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A Dynamic Approach To Identify The Keypoints In A Image Of Diseased Plant Leaf Using Multiclass SVM And SIFT Methods

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Abstract: This research presents the processes involved in Multiclass SVM and SIFT algorithms. Support Vector Machines (SVM) is a popular method in the machine learning area for binary classification problems. Multi-class SVM usually implemented by combining several binary SVMs. The scale-invariant feature transform is also used as a feature detection algorithm. This method transforms an image into a great collection of feature vectors, every vector is invariant to image translation, rotation, and scaling, partially invariant to illumination changes and forceful to local geometric distortion. In this research keypoints are identified with the SIFT algorithm and also multiclass SVM classifier is implemented to identify percentage of area affected in the diseased image.

Index Terms - **Multiclass SVM, SIFT , Classification, Plant disease.**

I. INTRODUCTION

Data mining is the method of sorting through huge data sets to recognize patterns and establish relationships to solve problems through data analysis. It’s measured a discipline under the data science field of study and this various from predictive analytics because it describes chronological data, while data mining aims to predict future outcomes. In addition data mining techniques are used to build machine learning (ML) models that power modern artificial intelligence applications such as search engine algorithms and recommendation systems.

Agricultural productivity is a major concern on which economy highly depends. This is the important reasons that disease detection in plants plays an imperative role in agriculture field, as having disease in plants are quite natural. If suitable measures is not taken in disease detection then it causes serious effects on plants and due to which respective product quality, quantity or productivity is affected. Identifying plant disease through some automatic technique is valuable as it minimize large work of monitoring in big farms of crops, and at near the beginning stage itself it detects the symptoms of diseases when they appear on plant leaves.

II LITERATURE REVIEW

“DETECTION OF DISEASED LEAF USING IMAGE PROCESSING TECHNIQUE” this paper is to get the input image in RGB format. The next step colour transformation. In masking RGB image is converted into grey level image. Range of Interest in diseased portion is automatically segmented using the segmentation process and it is achieved by “Mumford shah algorithm”. Followed by segmentation process, the feature extraction process using SIFT algorithm takes place. SIFT feature extraction method is carried out in order to extract colour and shape features. Then, it will generate the featured value for the input image and it will compare it with the dataset. Finally, the extracted features are passed to the classifier using ANN algorithm. The classifier using ANN is developed to classify the leaf according to their growth and colour change.

This paper “Identification Method of Sunflower Leaf Disease Based on SIFT Point” mainly details the use of SIFT algorithm to find different diseases of sunflower leaves. At first the collection of image of sunflower disease is described. In Second step, the image is preprocessed before image recognition. In this paper author used histogram equalization to defog the image and the image is denoised by homomorphic filtering. In third step the feature vector of image is extracted by SIFT algorithm. At last, the characteristic vector was coordinated and the identification of the disease image was completed.

In this paper" Plant Species Identification using SIFT and SURF Technique" the author analyzed SVR method and two combined methods for plant species recognition and classification. Efficiency and Accuracy measurement of each method are described. All the methods are tested with digital dataset. Experimental results compares a number of quantitative results and discussed allowing to human visualization for four different species. Investigates on the dataset, confirm that SIFT-SURF method has the superlative performance between proposed methods. The proposed work will be positive for forth coming procedure, SURF. Particular other groupings of dissimilar approaches of recognition and extraction of features can be used for next steps.

In this paper, "Detection and Classification of Plant Diseases Using Image Processing and Multiclass Support Vector Machine", the author described a framework for detection and classification of plant disease. We used Multiclass Support Vector Machine (SVM) as a classifier during training and testing phases. Each type of disease and healthy leaves are assigned a unique label. Segmentation is used in image to identify the disease affected regions of a leaf. Then the standard features are extracted from diseased affected segmented image. Finally,the author used features to classify leaves into healthy and disease types using Multiclass Support Vector Machine (SVM).

III METHODOLOGY

3.1 MULTICLASS SVM

SVM multiclass uses the multi-class formulation which optimizes it with an algorithm that is very rapid in the linear case. For a training set (x1,y1) ... (xn,yn) with labels yi in [1..k], it gives the solution of the following optimization problem during training.

minimum $1/2\Sigma i=1..k\ wi*wi + C/n\ \Sigma i=1..n\ \xi i$
for every y in [1..k]: $[\ x1 \bullet wyi\ ] >= [\ x1 \bullet wy\ ] + 100*\Delta(y1,y) - \xi 1$
therefore for all y in [1..k]: $[\ xn \bullet wyn\ ] >= [\ xn \bullet wy\ ] + 100*\Delta(yn,y) - \xi n$

C is the default regularization parameter that trades off margin size and training error. Therefore $\Delta(yn,y)$ is the loss function that returns 0 if yn equals y, and 1 otherwise.To crack this optimization problem, SVMmulticlass uses different algorithm. This algorithm is based on Structural SVMs and it is an instance of SVMstruct. Non-linear kernels are not (really) supported. SVMstruct programming interface is the easy example on how to use this in programming. SVMmulticlass V2.20 is very fast in linear kernels and runtime scales linearly with the number of training examples.

