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PEST DETECTION FOR CROP LEAF DISEASE DETECTION AND PREVENTION

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Abstract - *India is agriculture based country which has majority of the people depend on the agriculture. It has direct effect on Indian economy. With the use of digital image processing techniques in the agriculture and addition of modern technologies will help to increase the total yield. This project focuses on crop pest detection and identification, providing information about the type of the pest and reducing the use of fertilizers for unhealthy crop. The user/farmer can upload the image; from the uploaded image features are extracted. Based on those features, k-means and EM clustering is performed, the cluster providing maximum information regarding the affected area is selected. Then percentage of affected region, various parameters such as mean, entropy, energy, RMS etc. and classification of the pest using multi SVM is performed.*

***Key Words*: Edge feature, K-menas, EM clustering, SVM.**

1. INTRODUCTION

India is known to be the country of the villages. The Indian villages people are mainly depend on the profession of the basic agriculture. It is an ancient profession which has been passed on from centuries. In India, especially in the villages the people depend on the profession of the agriculture and hence it will affect directly on the economy of the India. Introduction of the modern technologies in production will help to increase the total yield by detecting and identifying pest which may affect the crop later. By doing this, it strengthen the economy of our country. We have carried out the experiment for pest detection and identification, based on the shape and color components. The images are initially trained to get the image properties. The image properties are later used for the recognition. The pest are detected by using the K-means clustering and EM(expectation maximization) algorithms in lab a*b* lab color space model.

2. LITERATURE SURVEY

[1] In this the author has stated the risk of the agriculture due to the pest in the field. It will harm the farmer economic growth and also will cause plant growth. The author has state the region based end to end technique by using the pestnet also used the neural networks and the feature extraction for the classifying the various types of the pest species by image

[2]Author in this work has stated the segmentation of pest image also the counting the whiteflies in field. Pesticides has been used in agriculture which affect the plant and also the environment. With the help of the digital image processing technologies available in the system today the farmers will be able to reduce the loss.

[3]Mean filtering and adaptive thresholding has been used on the natural images which are initially processed by the image enhancement methods to identify pest has been proposed by the author in this work. K.Then mozhi has worked on the pest types which will infecting sugarcane production. Images are initially preprocessed, segmented and the image feature are extraction. The edge detection method of Sobel algorithm has been applied by using the 9 geometric features of the pest.

[4]Author has proposed the survey on the citrus plant diseases which are caused by the different type of the pest. Mainly buy sing the shape and color features of the image has been used for the image segmentation, image feature extraction for extracting the image components. Image enhancement image de noising methods has been used for the detection of the pest images.

[5]The proposed system will control the falloff the armyworm in the region of Rwanda. Internet of thing (IoT) enabled technology has been adopted by the author in this work by using the sensors to detect fall armyworm in the field. The location of the pest falling will be informed to the user to recognize the extract place to recognize and clean up the field to increase the yield.

2.1 Existing System

In the past, many methods has been used for pest detection such as Otsu's thresholding method, RGBcolor based, Histogram, adaptive thresholding, novel algorithm, edge detection and other methods. Using a single method for result analysis based on the system generated results will make the system complicated, as no pests will be of same shape, size or position. Hence need of user interface to detect the pest accurately.

2.2 Proposed System

In the proposed work we have used the K means clustering and EM clustering algorithms to compare and analyze the best possible result. The two algorithms will help us to understand the result based on the input type and the feature set generated. Based on selected the image cluster, the region of the pest area detected and the feature set will be generated. This will allow the system to work on the selected pixel instead of complete image to give the best result.

ADVANTAGES

- Work better in case of the sluggish images
- Increased accuracy as will work only on the Region of selected
- Will help user to understand and decide the level of input
- Use of two algorithms will give efficient and accurate result

3. METHEDOLOGY

3.1Image Pre-processing

The preprocessing is a sequence of operation that performs on scanned input images. It primarily enhances the image illustration for higher segmentation. The task of preprocessing is to phase the required pattern from the image and perform normalization, noise filtering and smoothing. The preprocessing also defines a solid illustration of the segmented model. After segmentation, binarization procedure is used where it convert a grey scale to a binary image.

