REVIEW ARTICLE OPEN ACCESS

Leaf Disease Detection Using Arm7 and Image Processing

Prof. R. N.kadu[1], S. Kangane [2], S.Vikhe[3], R.Pandita[4], V. Inamke[5]
Department of Electronics and Telecommunication Engineering, PREC, Loni Savitribai Phule Pune University, Maharashtra, India

Abstract-
In an agricultural field plant diseases are very important aspect as it directly affect on the production of plant and economical value of market. In this research generally we uses image processing technique that is automatically detect symptoms of the disease as early as possible. This is the first and important phase for automatic detection and classification of plant diseases. There are some stages to find the disease like image acquisition, preprocessing on image, color transform usingYCbCr, segmentation using Otsu method, feature extraction using Gabor filter method and classification using SVM, using those steps we can surely detect the disease and classified it and also can take preventive measures.
Keywords- Leaf disease, Image processing, Gabor filter, SVM, Otsu

I. INTRODUCTION

Agriculture has potential to supply source of energy and it fulfills the need of food for increasing population and that’s why it is important to grow plant health. Generally the growth of plant is affected mostly by the plant disease. Finding leaf diseases is the first step for treating the disease. The proposed system is used to detect the plant diseases by image processing.

If you got problem, by using the image of the leaf you can learn how to about identifying leaf diseases for effective diseases control. With little know,we can stand a better chances of treating the leaf diseases problem onearlierstages and through which the production can’t be decrease.

Generally there are many causes of leaf diseases and perennials landscape plant problems and no. of these problems can appear to have the same symptoms on the plant hence the naked eyes fails to detect the diseases. In the proposed system we use the image processing technique. Any image can be described by its Red,Green,&Blue co-ordinates. By using Ycbcrthe RGB image is converted into grayscale. The Otsu threshold method used for image segmentation [7]. In which the diseased area is a foreground &undiseased area is background. The Gabor filter is applied on this image for texture feature extraction [4]. SVM(support vector machine) is used for classification [3].

Once, you indentified the disease corrective measures can be taken to eliminate or reduce the problem, And by which, the low market value for low grade and diseases affected production can be turn into good marketing value.

II. OUR APPROACH

1] Image Acquisition-

The first stage of any vision system is the image acquisition stage. Image acquisition in image processing can be broadly defined as the action of retreating an image form some sources, usually a hardware based source.Depending on our field of work, a major factor involved in image acquisition in image processing sometimes is the initial setup & long term maintenance of the hardware used to capture the image.[6]For image acquisition we used night vision xpro webcam.

2] Preprocessing-

In the proposed system there are two techniques for preprocessing. One is resizing of image. After the image acquisition, the acquire image can be resize into 150X150. Another technique is contrast adjustment. Illumination is the measure error in the image capturing. Hence the contrast adjustment is used to reduce illumination change.[1]

3] Color transform-

Any image can be described by its red(r),green (g), & blue (b) co-ordinates (the well knownrgb system). The proposed system used to covert RGB to grey color image for this used aYCbCr technique. It is used to detect infected area easily. YCbCr signals (prior to scaling and offsets to plane the signals into digital form) a called yPbPr,and created from the corresponding gamma adjusted RGB (red, green& blue) source using two defected constants kb and kr as follows:

$Y' = kr.r' + (1-Kr-kb)$
$P_b = ½[\ b'-y'/1-kb]$
$P_r = ½[\ r'-y'/1-kr]$

Where kb and kr are ordinarily derived from the definition of the corresponding rgb space. The conversion of rgb colors into full-range ycbcr colors is described by following eq^n.[7]

$$\begin{bmatrix} y & 0 & 0 \\ cb & 0 & 0 \\ cr & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 128 & 0 & 0 \\ 128 & 0 & 0 \end{bmatrix} + \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ -0.169 & -0.331 & 0.500 \\ 0.500 & -0.419 & -0.081 \end{bmatrix} * \begin{bmatrix} R & 0 & 0 \\ G & 0 & 0 \\ B & 0 & 0 \end{bmatrix}$$

Ranges:
R|G|B [0….255]
Y|cb|cr [0….255]

Figure1: Original image

Figure2: Color Balanced Image

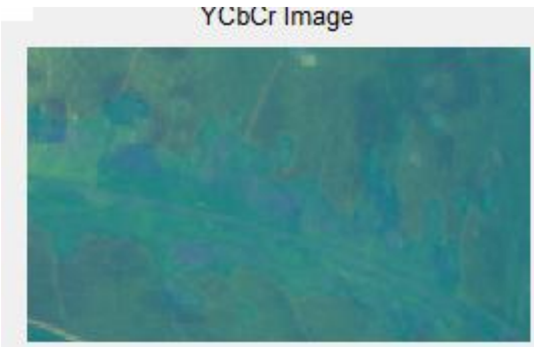

Figure3; YCbCr Image or gray Image

4] Segmentation:

For segmentation we use different methods.

