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Flower Grain Image Classification Using Supervised Classification Algorithm

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Abstract:- Some of the world's plants are already at the edge of becoming extinct. So to saving earth's biodiversity for future generations is an important global task. To identify flower pollen grain is an important task for the reproduction procedure. This involves mapping plants distribution by collecting pollen and identifying them in a laboratory environment. But it takes long time consuming process to identify them so for that computer system is developed the model to identify pollen grain and classify them. Our proposed system identifies flower pollen grain images and classifies them into different families. Flower pollen grain surface parameters like color, texture, shape etc are used to extract the features. In our proposed system we used color and texture feature. In order to extract the color feature we used HSV color model and for texture feature used GLCM (Gray level co-occurrence matrix).We have used ANN feed forward back propagation algorithm to classify our pollen grain images. Accuracy of classification is checked using color feature and texture features standalone and also with combined features. Instead of using single features combined features gives better result. In our proposed system we have taken dataset of 122 images, 77 images are trained with ANN feed forward back propagation and 35 images used for testing set. Our system gives approximate 77.14% accuracy with ANN.

Keywords:- Feature extraction, Color feature, Texture feature, HSV, Otsu's method, Canny edge detection, GLCM, neural network.

I. INTRODUCTION

A flower is the reproductive structure found in flowering plants. The biological function of a flower is to effect reproduction, usually by providing a mechanism for the union of sperm with eggs [2].

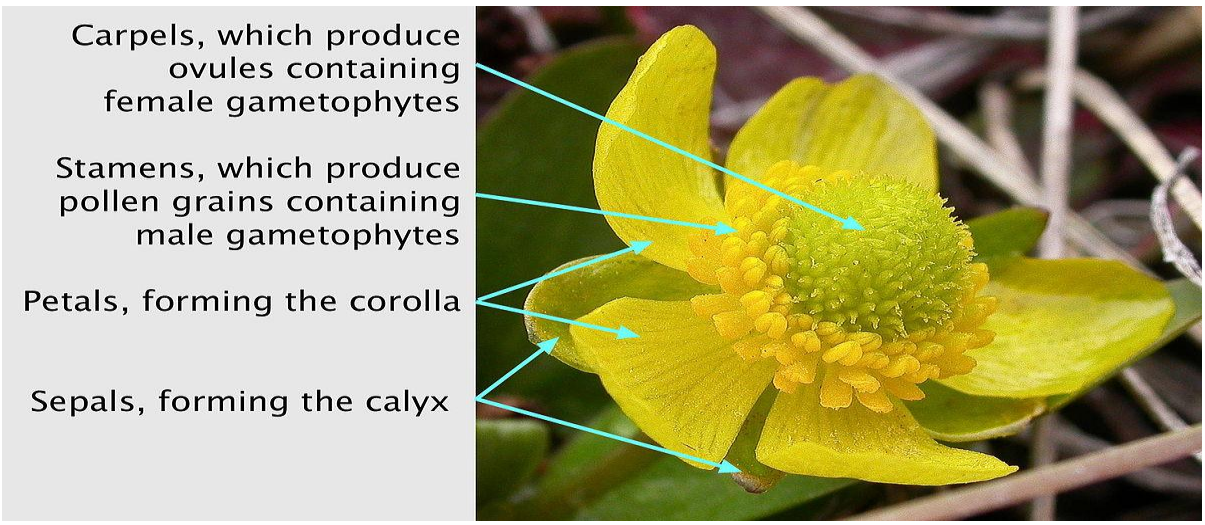

Fig.1 Diagram of flower part[2]

Pollen grains represent the male portion of the reproductive process in plants and trees [2]. The pollen grain in a plant is apart used to transport the male gamete to the female part of a flower. These tiny bodies are swirling in the air and on the legs of insects so that they can join the female part of the plant to create a new seed.

