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GRAPE LEAF DISEASE IDENTIFICATION USING MACHINE LEARNING TECHNIQUES

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ABSTRACT

Grapes are familiar fruits in the Mediterranean, Central Europe and Southwest Asia. Various components of this plant have many uses, including leaves used in the preparation of foods. The quality of the grape leaves is especially important for the preparation of food and this requires careful consideration. One of the indicators of grape leaf selection in food is its surface integrity and absence of grooves. In this paper, by using image processing technique, the geometrical characteristics of the grape leaf including its area and perimeter are extracted and numerical value is given based on the defined index. Grapes are familiar fruits in the Mediterranean, Central Europe and Southwest Asia. Various components of this plant have many uses, including leaves used in the preparation of foods. The quality of the grape leaves is especially important for the preparation of food and this requires careful consideration. One of the indicators of grape leaf selection in food is its surface integrity and absence of grooves. In this paper, by using image processing technique, the geometrical characteristics of the grape leaf including its area and perimeter are extracted and numerical value is given based on the defined index.

Keywords: Grape Leave, Modeling, Image Processing, Quality Index.

I. INTRODUCTION

Indian Economy is highly dependent on agricultural productivity of the country. Grape is very commercial fruit of India. It can easily be grown in all tropical, sub-tropical and temperate climatic regions. India has got different types of climate and soil in different parts of the country. This makes grapevines a major vegetative propagated crop with high socioeconomic importance. The grape plant will cause poor yield and growth when affected by diseases. The diseases are due to the viral, bacteria and fungi infections which are caused by insects, rust and nematodes etc., these diseases are judged by the farmers through their experience or with the help of experts through naked eye observation which is not accurate and time consuming process. Early detection of disease is then very much needed in the agriculture and horticulture field to increase the yield of the crops. We have proposed a system that can detect and identify diseases in the leaves of the grape plants.

II. PROBLEM DEFINITION

To develop a system which detects the disease on grape leaf and also detect disease name and apply on it the image processing techniques.

III. METHODOLOGY

System Architecture: System architecture is divided into three different layers sense, analyses & predicts, act as shown in figure Fig. Purpose of sensing layer is to sense all the meteorological parameters; hence this layer involves all the sensors. Also, the sample image of the suspected host will be given as an input by the user. Before analyze and predict layer there exists a layer for data pre-processing. This layer will transform the inputs into a pre-processing .This layer will transform the inputs into a required standard format. Data pre-processing will consist of tasks such as feature selection, data cleaning, handle out of range values and missing values. Next layer is analyses and predict layer, this layer includes a trained model of for predicting the probability of occurrence of disease. The model is trained using a dataset of image samples of each disease. The output of this layer will be a probability of disease occurrence. Execution of this layer will be performed on Microsoft's Azure Cloud. Use of Azure cloud services is preferred to enable the mobility of the system on field.

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The next layer in the system is act which accepts the output of analyse and predict layer as an input and it acts according to the probability of disease occurrence.

Image Preprocessing: The images are acquired from the web and are from different sources and sizes. The images also contains 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. These scaled images are then processed to filter the noise using Gaussian filter. The Gaussian blur is a low pass filter that reduces the high frequency components.

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. The results of the Grab-cut method are depicted. We have proposed an automated disease detection and classification system for grape leaves using traditional image processing and machine learning techniques.

Relevant mathematics associated with the Project:

1. Start
2. Upload image
3. Image segmentation and feature extraction.
4. Find disease
5. Show result
6. Stop

Image Processing in Leaf Pattern Recognition:

Leaf pattern recognition usually follows the steps as shown in Figure 1. The most challenging part of this study is to extract distinctive features of leaves for plant species recognition. In this case, different classifiers using high performance statistical approaches have been used to perform leaf features extraction and classification. The advancement in computer vision and artificial intelligence has greatly assisted researchers to classify plants through statistical modeling.

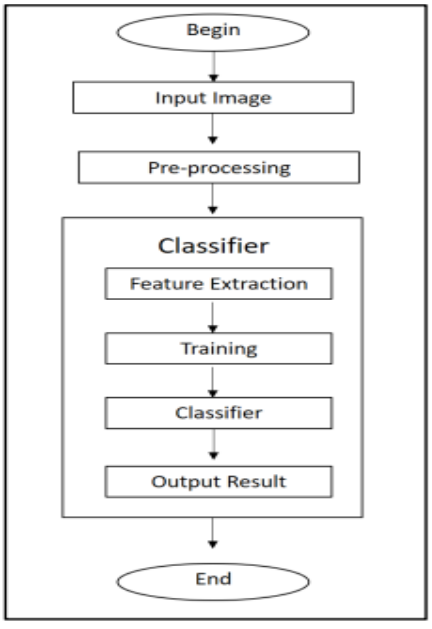

Figure 1. Fundamental of leaf pattern recognition.

The pre-processing step consists of image reorientation, cropping, gray scaling, binary thresholding, noise removal, contrast stretching, threshold inversion, and edge recognition.

