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Leaf Classification for Plant Recognition using Machine Learning

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Abstract - Plant acknowledgment frameworks that created by PC vision specialists, help botanists in quicker acknowledgment and identification of obscure plant species. As of not long ago, various investigations concentrated on the procedure or calculations that boost utilization of herbal datasets for plants expectation demonstrating, however this strategy relies upon leaf attributes which can be changed with plant information and diverse element extraction methods. Making a plant database for brisk and proficient arrangement and acknowledgment is a significant advance for their protection. This methodology would assist with separating helpful highlights of leaf and improve the precision of leaf order. The standard leaf pictures are exposed to pre-preparing. Highlight esteems are extricated from pre-prepared picture and they are prepared and arranged. The proposed strategy is assessed on notable natural datasets and has prevailing with regards to accomplishing an exactness of over 91% individually.

Key Words: Image acquisition, Image Pre-processing, GLCM Feature extraction, Multiclass SVM classifier.

1. INTRODUCTION

A decent comprehension of plants for help to perceive new and uncommon plant species is fundamental for improving pharmaceutical businesses, the eco-framework balance, agronomy usage and vigor. Botanists use minor departure from the leaf attributes as a near instrument for their examination about plants. Then again, because of the advancement of science and hereditary points, a considerable lot of the compound plants can't perceive by conventional individuals or even master individuals in this field. Consequently, attempted to utilize Machine learning methods to illuminate this issue. In PC vision, in spite of the numerous endeavors that have been led, plant acknowledgment appears as a difficult and unsolved issue. This is on the grounds that a plant in nature has a fundamentally the same as shape and shading. Notwithstanding plants leaf morphological varieties, for example, changes in the size, surface, shape, venation, etc, has been added to this difficult issue.

Along these lines, there is a requirement for simple and effective acknowledgment and characterization of plant by their classification. Plants are generally recognized by taxonomists and the procedure is tedious. A portion of the plants species helps in recognizing them are root, stem, leaf, blossom, seed and natural product. Leaf is one of the significant component for perceiving a plant because of its accessibility nearly consistently. The fundamental point of this undertaking is to focus on the plant order dependent on the surface of the leaf. The surface is the intriguing region of exploration for plant leaf arrangement which incorporates propelled strategies.

2. RELATED WORK

In [1], Introduced a novel approach for classification of plants which was based on the characterization of texture properties. They have utilized a combined classifier learning vector quantization along with the radial basis function. The proposed systems ability to classify and recognize a plant from a small part of the leaf is its advantageous thing. This system is mostly applicable as the combined classifier method produced high performance far superior to other tested methods as its correct recognition rate was 98.7% which has been revealed in the result.

In [2], Proposed a method that incorporates shape, vein, color, and texture features. They have used probabilistic neural networks (PNN) as a classifier for the plant leaf classification. Commonly several methods are there for plant leaf classification but none of them have captured color information, because color was not recognized as an important aspect to the identification.

In [3], Proposed a feature fusion technique using the Gabor filter in the frequency domain and fusing the obtained features with edge based feature extraction. The extracted features were trained using 10 fold cross validation and tested with CART and RBF classifiers to measure its accuracy.

In [4], This research paper introduced an approach that combines relatively simple methods which used shape and texture features. The shape-based method extracts the contour signature from every leaf and then calculates the dissimilarities between them. The orientations of edge gradients are used to analyze the macro-texture of the leaf. The results of these methods are then combined with the help of incremental classification algorithm which provides 81.1%accuracy.

In [5], This paper concentrates mainly on the procedure of how the test feature can be compared with the database. The database is created with different kinds of leaf and other purpose leaves. For the execution of test leaf a test image is captured and the parameter is tested. With this the leaf which gives the closest match will be labeled.

In [6], Current study used the image processing techniques in order to classification of plants based on leaves recognition. Two methods called the Gray-Level Co-occurrence matrix (GLCM) and Principal Component Analysis (PCA) algorithms have been applied to extract the leaves texture features. To classify 13 kinds of plants with 65 new or deformed leaves as test images, the Algorithms are trained by 390 leaves. The findings indicate that the accuracy of PCA method with 98% come out to be more efficiency compare to the GLCM method with 78% accuracy.

In [7], The important aspect is to develop a system which classifies the plants. In this paper a novel framework for recognizing and identifying plants is been proposed, leaves can be recognized based on certain methods. The recognition of the leaves is done based on feature extraction method and the Zernike moments. Shape, vein, color and texture features have been used to identify the leaf and neural network approach is used to classify them and it provides accurate results in less time.

In [8], This paper proposes a simple and efficient methodology for plant classification using digital image processing and machine vision technology. The three major phases in proposed methodology are pre-processing, feature extraction and classification. Pre-processing is done in order to reduce unwanted noise from the input image. In feature extraction phase, different morphologic features such as mean, standard deviation, entropy are extracted from the pre-processed leaf image. In the third phase, to classify and recognize plant species. An accuracy of 93.75% is obtained for the proposed methodology.