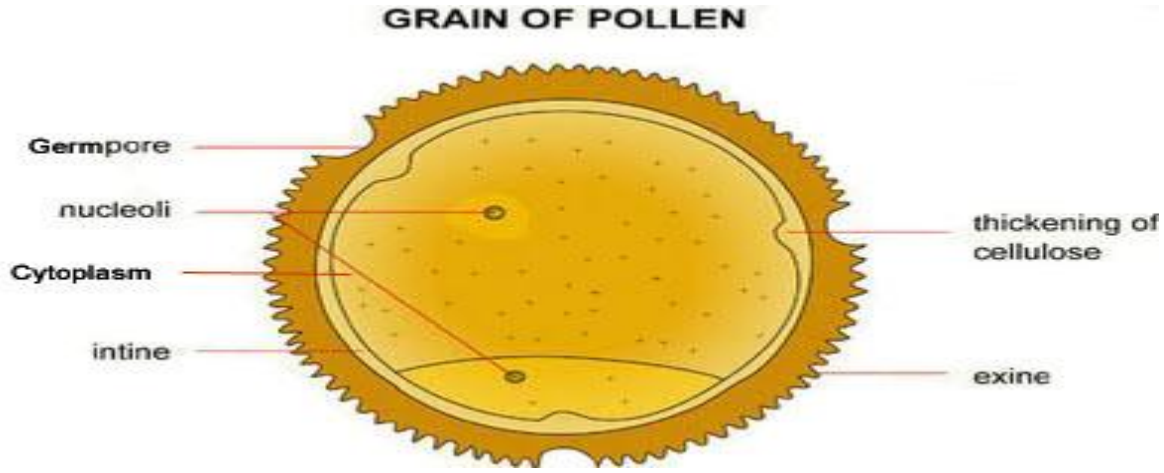

Fig.2 Diagram of pollen grain[2]

Digital image processing is a rapidly growing area of computer science since it was introduced and developed in the 1960's [1]. Digital image processing deals with manipulation of digital images through a digital computer. It is focuses on developing a computer system that is able to perform processing on an image [1]. Digital image processing allows one to enhance image features of interest and extract useful information from it.

Classification techniques are widely used to classify data among various classes. Classification techniques are being used in different system to easily identify the type and group to which it is belongs to. There are many algorithm used for classification. There is mainly two types of classification algorithms Supervised classification algorithms and Unsupervised classification algorithms. In Supervised learning the computer is presented with example inputs and their desired outputs, given by a "teacher", and the goal is to learn a general rule that maps inputs to outputs [3]. While in Unsupervised learning, no labels are given to the learning algorithm, leaving it on its own to find structure in its input. Unsupervised learning can be a goal in itself (discovering hidden patterns in data) or a means towards an end [3].

A multilayer preceptor (MLP) is a feed forward artificial neural network model that maps sets of input data onto a set of appropriate outputs[4].A MLP consists of multiple layers of nodes in a directed graph, with each layer fully connected to the next one. Except for the input nodes, each node is a neuron (or processing element) with a nonlinear activation function. MLP utilizes a learning technique called back propagation for training the network.

II. LITERATURE REVIEW

Here we have presented the review of our working related area of flower pollen grain classification and also present the methods used for to classify the images. [6] Fadzilah Siraj, Muhammad Ashraq Salahuddin and Shahrul Azmi Mohd Yusof proposed the system for classification of Malaysian blooming flower. HSV color extraction and GLCM Texture Extraction are used to extract the flower features.Otsu's method was applied in order to compute a global threshold. NN has shown a higher average prediction results vs. logistic regression. [8] Pavan Kumar Mishral, Sanjay Kumar Maurya, Ravindra Kumar Singh and Arun Kumar Misral present a semi automatic plant identification based on digital leaf and flower images. Extracted features from RGB component, shape feature Area Convexity, Perimeter Convexity, sphericity and Circulatory. They have used Unsupervised learning algorithm which has less accuracy as compared to supervised classification algorithm. [7] Tanakorn Tiay, Pipimphorn Benyaphaichit, and Panomkhawn Riyamongkol proposed flower Recognition System Based on Image Processing.The system uses edge and color characteristics, Hu's seven moment algorithm, K-nearest neighbor is used to classify flowers. The Canny edge detection algorithm is applied .This system is based on color model so the accuracy is high if their color are distinct. [9] Prof.Suvarna Nandyal, Miss.Supriya Bagewadi proposed Automated Identification of Plant Species from Images of Leaves and Flowers used in the Diagnosis of Arthritis. The features namely height, width, margin and texture features are used for extracting leaf shape features. Similarly for flowers, the petal count and colors are extracted in RGB and Ycbcr color space. The obtained features are trained by neural network classifier. [16] Dr.S.M.Mukane, Ms.J.A. Kendule proposed Flower Classification Using Neural Network Based Image Processing.In this paper, it is proposed to have a method for classification of flowers using Artificial Neural Network (ANN) classifier.Textural features such as Gray level co-occurrence matrix (GLCM) and discrete wavelet transform (DWT).It is found that flower images can be classified easily with the GLCM features only. [12] R.S.Sabeenian, M.E.Paramasivam and P.M. Dinesh proposed a system to Identification and Counting of Fertile Pollen Grains