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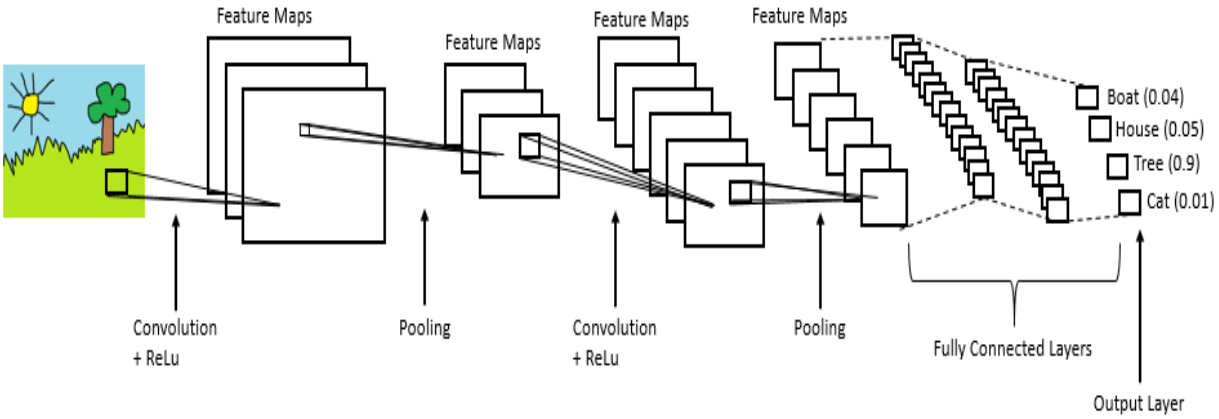
Image Acquisition: The first stage of any vision system is the image acquisition stage. After that sample images are obtained or collected from the farm of grape using different mobile cameras with different resolutions. Which are used to train the system? These sample images are stored in standard jpg format. All sample images are in RGB (Red, Green, and Blue) form. Collected images include the healthy leaf as well as affected leaf by different diseases like powdery mildew, rust, black rot etc.

Convolutional Neural Network (CNN) — Deep Learning: In neural networks, Convolutional neural network (ConvNets or CNNs) is one of the main categories to do images recognition, images classifications. Objects detections, recognition faces etc., are some of the areas where CNNs are widely used.

Convolution is the first layer to extract features from an input image. Convolution preserves the relationship between pixels by learning image features using small squares of input data. It is a mathematical operation that takes two inputs such as image matrix and a filter or kernel.



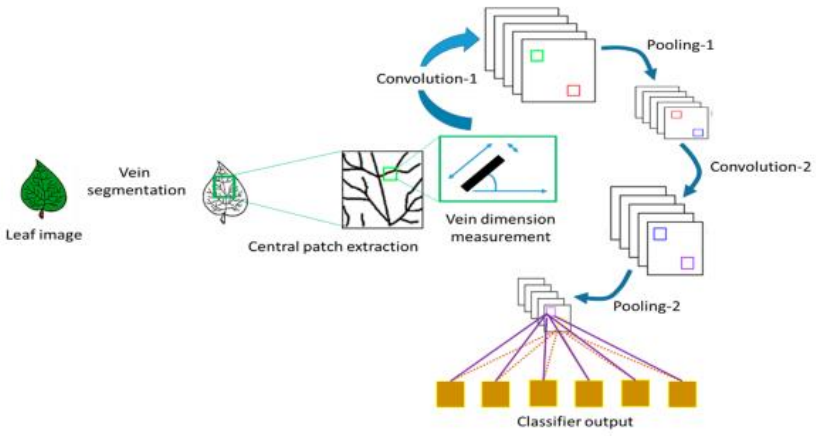
Convolution of an image with different filters can perform operations such as edge detection, blur and sharpen by applying filters. The below example shows various convolution image after applying different types of filters (Kernels).

Convolutional Neural Networks have 2 main components.

1. **Feature learning**: You can see convolution, ReLU Pooling layer phases here. Edges, shades, lines, curves, in this Feature learning step are get extracted.
2. **Classification**: you see Fully Connected (FC) layer in this phase. They will assign a probability for the object on the image being what the algorithm predicts it is.

Some of the computer vision problems which will be solving using CNN are following:-

1. Image classification
2. Object detection
3. Neural style transfer



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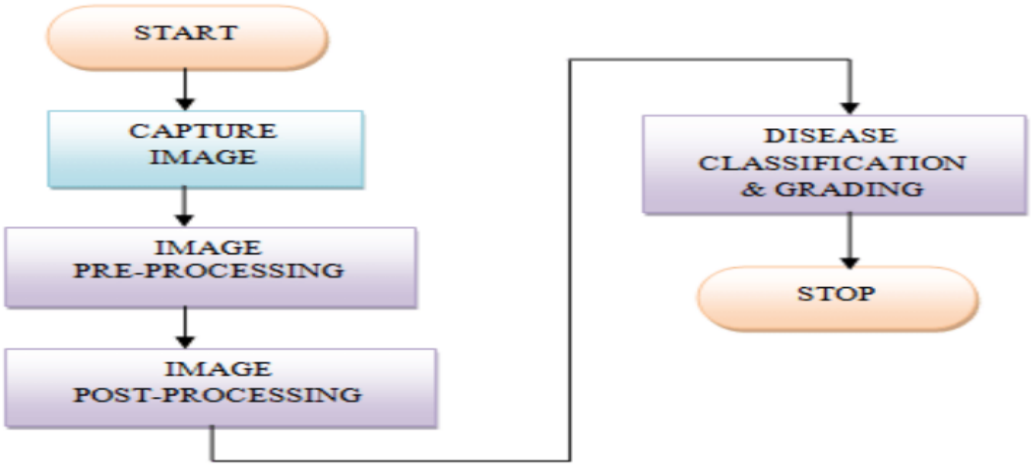
Algorithm:

