# SPECIMEN FORMAT FOR THESES OF MONTH

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|---|---|---|
| **Faculty** | : | Science |
| **Department** | : | Computer Science |
| **Branch/ Area:** | : | Image Processing |
| **Sub Subject Heading:** | : | - |
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| **Title of the thesis** | : | Computer-Aided Plant Identification Through Leaf Recognition Using Enhanced Image Processing and Machine Learning Algorithms |
| (i) In Roman Script<br>(ii) In roman Script | | – |
| **Nomenclature of Degree**: | : | Doctor of Philosophy |
| **Month & Year of Enrolment**: | : | November, 2008 |
| **Month & Year of Registration**: | : | November, 2008 |
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| **Month &Year of Award** | : | September, 2014 |
| **Name of Supervisor** | : | Dr.S.N.Geethalakshmi |
| **Designation of Supervisor** | : | Professor |
| **Centre/department/school in which research was conducted** | : | Computer Science |
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**Abstract within 300 words:**

Computer aided identification of plants is an area of research that has gained more attentionin recent years and is proving to be a very important tool in many areas including agriculture, forestry and pharmacological science. A general process of a Computer Aided Plant Classification through Leaf Recognition (CAP-LR) contains four steps, namely, leaf image enhancement, leaf segmentation, feature extraction and classification. The first step in CAP-LR, enhances a leaf image by using an approach that simultaneously removes noise, adjusts contrast and enhances boundaries. The second stepuses a wavelet based segmentation approach that combine clustering with texture based color features to extract the leaf from its background. A total of 28 features were extracted which were grouped into five categories, namely, geometric features, color features, texture features, fractal features and leaf features. To enhance the process of leaf recognition, a fusion method is proposed which combines Genetic Algorithm (GA) and Kernel Principal Component Analysis (KPCA) with shared and merger operations in the third step. The single and fused feature sets are then used by classifier to recognize the leaves and identify the plants. For this purpose, a two-level classification model was used, where the first level classifier was used to produce an refined training set, which was used to train the second level classifier. Two leaf image datasets, namely, standard and real, were used during experiments that evaluated the performance of the proposed algorithms. The experimental results showed that the two-level classification algorithm improved the efficiency of recognition and identification in terms of accuracy and speed. The various results showed that the model WNN for the first classifier and SVM for the second classifier that used GA $\cap$ KPCA with leaf and fractal produced high recognition rate.

**i) Major objective** :

To design and implement an automated system that identifies a plant through digitized images of various leaves.

**ii) Hypothesis**:

**iii) Methodology** :

(i) To improve the quality of the leaf images using wavelet based denoisingand edge enhancement algorithm.

(ii) To segment the leaf imagefromits background using wavelets and texture based color features.

(iii)To perform feature extractiontechniquesto identify and extract characteristics that best represent a leaf image and then use feature selectiontechniques to obtain a reduced feature subset.

(iv)To identify a plant using a two-levelclassification algorithm to perform a matching process that maps a leaf image to a plant category.

**(i) Findings:**

Experiments were designed to evaluate the proposed algorithms of each step of CAP-LR. Two datasets, one standard dataset (flavia leaf recognizer) and one real dataset (created by the researcher) were used during experimentation. The enhancement algorithm was evaluated using four metrics, namely, Peak Signal to Noise Ratio (PSNR), Figure of Merit (FoM), Mean Structural Similarity Index (MSSI) and Speed of enhancement (Seconds). The segmentation algorithm was evaluated by analyzing its visual results and speed of segmentation. The feature extraction and selection algorithms were evaluated in terms of number of features selected and time taken to select the most prominent set of features. Their effect on identification and recognition was also analyzed. The proposed CL-CL models were evaluated using three parameters, namely, recognition rate, error rate and speed.

. Thus, from the results, it can be seen that maximum accuracy is produced using leaf features while considering single feature set and leaf with fractal in fused feature set.The intersection operation on GA and KPCA selected features proved that they provide more effective results when compared with GA, KPCA and GA, KPCA with union operation.

During recognition, best results were produced when WNN was used for first level and SVM is used for second level. The results proves that when different classifiers are used for level 1 and level 2 during classification, the process of leaf recognition for plant identification is efficient in terms of the parameters recognition rate, error rate and speed.. In general, models that used different classifiers for first and second level produced better result when compared to the conventional models and the models that use the same classifier for both the levels.

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