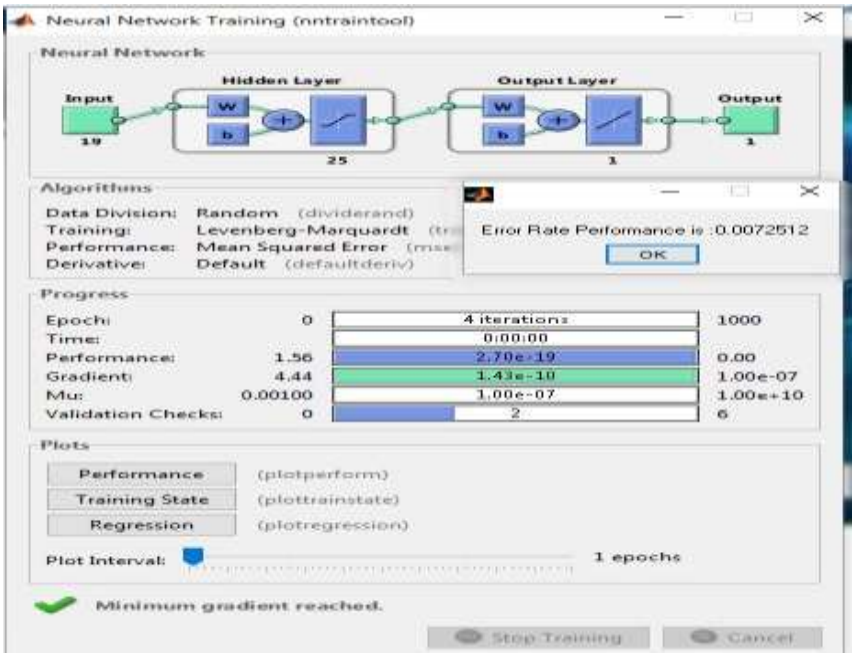

Fig -3: Neural network Training Tool

4.2 Identification of Flower

In this work we collect our own database. The proposed system is tested for 10 flower class (Marigold, Lotus, Rose, Hibiscus, Sunflower, Lilies, Zinnia, Petunia, Tulips and Dahlias) and 15 images from each class hence total 150 images is used for classification. We have tested 5 images per 10 flower species, so total 50 images are tested on our proposed system, 48 Images are identified as their respective flower Species.

The test input flower image will be loaded and again preprocessing will be done as shown below. The input database image features are extracted with respect to colour, texture and shape. And after calculation the input features will be matched with the previous database.

Fig-4: Input Flower Image and Preprocessed Image

In the last step the neural network classifier executes the testing. In the similarity measurement, the features of the user query image are computed in same manner and compared with features of images in database to retrieve relevant images. Features from database are compared with feature vector of query image for similarity and retrieval of relevant images. After validating it identifies the image species and will show the flower species name as a result shown below.

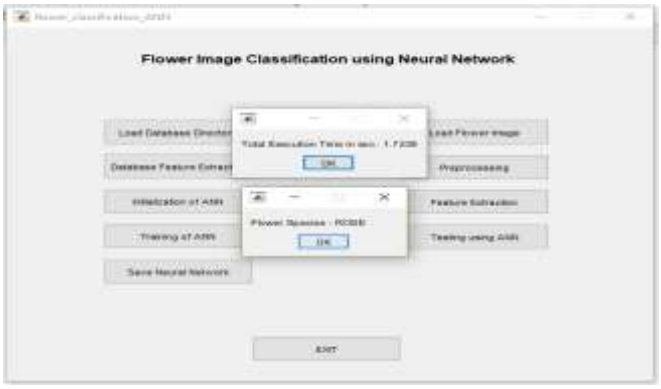

Fig-5: Identification of Flower

Out of 50, 48 are correctly identified as their respective flower species, 2 images are misclassified. Flowers with Successfully identified species are shown below in Table 1.

Table -1: Successfully identified Flower species Name.

Sr.No	Flower Image	Image Name	Identificaton
1		Rose	Rose

2		Hibiscus	Hibiscus
3		Lilies	Lilies
4		Lotus	Lotus

5. Conclusion

The flower classification system based on digital image processing takes the input image which is flower image taken from dataset. In this system of flower classification for speedy processing the input. Original flower image is resized.. In this proposed study we created a flower classification system based on image processing techniques and ANN. The comparison that have been carried out on this proposed work, was based on partial data that include all flowers species with 10 images for training and 5 images for testing, so total 15 images per species and total 10 species were considered which are famous in India. For flower classification, neural network classifier is used as Feed Forward Back propagation algorithm.
From this point we can consider implementing our system on the whole data as one of the future works. The work have been done in this project is considered as one step in a long science journey, many of modification and future works are available; like enhancing the output of segmentation process by modifying parameters of active contour model or by using another segmentation approach, there are many color, texture and shape descriptor may be used as replacements of our used approach or same descriptor in deferent approaches The accuracy of this flower classification system is 96.0 %.

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