Neural Network Algorithm: A neural network is a network or circuit of neurons, or in a modern sense, an artificial neural network, composed of artificial neurons or nodes. Thus a neural network is either a biological neural network, made up of real biological neurons, or an artificial neural network, for solving artificial intelligence (AI) problems. The connections of the biological neuron are modeled as weights. A positive weight reflects an excitatory connection, while negative values mean inhibitory connections. All inputs are modified by a weight and summed. This activity is referred as a linear combination. Finally, an activation function controls the amplitude of the output. For example, an acceptable range of output is usually between 0 and 1, or it could be −1 and 1. These artificial networks may be used for predictive modeling, adaptive control and applications where they can be trained via a dataset. Self-learning resulting from experience can occur within networks, which can derive conclusions from a complex and seemingly unrelated set of information.

Flowchart:



IV. ADVANTAGES OF PROPOSED SYSTEM

- Capable in distinguishing complex nonlinear relationship between independent and dependent variables.
- Simplistic statistical training.
- Multiple features can be extracted simultaneously.
- Robust to noise.
- High distortion resistance.
- Flexible to changing data.
- Specimen can be classified into multiple output.
- Great generalization potential.
- Exceptionally robust.
- No training needed.
- Robust in terms of research space.
- Simplest Classifier.

V. RESULTS AND DISCUSSION

We have evaluated the proposed system using 5675 grape leaves which have been downloaded from the plant village website and also from web. We have used 80% of the images for training and others for testing. The global thresholding method used for segmenting leaf disease part was found to be more suitable for training the model as it segments the precise diseased part of the leaves which leads to improved classification results.

VI. CONCLUSION

In this paper, we propose an automatic leaf recognition system that identifies diseases in grape leaves using machine learning technique. The proposed system first segments the leaf part from the background using grab cut segmentation technique. From the segmented leaves diseased region are identified using two different

methods. The first method uses global thresholding technique whereas the second method using semi supervised learning technique. From the identified diseased part texture and color features are extracted and trained using different classifiers and the results are compared. We have used SVM, random forest and Ad boost algorithms for classification. We have achieved a better result of 93.035% as testing accuracy by using global thresholding and SVM.

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VII. REFERENCES

[1] Chitwood, D. H. et al. (2014) 'A Modern Ampelography: A Genetic Basis for Leaf Shape and Venation Patterning in Grape', Plant Physiology, 164, pp. 259–272.

[2] Lakso, N. A. et al. (1982) 'Photosynthesis, Transpiration, and Water Use Efficiency of Mature Grape Leaves Infected with Uncinula necator (Powdery Mildew)', Physiology and Biochemistry, pp. 232–236.

[3] Loughner, R. et al. (2008) 'InXuence of leaf trichomes on predatory mite (Typhlodromus pyri) abundance in grape varieties', Exp Appl Acarol, 45, pp. 111–122.

[4] Montero, F. J. et al. (2000) 'Nondestructive Methods to Estimate Leaf Area in Vitis vinifera L.', HORTSCIENCE, 35(4), pp. 696–698.

[5] Narvekar, P., Kumbhar, M. and Patil, S. N. (2014) 'Grape Leaf Diseases Detection & Analysis using SGDM Matrix Method', International Journal of Innovative Research in Computer and Communication Engineering, 2(3), pp. 3365–3372.

[6] Nita, M. et al. (2006) 'Evaluation of a Disease Warning System for Phomopsis Cane and Leaf Spot of Grape: A Field Study', Plant Disease, 90(9), pp. 1239–1246.

[7] Patil, S. P. and Rupali, S. Z. (2014) 'Classification of Cotton Leaf Spot Disease Using Support Vector Machine', Int. Journal of Engineering Research and Applications, 4(5 (Version 1)), pp. 92–97.

[8] Perrone, I. et al. (2012) 'Recovery from water stress affects grape leaf petiole transcriptome', Planta. Robert A. Spotts (1977) 'Effect of Leaf Wetness Duration and Temperature on the Infectivity of Guignardia bidwellii on Grape Leaves', Ecology and Epidemiology, pp. 1378–1381. Sat,

[9] I.G., Sengul, M. and Keles, F. (2002) 'Use of Grape Leaves in Canned Food', Pakistan Journal of Nutrition, 5 1(6), pp. 257–262.