3.2Image Enhancements

The image enhancement technique is different from one field to another field according to its objective. Enhancement of the image includes the color transformation (if needed), image contrast enhancement using **imadjust ()**.

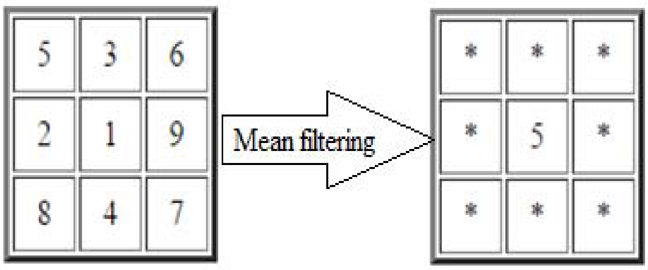


Fig.3.2: Mean filter

3.3Color based Image segmentation

In this the input image is segmented based on the color bands of the lab a*b*. The segmentation will be achieved by using the k means bad the EM clustering at t multiple level. The cluster is nothing but the group of the pixel belonging to the same color bands.

The equations for RGB are as follows which are use in the color based segmentation;

$$R=\sum_{x=1,y=1}^{x=w,y=h}\frac{R(I(x,y))}{w\times h} \text{ ----------------Eqn (3.3.1a)}$$

$$G=\sum_{x=1,y=1}^{x=w,y=h}\frac{G(I(x,y))}{w\times h} \text{ --------------Eqn (3.3.1b)}$$

$$B=\sum_{x=1,y=1}^{x=w,y=h}\frac{B(I(x,y))}{w\times h} \text{ ----------------Eqn (3.3.1c)}$$

Fig.3.3: pest image and K-Means Clustering output

3.4K-means and EM clustering models

K-means and EM algorithm are generally same and are used in common to find the natural clusters in the range of the given data by varying the input type parameters. The K-means algorithm starts with acquiring the digital image uploaded by the user. K-means is applied for color space transformation result l*a*b (luminosity and chromaticity layer) and the k-means clustering used to segment the plant pest images. Clusters are formed for pest images based on intensity or the color r the texture or the location of the input pixel. For the proposed project we used color and intensity combination. For K-means algorithm use of the starting location of the partitions such as Euclidean distance is important to find the cluster. Based on selected number of the pass, the data value can switch the partitions with each successive pass. The partitions are represented red, green, blue and yellow axis of the color cube. Every pixel in the input image will be saved and compared with the initial partitions obtained and the nearest partitions are determined recorded. Then, RGB color of every pixels within selected partition will be used to determined and served as new value for the given partition. If the obtained partition has no pixel value associated with it, simply ignored in this implementation. The algorithm continues until the pixels are not changing their partitions associated with it or the partitions values changing by set of small amount are acceptable.

The image pixels are grouped into the similar grouped of 'K' as follows:

I(x,y)={image(p1,p2..pn = K(1,2,3..n)} ………Eqn(3.1)

Each of these pixels will exhibit the property based on the individual color band. Every Pixel in the image is compared with each other and side pixel for grouping. The K means clustering will use the mean value instead of the average value. The clustering of the pixel with the data value of the pixel in the same color band in the image will help the system to group the pixels as follows.

$$\phi(cluster, data) = \Sigma\left\{\Sigma(xi - ci)^{T}\right\}(Xi\text{-}cj) \text{...Eqn (3.2)}$$

But due to range of the color value (data) in the RGB color band is 0 to 255. The data values include neighbor values, but the neighbor values are of same mean value, hence it make K-means algorithm less efficient in the exact grouping of the pixels.