using Morphological operators,The scope of the work is to identify the fertile pollen grains using Morphological operators along with FSF and CGF. The identification can be done using two approaches-based on intensity and size variation. The Proposed work mainly focuses on the identification of fertile pollen grains based on size variation.[11] C. H. Aru, W. R. Sam and D. Christopher Durairaj proposed a system of Texture Feature Extraction for Identification of Medicinal Plants and Comparison of Different Classifiers. Texture analyses of the leaf images have been done in this work using the feature computation. The features include grey textures, grey tone spatial dependency matrices(GTSDM) and Local Binary Pattern(LBP) operators. Various features from first order statistics, GTSDM featureand LBP are computed. They are mean, variance, skewness, standard deviation, GTSDM Entropy and LBP mean. Different combinations of the computed features are worked out to find out the best feature combination that will provide the better classification. The method of classifying without preprocessing performed better [14] NefeliVassiliki Politi-Stergiou, IliasTheodorakopoulos proposed a system of Local focus-tolerant image descriptors for classification of biological Particles.In this proposed system they have use SIFT descriptors in order toencode local gradient, fused with features derived from anintroduced adaptive filterbank of Gabor filters. Gabor (Mean) **,**Gabor (Mean &Skewness) **,**SIFT and SIFT & Adaptive Gabor are used to extract the features.

III. FEATURE EXTRACTION

In order to extract the relevant information from raw data, they need to be further processed by the feature extractors.

Feature Extraction using Color Model:

Hue, Saturation, Value or HSV is a color model that describes colors (hue or tint) in terms of their shade (saturation or amount of gray) and their brightness or value. The HSV color wheel may be depicted as a cone or cylinder[4].Hue is expressed as a number from 0 to 360 degrees representing hues of red (starts at 0), yellow (starts at 60), green (starts at 120), cyan (starts at 180), blue (starts at 240), and magenta (starts at 300). Saturation is the amount of gray (0% to 100%) in the color. Value (or Brightness) works in conjunction with saturation and describes the brightness or intensity of the color from 0% to 100%.

Feature Extraction using Texture analysis:

Co-occurrence matrix captures numerical features of a texture using spatial relations of similar gray tones. Numerical features computed from the co-occurrence matrix can be used to represent, compare, and classify textures. The following are a subset of standard features derivable from a normalized co-occurrence matrix: Contrast: Measures the local variations in the gray-level co-occurrence matrix. Correlation: Measures the joint probability occurrence of the specified pixel pairs. Energy: Provides the sum of squared elements in the GLCM. Also known as uniformity or the angular Homogeneity: Measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal.

IV. PROPOSED MODEL

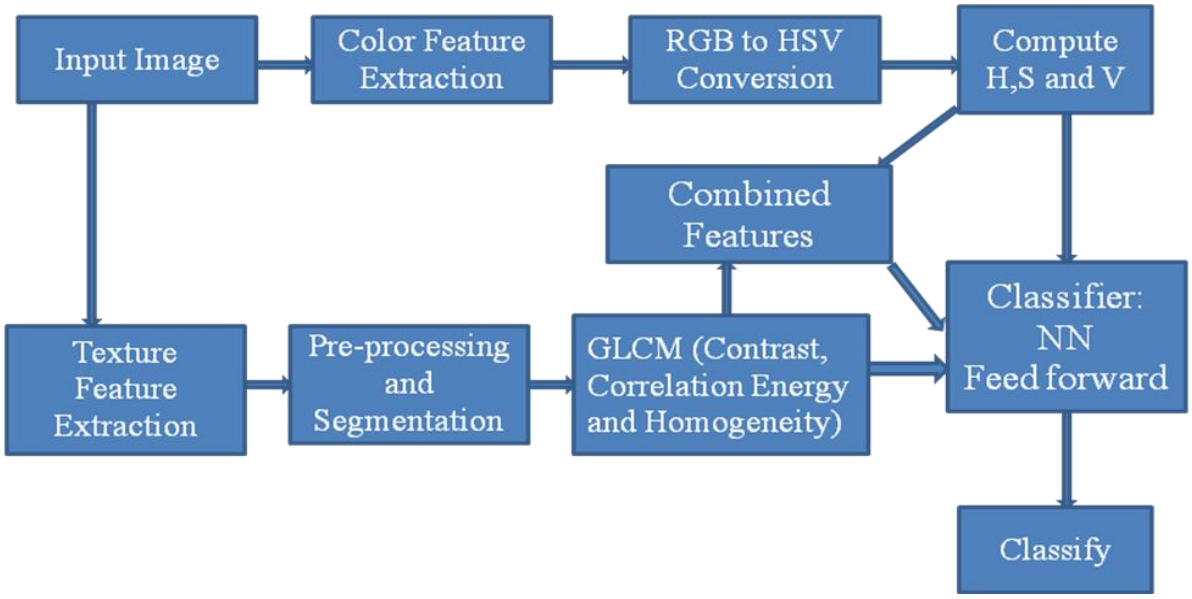

Fig.3 Flow of proposed Model

Our proposed model is described the flow of the system. Pollen grain images are processed to extracts the features. Color feature extraction and texture feature extraction are used in our proposed system. Feed forward NN is used to trained and test our data for the classification.