3. PROPOSED METHODOLOGY

This approach can be a case study to provide improved accuracy in identification of proper plant leaves. It will help for horticulture and botanical industry as this framework can be used as an automated tool that can classify or identify the proper leaf. So that this work can provide an helping hand to the skilled farmers in identifying the plant categories.

- **Image Acquisition**

The initial step of the framework is picture obtaining. The picture of a leaf of the plant to be perceived is caught and taken care of to the framework. Since our framework is presently a work area application, we need to find the picture by means of the UI.

- **Image Pre-processing**

Pre-processing is utilized to get the external state of the picture from the shaded picture of the leaf and to expel any sort of outer clamors present in a picture. The fundamental thought of preprocessing is to improve the picture subtleties so includes are obviously found for additional preparing.

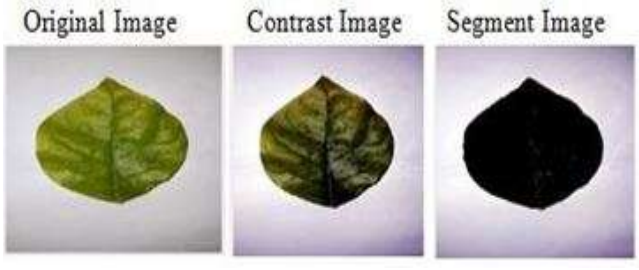

Fig -1: Image Pre-processing Stage.

- **GLCM Feature Extraction**

Features extraction is the next important step after pre-processing to perform. GLCM feature extraction aims at the extraction of the relevant information that characterizes different classes. GLCM creates a gray-level co-occurrence matrix from particular image. The GLCM involves several properties and parameters for extracting the texture features.
Properties of GLCM:

1. Contrast: Returns a proportion of the facility differentiate between a element and its neighbor over the whole image.

2. Correlation: Returns a proportion of however corresponded a element is to its neighbor over the whole image. association is one or - one for associate degree impeccably definitely or contrarily connected image.

3. Energy: Returns the overall of square parts within the GLCM. Vitality is one for a gradual image.

4. Homogeneity: Returns a price that gauges the closeness of the dissemination of parts within the GLCM to the GLCM motility. Homogeneity is one for associate degree motility GLCM.

- **Multiclass SVM classifier**

This is the last advance of discovery where classifier is utilized to perceive the sort of the leaf. Characterization manages coordinating the given information vectors with one of the prepared information of various classes. Picture grouping investigates the numerical properties of different picture includes and composes information into classifications. Arrangement calculations commonly utilize two periods of handling: preparing and testing. In the underlying preparing stage, trademark properties of ordinary picture highlights are disengaged and dependent on these every arrangement class, for example instructional course, is made. In the resulting testing stage, these element based are utilized to characterize the picture highlights.

4. SYSTEM DESIGN

Framework Design is a procedure of characterizing the engineering, modules, interface and the information for the framework to fulfill these particular necessities. Framework Design could be appear as a use of a framework hypothesis to item improvement.

- **System Architecture**

The framework engineering gives a significant level outline of the capacities and obligations of the framework. It characterizes the breakdown of the framework into different subsystems and the individual jobs played by them. The elevated level plan of the proposed framework is appeared in figure.

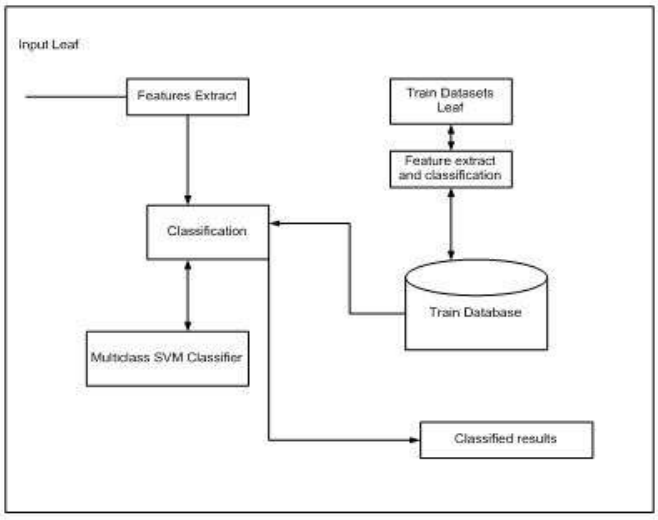

Fig -2: Proposed System Architecture.

- **Sequence Diagram**

A sequence graph is an association outline that shows how articles work with each other and in what request. It is a build of a message arrangement outline. At first information is given, one's picture distinguished then it is divided, checked with RGB determinations. SVM information recognize the leaf.

