Plant leaf damage detection using Mean-shift algorithm

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Abstract- Diseases in plants cause major production and economic losses in agricultural trade worldwide. observation of health and detection of diseases in plants and trees is vital for property agriculture. A novel approach for Image segmentation is proposed based on mean shift algorithm. By using Mean Shift algorithm on the original image to partition it into sub graphs we can create image matrices with lower dimensions. The experimental results also show that the results obtained by the proposed algorithm are better than results obtained by conventional clustering techniques**.**

I. INTRODUCTION

India is eminent for Agriculture that means most of the people are engaged towards agriculture industry. The agriculture industry act as a significant role in the economic sectors. Most of the plants are infected by variant fungal and bacterial diseases. Due to the exponential inclination of population, the climatic conditions also cause the plant disease.The major challenges of sustainable development is to reduce the usage of pesticides, cost to save the environment and to increase the quality. Precise, accurate and early diagnosis may reduce the usage of pesticides.

Data mining is termed as extracting the relevant information from large pool of resources. The advents of data mining technologies have been adopted in the prediction of plant diseases. Rice is one of the major crops cultivated in India. Nowadays, technology is widely used for plant disease prediction. The management of perennial leaf requires close monitoring system especially for the diseases that affects production and post-harvest life. The concept of image processing with data mining technologies assists us in following purposes:

i) Recognizing infected leaf and stem
ii) Measure the affected area
iii) Finding the shape of the infected region
iv) Determine the color of infected region
v) And also influence the size and shape of the leaf.

The user is to select a particular diseased region in a leaf and the cropped image is sent for processing [1].This paper intends to study about the prediction of the plant diseases, at an untimely phase using k-mean clustering algorithm. Specifically, we concentrate on predicting the disease such as Alternaria alternate, Anthracnose, Cercospora, bacterial blight and leaf spot. It would be useful for identifying different diseases on crops [2].It provides various methods used to study crop diseases/traits using image processing and data mining. In addition, the infected area and affected percentage is also measured. Back Propagation concept is used for weight adjustment of training database [3].

II. LITERATURE SURVEY

An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques byKiran R. Gavhale, and U. Gawande, Gavhale and Gawande [4] presented reviews and summarizes image processing techniques for several plant species that have been used for recognizing plant diseases. The major techniques for detection of plant diseases are: back propagation neural network (BPNN), Support Vector Machine (SVM), K-nearest neighbor (KNN), and Spatial Gray-level Dependence Matrices (SGDM). These techniques are used to analyses the healthy and diseased plants leaves.

Intelligent Diagnose System of Wheat Diseases Based on Android Phone by Y. Q. Xia, Y. Li, and C. Li , In [1], Xia and Li have proposed the android design of intelligent wheat diseases diagnose system. In this process, users collect images of wheat diseases using Android phones and send the images across the network to the server for disease diagnosis. After receiving disease images, the server performs image segmentation by converting the images from RGB color space to HSI color space. The color and texture features of the diseases are to be determined by using colour moment matrix and the gray level co-occurrence matrix. The preferred features are input to the support vector machine for recognition and the identification results are fed back to the client.

Implementation of RGB and Gray scale images in plant leaves disease detection –comparative study by Padmavathi and Thangadurai (2016) have given the comparative results of RGB and Gray scale images in leaf disease finding process. In detecting the infected leaves, color becomes an important feature to find the disease intensity. They have considered Grayscale and RGB images and used median filter for image enhancement and segmentation for extraction of the diseased portion which are used to identify the disease level. The plant disease recognition model, based on leaf image classification, by the use of deep convolution networks have developed. 13 kinds of diseases are identified from the healthy leaves with the capability to differentiate leaves from their surroundings.

III. MEAN SHIFT SEGMENTATION

Mean shift clustering is a general non-parametric cluster finding procedure — introduced by Fukunaga and Hostetler

[5], and popular within the computer vision field. Nicely, and in contrast to the more-well-known K-means clustering algorithm, the output of mean shift does not depend on any explicit assumptions on the shape of the point distribution, the number of clusters, or any form of random initialization.

We describe the mean shift algorithm in some detail in the technical background section at the end of this post. However, its essence is readily explained in a few words: Essentially, mean shift treats the clustering problem by supposing that all points given represent samples from some underlying probability density function, with regions of high sample density corresponding to the local maxima of this distribution. To find these local maxima, the algorithm works by allowing the points to attract each other, via what might be considered a short-ranged "gravitational" force. Allowing the points to gravitate towards areas of higher density, one can show that they will eventually coalesce at a series of points, close to the local maxima of the distribution. Those data points that converge to the same local maxima are considered to be members of the same cluster.

A general formulation of the mean shift algorithm can be developed through consideration of density kernels. These effectively work by smearing out each point example in space over some small window. Summing up the mass from each of these smeared units gives an estimate for the probability density at every point in space (by smearing, we are able to obtain estimates at locations that do not sit exactly atop any example). This approach is often referred to as kernel density estimation — a method for density estimation that often converges more quickly than binning, or histogramming, and one that also nicely returns a continuous estimate for the density function.