V. IMPLEMENTATION

1. Take input images of flower pollen grains.

2. Color feature extraction

To extract the colour parameter independent of external illumination, the RGB space is converted to Hue, Saturation and intensity Value (HSV) parameters, where Hue represents the colour component independent of colour saturation and illumination intensity.

- Compute H,S and V from RGB image
- Find mean of H,S and V values
- Plot Histogram

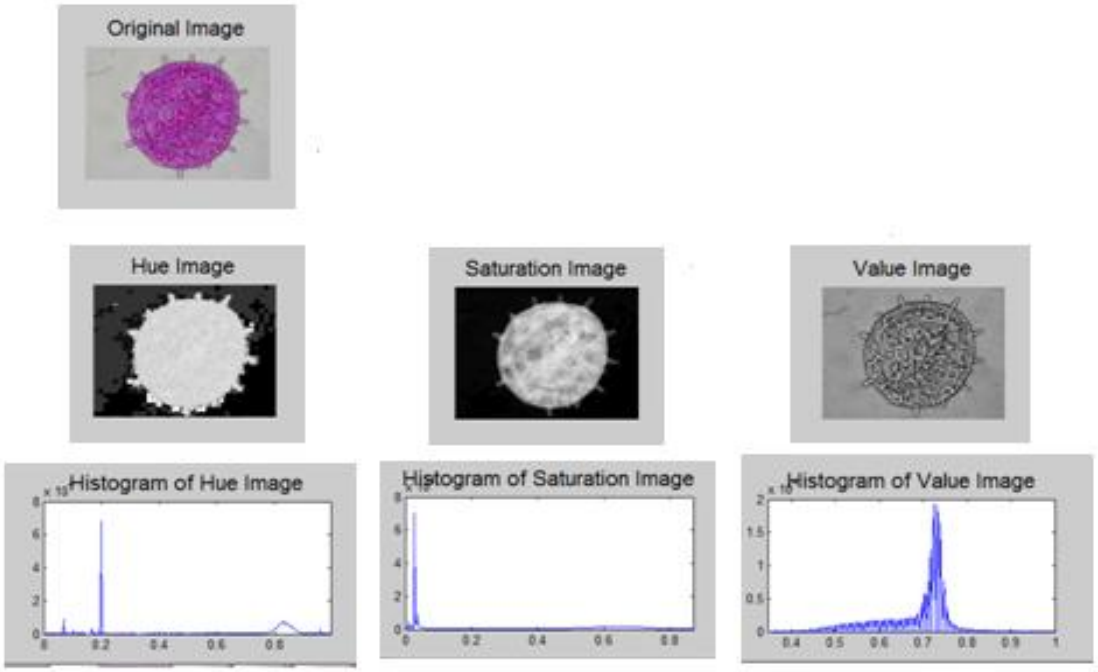

Fig.3 Results of RGB to HSV

4. Texture Feature extraction

- Perform pre-processing
- Edge detection using Canny edge detector

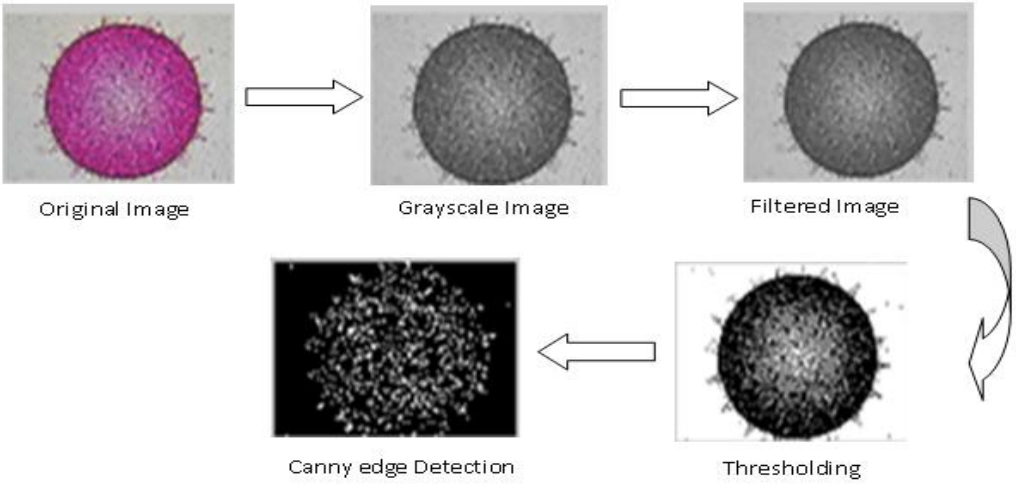

Fig.4 Pollen of Pavonia x gledhillii. Preprocessing and Segmentation

Apply GLCM(Gray level co-occurrence matrix)

- Compute contrast, energy, correlation and homogeneity

5. Feed features to the neural network

V. RESULTS AND DISCUSION

We have taken Dataset of 112 images,77 images are used for training set and 35 images are used for testing set. Taken 5 images from each class for testing. HSV color feature and GLCM texture features are extracted and feed this features to the neural network for classification.

Class	Family	HSV+NN correct Result (%)	Incorrect Result (%)
1	Ranunculaceae	20.00	80.00
2	Solanaceae	20.00	80.00
3	Liliaceae	20.00	80.00
4	Compositae	40.00	60.00
5	Malvaceae	80.00	20.00
6	Rosaceae	80.00	20.00
7	Pinaceae	40.00	60.00