A] Otsu threshold- In the proposed we uses this method. In Otsu's method we exhaustively search for the threshold that minimizes the intra-class variance (The variance within the class), define as a weighted sum of variances of the two classes.[5]

$\sigma^2 w(t) = w_1(t)\,\sigma_1^2(t) + w_2(t)\,\sigma_2^2(t)$

Weightsw$_i$are the probabilities of two classes separated by a threshold t and σ_i^2 variance of these classes.

Otsu shows that minimizing the intra – class variance is the same as maximizing interclass variance.

$\sigma_b^2(t) = \sigma^2 - \sigma^2 w(t) = w_1(t)\, w_2(t)\, [\mu_1(t) - \mu_2(t)]^2$

Which is expressed in terms of class probability w_i and class means μ_i

Though class probability w_1 (t) is computed from the histogram as t.

$w_1(t) = \sum_0^t p(i)$

While the class means μ_1 (t) is

$\mu_1(t) = [\sum_0^t p(i)\ x(i)]/w_1$

Wherex (i) is the values at center of the ithhistogram bin. Similarly, you can compute w_2 (t) and μ_2 on the right-hand side of the histogram for bins greater than t.[5]

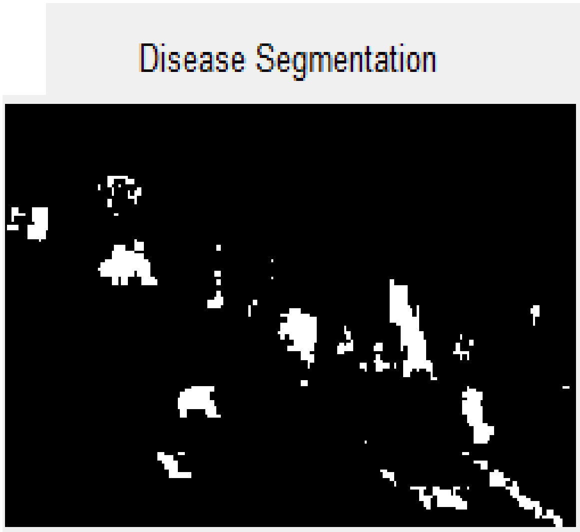

Figure4: Disease Segmentation

B] Level Set- Level set methods [LSM] are a conceptual framework for using level sets as a tool for numerical analysis of surface and shapes.

C] Water shed- A gray level image may be seen as a topographic relief where the gray level of a pixel is interpreted as its altitude in the relief. In image processing, different types of water shed lines may be computed.

D] Active Contour- Active contour model, also called snakes is a framework in a computer vision for delineating an object outline from a possibly noisy 2D image.

5] Feature extraction –

Feature extraction is obtained from textual feature. For which the Gabor filter is applied on segmented image.

In image processing a Gabor filter named after Denis Gabor, is a linear filter used for edge detection. Frequency and orientation representation of Gabor filters are similar to those of the human visual system, and they have been found to be particularly appropriate for textual representation and discrimination. In the spatial domain, a 2D Gabor filter is a Gaussian Kernel function modulated by a sinusoidal plane wave.

The filter has a real and imaginary components representing orthogonal direction. The two components may be formed into a complex number or used individually.[4]

Complex:

$g(x, y; \lambda, \theta, \psi, \sigma, \gamma) = \exp[(-x'2+\gamma 2y2)\ /2\sigma 2]\ \exp[I\ (2\pi x'/\lambda+\psi)]$

Real:

$g(x, y; \lambda, \theta, \psi, \sigma, \gamma) = \exp[(-x'2+\gamma 2y2)\ /2\sigma 2]\ \cos(2\pi x'/\lambda+\psi)$

Imaginary:

$g(x, y; \lambda, \theta, \psi, \sigma, \gamma) = \exp[(-x'2+\gamma 2y2)\ /2\sigma 2]\ \sin(2\pi x'/\lambda+\psi)$

Where, $x' = x\cos\theta + y\sin\theta$

And $y' = -x\sin\theta + y\cos\theta$

In this equation, λ represents wavelength of sinusoidal factor, θ represents orientation normal to parallel strips of a Gabor function, ψ is the phase offset, σ is the (sigma) standard deviation of Gaussian envelope and γ is the spatial aspect ratio.

The color features can also be used for feature extraction.