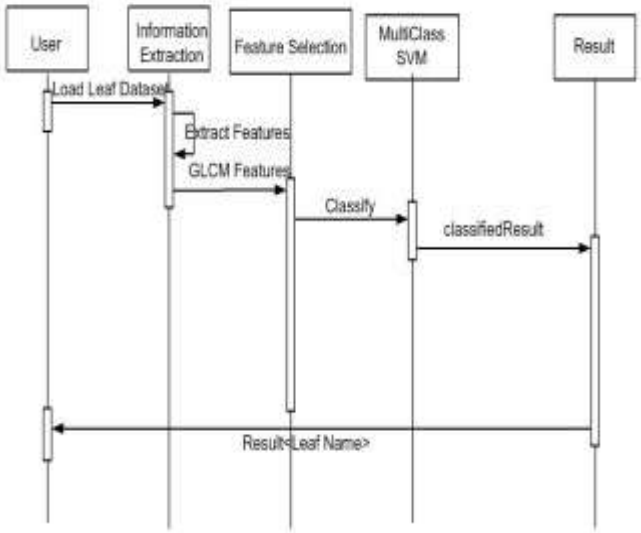

Fig -3: Sequence Diagram of the System.

- **Use case Diagram of the system**

A use case diagram is a type of behavioral diagram created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases.

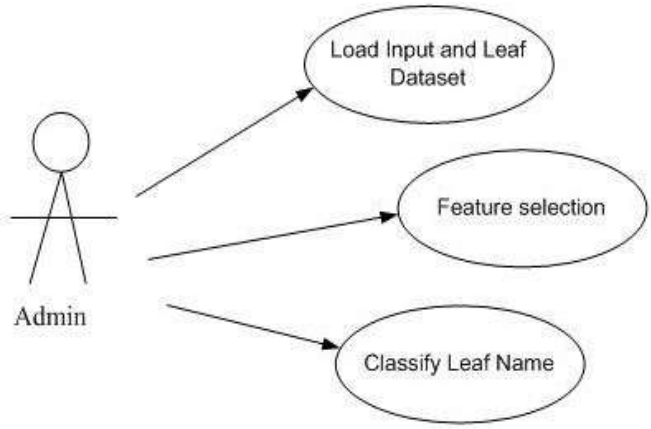

Fig -4:Use Case Diagram.

5. RESULTS AND DISCUSSION

- **Dataset**

The dataset used in our experiment is collected by our self. We pluck the leaf from the plant in the fields near, which consists of intact and fresh leaf images in different rotation for 12 plant species class and constructed by our self. Feature values are extracted from standard datasets and they are trained and tested.

Fig -5: The sample dataset of leaf images.

- **Home Page**

Fig – 6: Home Page.

- **Select the leaf image from Test Dataset**

Fig -7: Loading the leaf image.

- **Displaying the result with the Accuracy graph**

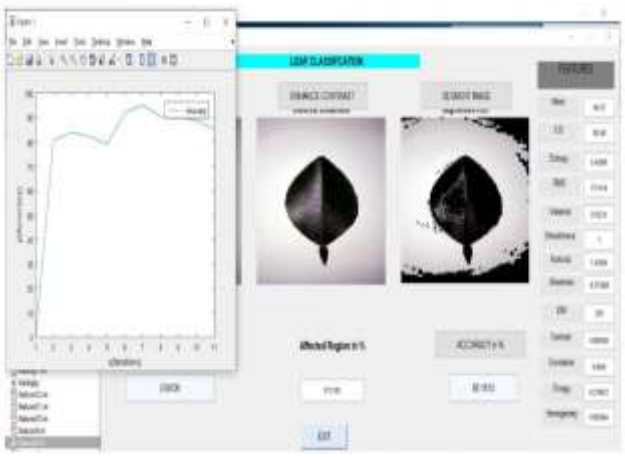

Fig -8: Accuracy Graph.

6. CONCLUSION

In this project the main aim is to identify the type of leaf. The database consists of a set of pre-defined leaf images which are then compared with the input leaf image to get the closest match. The leaf classes are identified with the features extracted using certain algorithms. The given input leaf is compared with the database created to get the closest match and the class name of the closest match is being assigned to the input leaf. The structure analysis is done with the morphological processing which is nothing but the structuring elements of binary images. The features are extracted with the GLCM technique. The classes of leaves are identified with the features determined. GLCM gives better structure approximations and hence makes classification easier. It is found that classification accuracy is better with SVM classifier than neural network classifier.

7. FUTURE SCOPE

Next step in the future work, different classifiers will be tested based on our dataset and the results will be recorded. Here in this project we are considering texture feature. However, we may have to consider images that contain many leaves in order to test the ability of the classifiers and we are looking to consider leaf margins, veins for better identification of confusing leaves. We can also build a mobile application of the proposed system, using this one can easily and efficiently classify the leaves.

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