Table-1 Results of HSV+NN(Avg.Accuracy:42.86%)

Class	Family	GLCM+NN correct Result(%)	Incorrect Result(%)
1	Ranunculaceae	20.00	80.00
2	Solanaceae	0.00	100.00
3	Liliaceae	40.00	60.00
4	Compositae	80.00	20.00
5	Malvaceae	60.00	40.00
6	Rosaceae	0.00	100.00
7	Pinaceae	60.00	40.00

Table-2 Results of HSV+NN(Avg.Accuracy:37.14%)

Class	Family	(HSV,GLCM)+NN correct Result (%)	Incorrect Result (%)
1	Ranunculaceae	80.00	20.00
2	Solanaceae	100.00	0.00
3	Liliaceae	60.00	40.00
4	Compositae	100.00	0.00
5	Malvaceae	60.00	40.00
6	Rosaceae	100.00	0.00
7	Pinaceae	40.00	60.00

Table-3 Results of (HSV, GLCM)+NN(Avg.Accuracy:77.14%)

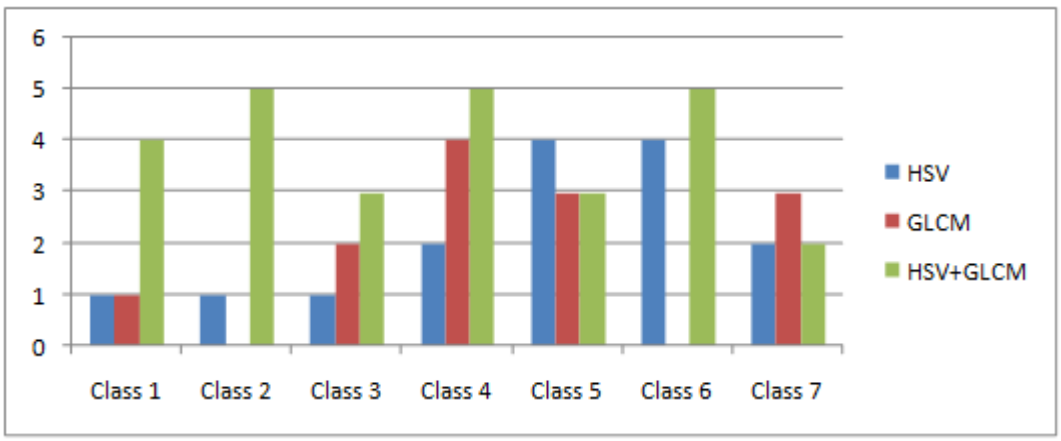

Fig.5 Comparison of results

IV. CONCLUSION

Our proposed system is identified flower pollen grain and classifies them into different classes. We have used colour and texture parameters to extract the features of pollen grains. ANN feed forward classifier is used as the classification algorithm. Dataset of 112 images are taken, 77 images are used for training set and 35 images are used for testing set. Taken 5 images from each class for testing. Colour Features with NN Gives 42.46% average accuracy. Texture Features with NN Gives 37.14% average accuracy.Combine Colour and Texture features with NN Gives 77.14% average accuracy.So as compared to using single features combine feature gives better result.

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