Properties of spatial gray level dependence matrices (SGDM) like contrast, energy, local homogeneity, and correlation are compound for the Hue content of the images as given following equation[1]

Property	**Description**	**Formula**
Contrast	Returns a measure of the intensity contrast between a pixel and its neighbour over the whole image. Range = [0 (size (GLCM, 1)-1) ^2] Contrast is 0 for a constant image.	$\sum_{i,j} \|i-j\|^2 P(i,j)$
Correlation	Returns a measure of how correlated a pixel is to its neighbour over the whole image. Range = [-1 1] Correlation is 1 or -1 for a perfectly positively or negatively correlated image. Correlation is Nan for a constant.	$\sum_{i,j} (i-\mu i)(j-\mu j)P(i,j)$ / $\sigma i \sigma j i,j$
Energy	Returns the sum of squared elements in the GLCM. Range = [0 1] Energy is 1 for a constant image.	$\sum_{i,j} p(i,j)^2$
Homogeneity	Returns a value that measures the closeness of the distribution a\of element in the GLCM to the GLCM diagonal. Range = [0 1] Homogeneity is 1 for a diagonal GLCM.	$\sum_{i,j} p(i,j)$ /1+ | I -j| [1]

6] Classification-

Support Vector Machine:

Support Vector machine (SVM) is a non-linear Classifier. This is a new trend in machine learning algorithm which is used in many pattern recognition problems, including texture classification. In SVM, the input data is non-linearly mapped to linearly separated data in some high dimensional space providing good classification performance. SVM maximizes the marginal distance between different classes. The division of classes is carried out with different kernels.SVM is designed to work with only two classes by determining the hyper plane to divide Two classes. This is done by maximizing the margin from the hyper plane to the two classes. The samples closest to the margin that were selected to determine the hyper plane is known as support vectors .Fig below shows the support vector machines concept. Multiclass classification is also applicable and is basically built up by various two class SVMs to solve the problem, either by using one-versus-all or one versus-one. The winning class is then determined by the highest output function or the maximum votes respectively.[3]

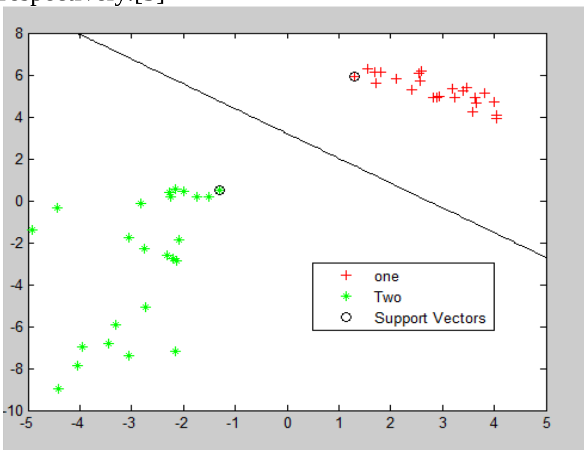

Fig.1 Support vector machine

Main advantages of SVM are:
- Its prediction accuracy is high.
- Its working is robust when training examples contain errors.
- Its simple geometric interpretation and a sparse solution.
- Like neural networks the computational complexity of SVMs does not depend on the dimensionality of the input space.

Drawbacks of SVM are:
- This classifier involves long training time.
- In SVM it is difficult to understand the learned function (weights).
- The large number of support vectors used from the training set to perform classification task

III. CONCLUSION

A computer based method that can read computer image of plant leaf and give a statement on infection of this leaf from the image with minimum user intervention is proposed. From study of computerised image processing technique we come up with a following conclusion.Otsu method is used to automatically perform clustering based image thresholdingor the reduction of a gray level image to a binary image. The image contains two classes of pixels following bi-model histogram (foreground pixel and background pixel).Also in addition to performing linear classification SVMs can efficiently perform. A nonlinear classification using what is called the Kernel trick, implicitly, mapping their inputs into high dimensional feature spaces. The whole system is robust, time efficient and can be used for Agriculture purpose like plant growth monitoring.

IV. ACKNOWLEDGEMENT

The authors sincerely like to thank the AgricultureResearch Center MPKV Rahuri. This work was not possible without help of Prof. R. A. Kadu, Prof. P. Kalane and all the people who have directly and indirectly encouraged us and helped us in working out our research.

REFERANCES

[1] *Arti N. Rathod, Bhavesh A. Tanawala, VatsalH. Shah ,**"leaf disease detection using image processing and neural network",** International journal of advance engineering and research development , IJAERD, 2014.*

[2] *Jayme Garcia arnalBarbedo,**"dgital image processing techniques for detecting and classifying plant disease",** Embrapa Agriculture Informatics, campinas, Springer, Brazil, 2013.*

[3] *Savita n. Ghaiwat, parularora**, "Detection and classification of plant leaf disease using image processing techniques: A** Review",ISSN,2014.*

[4] *S. Marcelja**, "mathematical description of the response of simple cortical cell".** Journal of the optical society of America, 70(11):1297-1300, 1980.*

[5] *Nobuyuki Otsu (1979). **"A threshold selection method from gray level histogram"**, IEEE Trans.sys, man, cyber 9(1): 62-66.*

[6] *Kamaljot singh kailey, gurjinder singh sahdra , **"content based image retrieval (CBIR) for identifying image based plant disease"**, IJCTA, May-June 2012.*

[7] *Piyush Chaudhary, Anand K. Chaudhari, Dr.A.N. Cheeran and Sharda Godara, **"Color transeform based approach for disease spot detection on plant leaf",IJCST,[Volume 3,issue 6, June 2012]***