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Grapes Leaf Disease Recognition using ML

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Abstract: ***Having diseases is quite natural in crops due to changing climatic and environmental conditions. Diseases affect the growth and produce of the crops and often difficult to control. To ensure good quality and high production, it is necessary to have accurate disease diagnosis and control actions to prevent them in time. Grape which is widely grown crop in India and it may be affected by different types of diseases on leaf, stem and fruit. Leaf diseases which are the early symptoms caused due to fungi, bacteria and virus. So, there is a need to have an automatic system that can be used to detect the type of diseases and to take appropriate actions. We have proposed an automatic system for detecting the diseases in the grape vines using image processing and machine learning technique. The system segments the leaf (Region of Interest) from the background image using grab cut segmentation method. From the segmented leaf part, the diseased region is further segmented based on two different methods such as global thresholding and using semi - supervised technique. The features are extracted from the segmented diseased part and it has been classified as healthy, root, esca, and leaf blight using different machine learning techniques such as Support Vector Machine (SVM), ad boost and Random Forest tree.***

Keywords: ML, Support Vector Machine, AdaBoost, Random Forest tree, Grape's diseases

1. Introduction

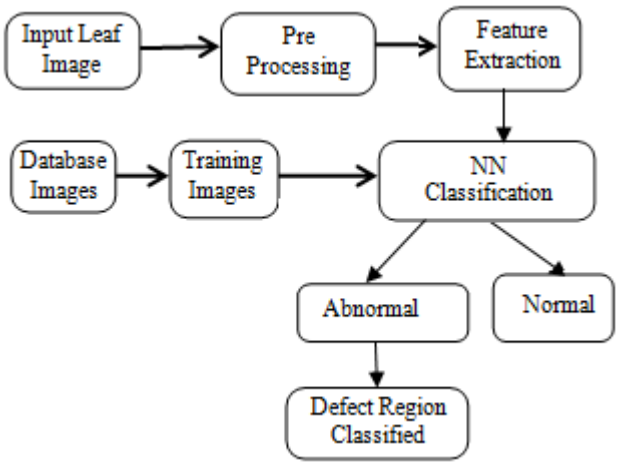

Figure 1: Block diagram

2. Workflow

These diseases are caused due to fungi infection on the leaves. Each disease has different characteristics where black rot appears to be circular in shape and has dark margins, esca appears as dark red stripes and leaf blight appears to be solid reddish - purple spots. The proposed system consists of five different process such as image preprocessing, image segmentation feature extraction, disease detection and identification. The overall flow of the proposed system is depicted in the Fig 2.

a) Image Preprocessing: The images are acquired from the web and are from different sources and sizes. The images also contain noise due to bad lightening condition, weather occlusion etc. To reduce the computational complexity the images are scaled down to a standard width and height. This scaled image is then processed to filter the noise using Gaussian filter. The Gaussian blur is a low pass filter that reduces the high frequency components, we have used 5*5 kernel size to filter the noise.

b) Image Segmentation: From the preprocessed image, the leaf part of the image is segmented from the background image Grab cut segmentation algorithm. This algorithm labels a pixel as foreground or background using Gaussian Mixture Model (GMM) and also takes initial rectangle which is a rough segmentation between background and foreground. We have used a rectangle of dimension (10, 10, w - 30 and h - 20) as the bounding box where w and h are width and height of the image.

c) Feature Extraction: Image features provide rich information about the content of the image. These features represent certain distinctive characteristics that can be used for differentiating among the categories of input patterns. In this work, I have used texture and color features of the images for classification.

Classification using Different Classifiers:

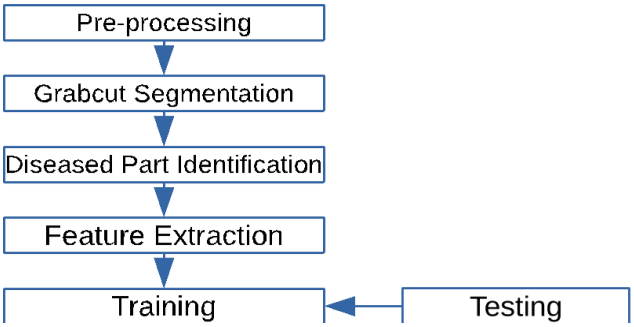

Figure 2: Architecture of the Proposed System

The extracted feature vectors are then used to train different classifiers and the results were analyzed.

a) Support Vector Machine: Given a labeled training data, SVM outputs an optimal separating hyperplane. This hyperplane categorizes new data point into classes. In order to improve the accuracy of SVM, some parameters

of the SVM classifier needs to be tuned. One of the parameters is kernel which defines whether separation should be linear or nonlinear. Another parameter is regularization which defines the extent to which misclassification of a training sample needs to be avoided. A larger value of regularization chooses small margin of hyperplane if it ensures minimum misclassification of training examples.