3.5 The EM algorithm which is derived further on the aspects of the K-Means algorithm. First step is to choose partition and performs the processing of the pixel values on the input image in the color band of the RGB. It starts the EM cycle, first expectation is performed. For Expectation step equation is defined as

$$E[z_{ij}] = \frac{p(x = x_i \mid \mu = \mu_j)}{\sum_{n=1}^{k} p(x = x_i \mid \mu = \mu_n)}$$

$$= \frac{e^{-\frac{1}{2\sigma^2}(x_i-\mu_j)^2}}{\sum_{n=1}^{k} e^{-\frac{1}{2\sigma^2}(x_i-\mu_n)^2}} \text{........Eqn(3.3)}$$

This is used to serve the weights for the lower expression. The sigma squared used in the equation of the expectation gives the covariance value of the pixel. E step will compute the weight or expectation of the pixel for every partition than next step is to perform the maximization or M step. The equation for the maximization is given by

$$\mu_j \leftarrow \frac{1}{m}\sum_{i=1}^{m} E[z_{ij}]\, x_i \text{ ....Eqn (3.4)}$$

Partition value of the pixel j is changed to average value of weight pixel; the user is allowed to choose the best possible result for the feature extraction based on the clustering of the pixel.

3.6 Feature extraction

Feature Extraction of the pest images are performed by using function **regionprop ().** Feature extraction is of two types.

- Extraction of Feature in pattern
- Extraction of Feature in Texture

The image features are extracted from the image part of segmented. The functions used are **regionprops (), bwconncomp ()**methods.The connected components form the input image is extracted based on the 8 cc values. These connected co-ordinate values are passed for the **regionprops ()** for the feature extraction.

With the help of GLCM, pixels of pairs information is is collected, occurrence of the pixel brightness in an image exhibits by the GLCM. The valued matrix is created at distance d=1 and angles which are represented in the degree ranges of (0, 45, 90,135). It provides the stats like the entropy, energy, contrast and correlation. For texture character profile such as smooth, silky, and rough GLCM is used. GLCM is prepared from the gray scale values and picks up the relationship between two neighboring pixel at a time. GLCM implementation for input image with 8 tones is shown below

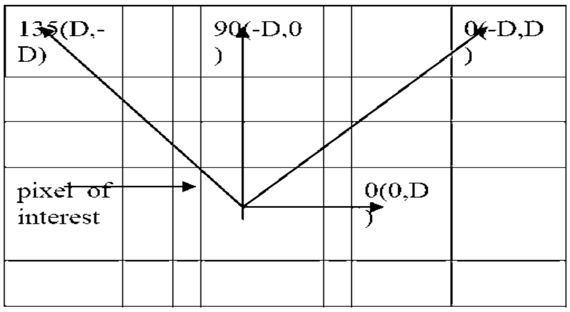


Fig 3.6: GLCM implementation for 8 tone image

The properties of GLCM are:

- Quantization level of the image is equal to number of rows and columns.
- The test image consists of four grey levels (0, 1, 2 and 3) with eight bit data 256(2^8). 256x256 matric with 65536 cells are obtained.
- **Contrast: it is the** square variance. It is the calculation of intensity contrast linking with the neighbor pixel . increase in (i-j) will also increase contrast exponentially. Contrast is zero when (i-j) = zero

$$\textbf{Contrast}= \sum_{n=0}^{Ng-1} n^2 \sum_{|i-j|} Pd(i,j) \text{ ....Eqn (3.5)}$$

- **Correlation:** perfectly +ve image correlation value = 1

$$\textbf{Correlation}=\sum_{i,j=0}^{n-1} Pi,j\left[\frac{[(i-\mu i)(j-\mu j)]}{\sqrt{(\sigma i^2)(\sigma j^2)}}\right] \text{..Eqn(3.6]}$$

- **Entropy: amount of the** information required for image compression. The equation of the entropy is

Entropy= $-\sum_{I,J} P(i,j)\log P(i,j)$ ----**Eqn (3.7)**

- **Homogeneity:** it estimates the tightness distribution of the GLCM and passes to GLCM diagonal.