To illustrate, suppose we are given a data set $\{u_i\}$ of points in d-dimensional space, sampled from some larger population, and that we have chosen a kernel KK having bandwidth parameter hh. Together, these data and kernel function return the following kernel density estimator for the full population's density function

$$f_k(u) = \frac{1}{nh^d}\sum_{i=1}^{n} K(\frac{u-u_i}{h})$$

The kernel (smearing) function here is required to satisfy the following two conditions:

1. $\int K(u)du = 1$
2. $K(u) = K(|u|)$ for all values of u

The first requirement is needed to ensure that our estimate is normalized, and the second is associated with the symmetry of our space. Two popular kernel functions that satisfy these conditions are given by

1. Flat/Uniform $K(u) = \frac{1}{2}\begin{cases} 1 & -1 \le |u| \le 1 \\ 0 & else \end{cases}$
2. Gaussian= $K(u) = \frac{1}{(2\pi)^{d/2}} e^{-\frac{1}{2}|u|^2}$

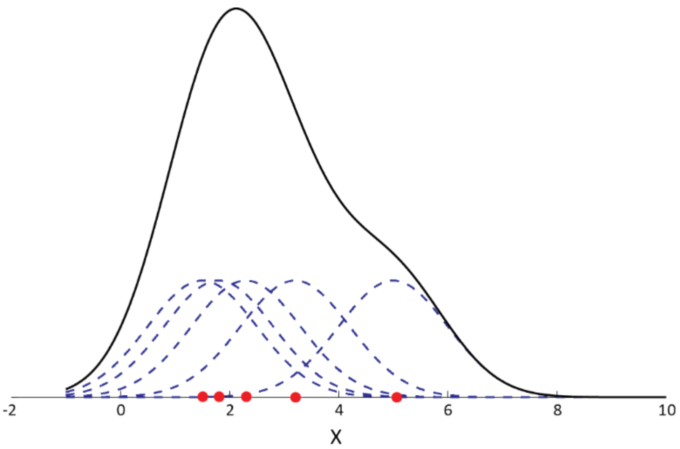

Fig 1. Example of a kernel density estimation using a gaussian kernel for each data point

The basic goal of the mean shift algorithm is to move particles in the direction of local increasing density. To obtain an estimate for this direction, a gradient is applied to the kernel density estimate discussed above. Assuming an angularly symmetric kernel function, $K(u) = K(|u|)$, one can show that this gradient takes the form

$$\nabla f_k(u) = \frac{2}{nh^{d+2}}(\sum_{i=1}^{n} g\left(\left|\frac{u-u_i}{h}\right|\right) m(u)$$

where

$$m(u) = \left(\frac{\sum_{i=1}^{n} u_i g\left(\left|\frac{u-u_i}{h}\right|\right)}{\sum_{i=1}^{n} g\left(\left|\frac{u-u_i}{h}\right|\right)} - u\right)$$

and $g(|u|) = -K'(|u|)$ is the derivative of the selected kernel profile. The vector $m(u)$ here, called the mean shift vector, points in the direction of increasing density — the direction we must move our example. With this estimate, then, the mean shift algorithm protocol becomes

- Compute the mean shift vector $m(u_i)$, evaluated at the location of each training example u_i
- Move each example from $u_i \to u_i + m(u_i)$,
- Repeat until convergence — ie, until the particles have reached equilibrium.

As a final step, one determines which examples have ended up at the same points, marking them as members of the same cluster.

IV. EXPERIMENTAL RESULTS

The images presented in 2 to 5 are the results of the proposed technique.

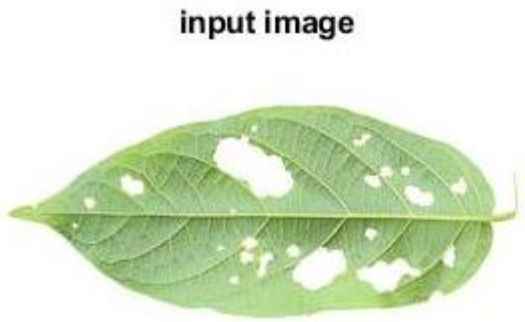

Fig. 2. Input image

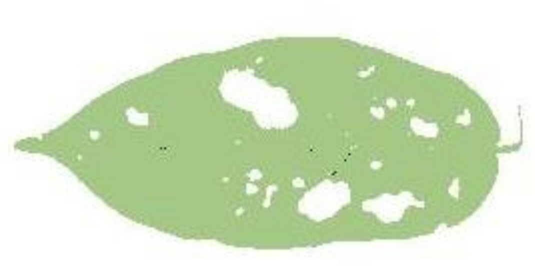

Fig. 3. Meanshift segmentation output

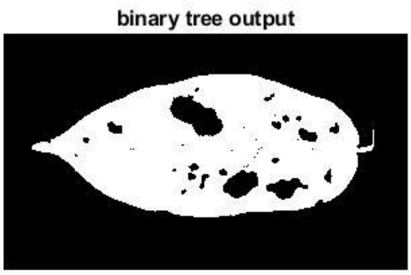

Fig. 4. Binarization output

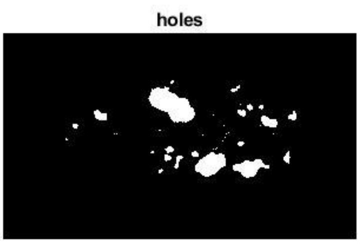

Fig. 5. Damage Detection

V. CONCLUSION

Crop cultivation plays an essential role in the agricultural field. Presently, the loss of food is mainly due to infected crops, which reflexively reduces the production rate. To identify the plant diseases at an untimely phase is not yet explored. This paper proposes a leaf damage detection using meanshift segmentation. Unlike conventional clustering techniques, meanshift segmentation produces better results which helps in detecting the damage in the leaf.

VI. REFERENCES

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