b) **Random Forest:** Random Forest is an ensemble learning method and also a supervised learning algorithm. It builds a forest of decision trees. Many trees fit into a random forest classifier. The extracted feature vector is passed as input vector to each tree of the forest and a decision rule is obtained. In other words, the trees vote for a class. The class having the majority votes by the trees is chosen by the forest.

c) **Adaboost**: Adaboost is used to boost the performance of a machine learning algorithm. It is used with weak learners. Weak models are trained using weighted training data where each instance is weighted. After training the model, the misclassification rate is calculated. This error rate is modified further and used to update the weights of training instances. The purpose of weight updating is to give more weight to misclassified instances. One of them will be implemented.

3. Literature Survey

Lots of researches have been done on the use of digital image processing and machine learning for detection of grape leaf diseases in agricultural applications. In parallel to that, we tried to work on the stand - alone mobile application that will be contain guidelines for the users and will pick for them the suitable pesticides for specific plant's disease hence it is an important research topic.

- RehanullahKhan - In this paper they have discussed how Machine learning in general and DL in particular have helped to identify the diseases in plants. If the disease is not correctly identified, they affected the crop yield and ultimately results in long - term issues Such as global warming.
- Maryam Takti - In their paper they proved image processing tool is able to guarantee accurate results regarding the detection of the plant diseases and also how it can assist the farmers in increasing the yields.
- S. M. Jaisakthi - "Grape leaf disease identification using Machine learning techniques", In this paper they proposed an automatic leaf disease recognition system that identify diseases in grape leaves using machine learning technique.
- Detection of leaf diseases and classification using Digital image Processing is done by R. Meena. Prakash - In this paper they discussed about a method for detection and classification of leaf diseases is implemented. The segmentation of the diseased part is done using K - means segmentation. and classification is done by SVM.

Problem Definition:
Plant diseases are impacting the agriculture in general and the monoculture more precisely. The detection of plant diseases most of the time is done only throughout the naked eye observation. This is a traditional way to deal with the detection of plant diseases, the farmers used to consult the experts who spend a lot of time trying to specify the type of disease that is affecting the plants' leaves. The experts based their analytics that includes categorizing and classifying the diseases, only on the visual symptoms that are usually shown on the leaves. The thing that is time consuming and costs a lot for the framers of this kind of agriculture. This operation of detecting plant diseases is expensive since the farmers must consult experts, and time consuming as those experts need time to detect that disease.

Approach:
The primary motivation for this project, of course, is to develop a system that capable to detect and identify the type of disease based on Blobs Detection and Statistical Analysis. The idea at first was to create an android mobile application that will be used by the farmer to help him upload the picture of the unhealthy plant's leaf and receive the type of the disease with the type of pesticide to use and the amount of pesticide that the farmer should not exceed. Plant disease detection was always requiring the existence of experts, the thing that costs a lot of money and waste of time as this manual work requires a lot of working and processing hours. Also, the detection is done after the healthy plant are contaminated also. The main purpose of our project is to ensure for the farmer the pre - prediction of the plant disease the thing that will minimize the use of pesticides especially in the monoculture. Therefore, this will increase the profit for any monoculture farming industry as it will guarantee the increase in the quantity of the products that are produced by the monoculture farming industry.

4. Results

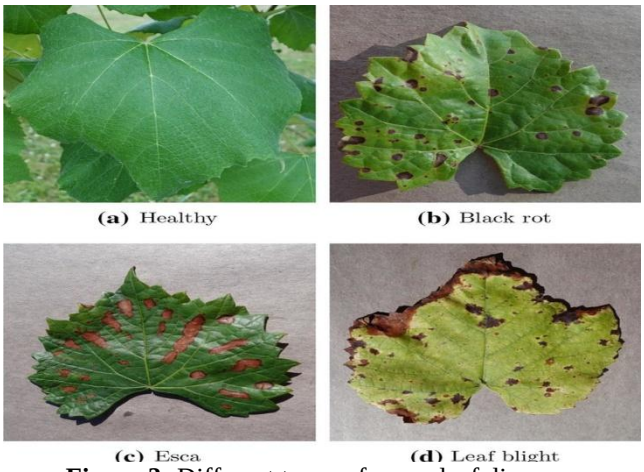

Figure 3: Different types of grape leaf diseases

I have proposed an automated disease detection and classification system for grape leaves using traditional image processing and machine learning techniques. The proposed system first segments the ROI from the back ground using grab cut algorithm and classify the segmented leaves as healthy, black - root, esca and leaf blight. Fig 3 depicts different types of disease in grape's leaves.

5. Conclusion

The main objective of this work is to develop a system that capable to detect and identify the type of disease based on Blobs Detection and Statistical Analysis.

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