3.2 SIFT

Scale-invariant feature transform (SIFT) is a computer vision algorithm to perceive and illustrate the local features in the image. It finds the intense point in the spatial scale and extracts its scale, position and rotation invariants for feature descriptors. Four steps are involved in the SIFT feature extraction process ie extreme value detection in scale space, localizing keypoints, Assigning direction and eigen vector generation.

In Scale Space theory the Extreme Detecting intends to simulate the multi-scale features of image data, and get different spatial scales by Lindeberg ,Gaussian blur etc has proved that the Gaussian convolution kernel is the only linear kernel and the only transform nuclear to achieve scale transformation . Therefore, the scale space in an image is defined as a function, $L(x, y, \sigma)$, that is produced from the convolution of a variable-scale Gaussian, $G(x, y, \sigma)$, with an input image,

$$I(x, y): L(x, y, \sigma) = G(x, y, \sigma)\ \Delta\ I(x, y), \quad (1)$$

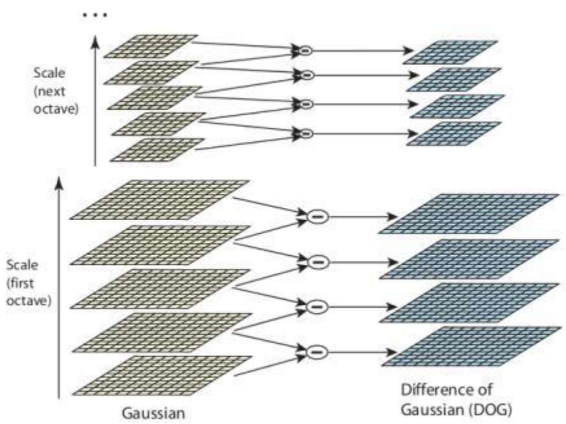

Fig 1 :Determining DOG from Octaves

Here Δ is the convolution operation in x and y, and G(x, y, σ) = 1 2πσ2 e −(x 2+y 2)/2σ 2 . stable keypoint locations are detected efficiently in scale space. Using scale-space extrema in the difference-of-Gaussian function convolved with the image, D(x, y, σ), which can be calculated from the difference of two nearby scales unconnected by a constant multiplicative factor k.

$$D(x, y, \sigma) = (G(x, y, k\sigma) - G(x, y, \sigma)) * I(x, y) = L(x, y, k\sigma) - L(x, y, \sigma). \qquad (2)$$

a.Keypoint localization

Many keypoints are derived by the scale-space extrema detection ,some of which are unstable. In the next step of algorithm a detailed fit to the in close proximity data for the precise location, scale and the ration of principal curvatures. With these information the points with low contrast or poor localization along the edge gets rejected.

For every keypoint candidate, interruption of close by data is used to precisely determine its position. The preliminary approach was to just trace each keypoint at the location and scale of the candidate keypoint. Using the quadratic Taylor expansion of the Difference-of-Gaussian scale-space function the interpolation is done.

b. Keypoints's orientation determination

Every certain feature point desires to assign a reference orientation, so that point is invariant to rotation. Computing pixels, orientation distribution and gradient within 3 neighborhood region are done in the scale space where keypoint belongs.

Gradient and orientation values are calculated as follows:

$$A = L(x + 1,y) – L(x -1,y) \qquad (3)$$

$$B = L(x,y+1) – L(x,y-1) \qquad (4)$$

$$m (x,y) = \sqrt{(A)2 +(B)2} \qquad (5)$$

$$\Theta tan(x ,y)= atan2(L(x,y+1) – L(x,y-1), L(x + 1,y) – L(x -1,y)). \qquad (6)$$

c. Keypoint descriptor

Assigned orientations ensured invariance to image location, scale and rotation. For each keypoint a descriptor vector is computed so that the descriptor is highly distinctive and partially invariant to the remaining variations such as 3D viewpoint , illumination, etc. Consider keypoint as center, set of orientation histograms is created on 4×4 pixel neighbourhoods and rotating the axis to the orientation of keypoint. For every pixel gradient will be calculated with the gradient and orientation in every subregion, the gradient values assigned to eight orientations by weight will figure seed points with eight data. The 128- dimensions gradient data needs to be normalized to reduce influence of light. Finally it gets the 128 dimensions feature descriptor of SIFT.