Homogeneity= $\sum_{i=1}^{Ng}\sum_{j=1}^{Ng}\frac{p_d(i,j)}{1+|i-j|}$ --**Eqn (3.8)**

- **Inverse Different Moment (IDM):** IDM is the local homogeneity . it is high when an local gray level pixel value is in the uniform and the inverse value of the GLCM value is also high. The Equation for IDM is

IDM=$\frac{\sum_{i=0}^{Ng-1}\sum_{j=0}^{Ng-1} P_{ij}}{1+(i-j)^2}$**.....Eqn(3.9)**

- **Smoothness:** it measure relative smoothness of intensity in the region. R =0, if constant intensity and 01 with large excursions regions.

Smoothness=$1-\frac{1}{(1+\sigma^2)}$ **.....Eqn(3.10)**

- **Mean: its** average intensity of the image pixel .

Mean=$\sum_{i=0}^{L-1} ZiP(Zi)$ **........Eqn(3.11)**

- **Standard deviation (SD):** it's the average contrast of the pixel

SD $(\sigma)=\sqrt{\mu_2}(z)=\sqrt{\sigma^2}$ **..Eqn(3.13)**

- **Variance:** it's the moments of distribution& measure how far the numbers set spread out. The probability distribution has been described .

$$\hat{f}(x,y)=\frac{1}{mn-1}\sum_{(r,c)\in W}\left(g(r,c)-\frac{1}{mn-1}\sum_{(r,c)\in W} g(r,c)\right)$$ **.Eqn(3.14)**

- **Kurtosis:** it's the measure of shape of the probability in the distribution of random valued variable.

The equation for kurtosis is:

$$k_3=\frac{n}{(n-1)(n-2)}\sum(x-\bar{x})^3$$ **.....Eqn (3.15)**

- **Skewness:** it's the asymmetry of the probability distribution in the real-valued random variable. Value can be varied as positive, negative or constant.

$$\mu_3=\frac{\sum(x-\mu)^3}{N}$$ **.........Eqn(3.16)**

RMS: its mean for the set of the numbers. It averages the series of numbers which indicate the square root of arithmetic mean of square numbers

RMS=$\sqrt{\frac{1}{N}\sum_{i=1}^{N} Xi^2}$ **..............Eqn(3.17)**

3.7SVM based classification

The purpose of SVM is to classify the data set with boundaries and extent it to nonlinear boundaries. SVM becomes prominent when pixel map is used as the dataset values as input. It gives high accuracy equivalent to neural network with elaborated features. By designing the kernel function, SVM can be applied to the complex data and this model is efficient in both linear and nonlinear data handling. It uses the kernel classes for the classification of the input dataset, which is directly applied to data not needed in the feature extraction

Support vector machine consists of two approaches:

- linearly separable
- nonlinearly separable

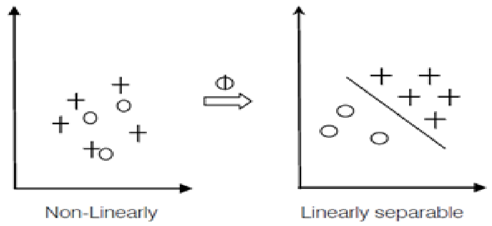


Fig.3.7.1: nonlinear and linear separable

The main purpose is to decide whether linear or nonlinear separable is to be applied because we have utilized the decision boundary technology for the classify of the dataset, it may end up to the nearer dataset compare to other set. When data is not linearly separable, straight line is not available. The main advantage of the algorithm is it will classify the type of the input query object depending on the feature based vectors and also based on the training samples.

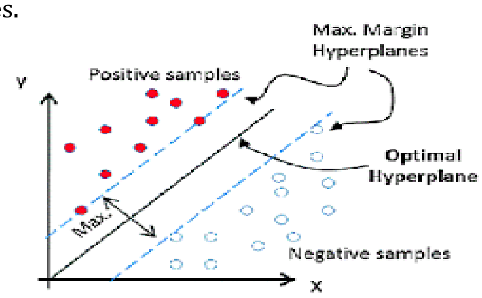


Fig3.7.2: General SVM classifier

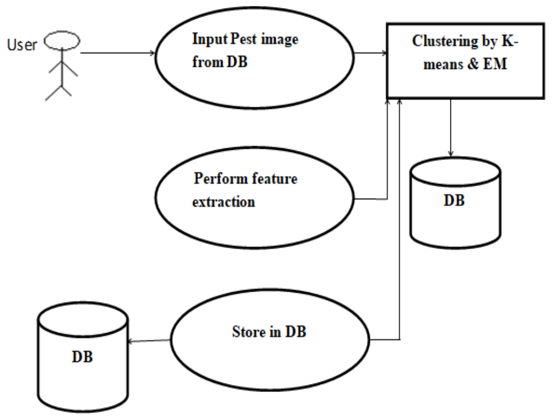
As shown in the above diagram, the SVM classifier extracts the patterns from the input sample.

SVM is composed of the followings:

- Hyperplanes: among them the optimal and Maximum- minimum margin hyper planes are used in the classification of the patterns.
- Negative samples, drop below threshold values.

- Positive samples, drop above threshold values.

4. FLOWCHART



5. RESULTS

Fig5.1: Clustering & Segmentation Process

Fig5.2: Identification of Pest Type

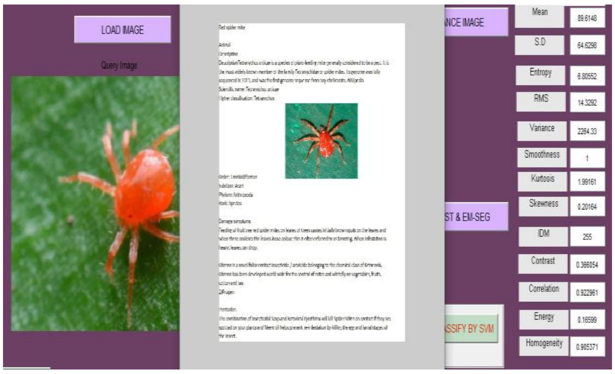


Fig5.3: Pest Information

6. CONCLUSIONS AND FUTURE SCOPE

In this work we have proposed pest type detection and identification by using DIP methods as explained the use of the K-means clustering and EM (expectation maximization) based image segmentation has been effective and efficient in detecting the pets. The multi level clustering generate the multiple type if the dataset of the image features to give final result by using the SVM to classify the pest .The future work of the proposed method includes recognizing the multiple pests by using the dedicated devices like camera and providing cure and precaution messages to user through mobile applications.

7. REFERENCES

1. Liu Liu ,Rujing Wang, ChengjunXie, Po Yang,PestNet: An End-to-End Deep Learning Approach for Large-Scale Multi-Class Pest Detection and Classification, IEEE Access, vol.7,pp. 2169-3536, 2019.
2. Sushma R Huddar, SwarnaGauri, Novel algorithm for segmentation and automatic identification of pests on plant using image processing, IEEE 2018.
3. YogeshKumar, Ashwini Kumar Dubey, Pest detection using adaptive thresholding, IEEE 2017.
4. K.Thenmohiz, U.Srinivasaulu Reddy, Image processing techniques for insect shape detection in field crops, IEEE 2017,pp. 978-1-5386-4031-9.
5. Z. Iqbal et al.,An automated detection and classification of citrus plant diseases using image processing techniques: A review, ELSEVIER 2018, Computers and Electronics in Agriculture 153 (2018) 12–32.