IV EXPERIMENTAL RESULTS

In this section, Firstly the image of a leaf is given as a input to Multiclass SVM algorithm. This results in the image with more determined region of diseased area. Computational results of the multiclass SVM with the diseased leaf image is to provide the as many clusters formed ,therefore the affected area of the input image in found.

Input image Resultant clusters

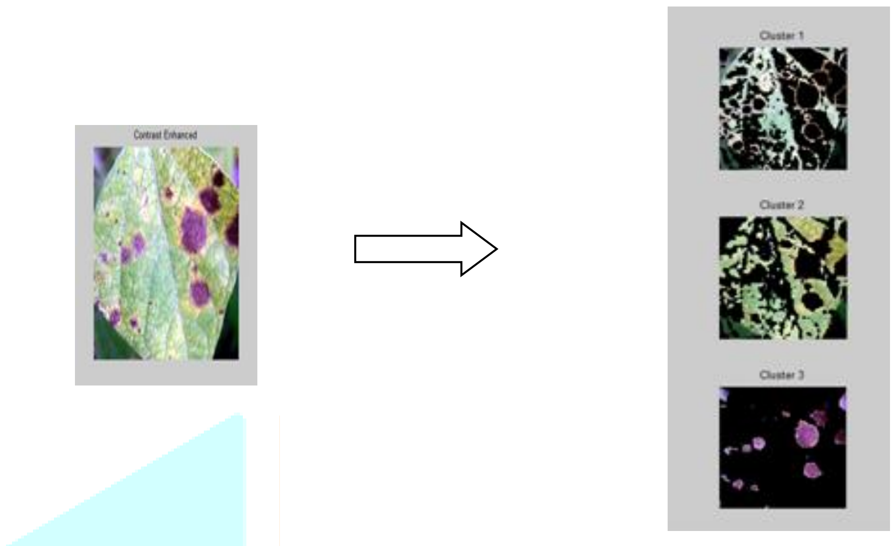

Fig.2: Result images for SVM multiclass

By implementing the Multiclass SVM algorithm in a leaf image ,the percentage of area infected in a diseased leaf image is identified .For this inputs the area of infected area is 15.0005%.The SIFT algorithm find outs the region of diseased image with the use of a given threshold value. The result will be the image with a more defined diseased region. Here x,y,z axis is defined ie the ROI with points described we find the time taken for Gaussian scale space value, differential scale space and time to determine the key points . The proposed algorithm also changes the intensity of the image.

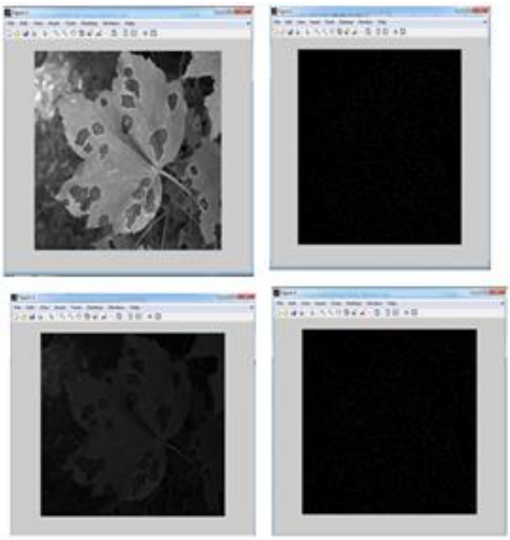

Fig.3 : Deriving keypoints from the diseased image

The image is segmented into octaves ,therefore all the octaves undergoes the DoG difference of Gaussian. Thus it gives the matching key points which helps to identify the disease invariant of orientation.

V CONCLUSION

In this research we identified the keypoints of an diseased leaf with SIFT algorithm and also multiclass SVM classifier is implemented to identify percentage of area affected in the diseased image. By implementing the Multiclass SVM algorithm in a leaf image ,the percentage of area infected in a diseased leaf image is identified .For this inputs the area of infected area is 15.0005%.With these algorithms sift provides better results and it also supports the image with the invariance. This can further taken to various diseases, the number of dataset can be increased to find more accurate results.

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