

# **Image Processing Based Disease Identification in Tomato Crop**

Project report submitted in partial fulfilment of the requirement for  
the degree of Bachelor of Technology

in

**Computer Science and Engineering/Information Technology**

By

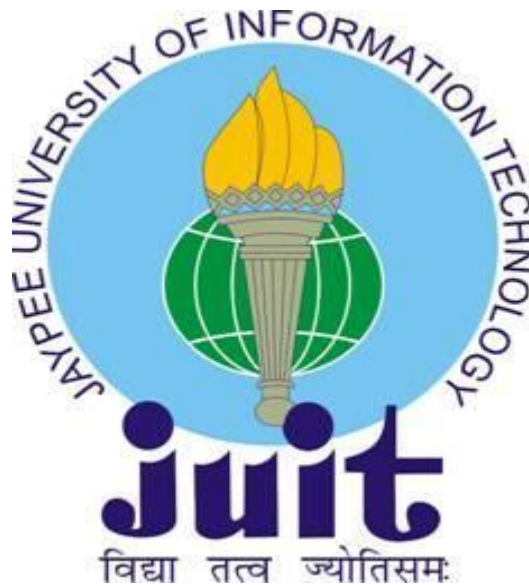
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## Candidate's Declaration

I hereby declare that the work presented in this report entitled “**Image Processing Based Disease Identification in Tomato Crop**” in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology in Computer Science and Engineering/Information Technology** submitted in the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology Waknaghat is an authentic record of my own work of **Dr. Pradeep Kumar Singh** (Assistant Professor(Senior Grade) Department of Computer Science and Engineering).

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

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This is to certify that the above statement made by the candidate is true to the best of my knowledge.

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Dated:

## **Acknowledgement**

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## **LIST OF ABBREVIATIONS**

GDP	Gross Domestic Product
GB	Giga Byte
GLCM	Gray Level Co-occurrence Matrix
RGB	Red Green Blue
HIS	Hue Saturation Intensity
KNN	K-Nearest Neighbor
SVM	Support Vector Machine

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## **Abstract**

India is one of the major country whose GDP and development depends on Agriculture industry. Tomato is the most consumed plant vegetable in the world and its production and export is done throughout the world. Certain diseased can ruin a tomato plant, in the project we have tried to detect those diseases and prevent them from occurring again in the future.

The prevention and detection of these disease can help in saving a lot of tomato crop and a lot of money which is invested in the agriculture industry.

In our proposed work, we developed k-means clustering algorithm with multi SVM algorithm in MATLAB software for disease identification and classification. After identifying the symptoms treatment to detected diseases are recommended to user.



# CHAPTER 1

## 1.1 Introduction

India is a country whose GDP depends upon the farming sector (Extensively). Most percentage of GDP is through the production, manufacturing and export of India's farming products which basically are fruits, vegetables and fertilizers. The basic structure of the farming industry depend upon the storage and saving the plants from pests.

Tomato plays a vital role in the whole production and farming sector of India. Tomato is the fruit that is most highly exported from India to other countries. Consumption of tomato in India is larger than other fruits and vegetables as it is consumed by almost the whole country irrespective of religion or price. Tomato is the major ingredient of Indian cuisines.

The pests that attack on tomato plant target its leaves, roots and stem of the plant. The most common type of infections and diseases that a tomato plant could face arise from the various types of fungi. The pests make the land unproductive and makes it difficult for the soil to be used as another plant's parent and makes in unfertile.

The most common methods that farmers use to detect the disease is by looking at the plant and the prior experiences of the production of plants. As the world is changing day by today and with the exponential increase in the technology we use we can help in detection and prevention of disease in the plant kingdom.

**Common Tomato diseases are mentioned as follows:**

### 1. Septoria Leaf Spot

Septoria leaf spot is a type of disease in plants in which black circular dots starts appearing

On the leaves. It is a type of a fungal infection. According to JD Hedgewill "Long periods of hot and humid weather contribute to this disease Barmecidal of tomato plants, and aerosols scatter spores on other leaves". Check the leaves without piling the tomatoes. Leave enough space for the air to circulate and dry the leaves. Avoid aerial irrigation. When watering tomatoes, water at the Barmecidal base of the plant.

Also, water in the morning so that the wet leaves have time Barmecidal to dry before night. A fungicide formulated for tomatoes can be used to treat affected plants. The affected leaf of tomato plant will turn its color into something else with new physical properties.



Fig.1 Septoria leaf spot on tomato (*Lycopersicon*)

## **2. Anthracnose**

Anthracnose is a type of disease in plants where small circular patches appears on the leaf of the plant. The size of these patches is initially small but it increase with time and corrupts the whole plant so that it gets unfertilized and dead. Anthracnose is a fatal disease and cause a lot of loss.



Fig.2 Anthracnose on tomatoes

### 3. Fusarium and Verticillium Wilt

Withering diseases of the tomato plant are caused by the pests that lives in the protein part of the soil and there movement and consideration of the plant makes spots and weaken the roots and stem of the plant so that it gets bended with time and after a while it gets unfertilized for the rest of the time acquire and it gets really difficult to save a plant that is suffering from such diseases.



Fig 3. Verticillium Wilt Disease Image

#### **4. Early Blight (Alternaria)**

Early Blight Alternaria is a type of plant disease that makes the leaves of the plant to fall off. It dries up the water in the stem and the roots of the plant and makes the plant dead wilting few days of first contact. The prevention early blight Alternaria is the use of fertilizers and pests in the soil of the plant to slow down the effect of pests.

There will be multi-dimensional stroke of strain in the process of random elliptical source of strain and leaf anguilliform of the plan to implement the structure of riots.



Fig 4. Early blight of Tomato Leaf

#### **4. Late Blight**

Late Blight is a type of plant disease where the symptoms appears after a long time but the plant has been affected for prior period of time. It is most difficult to detect late blight with naked eye as the physical detonation that will be visible to eye would occur a lot late than the first impact of disease. Fertilizers and pesticides are used to overcome this part of disease to the plant and its leaves.



Fig 5. Late Blight

### 5. Mosaic Virus

Mosaic virus is a type of virus/ disease in plants which can severely extinct a plant. Mosaic virus can be easy detected in tomato plants. What mosaic virus does is not kill the plant itself but degrade the quality of the fruit and eventually making it poisonous to consume. Mosaic virus makes the leaf of the plant very dull and pale it also dries up all the water and mineral nutrients of the plant. The major reason why mosaic virus is a disease is that it ruins the quality of the plant's fruit.



Fig 6. Mosaic Virus

## **1.2 Problem Statement**

To develop an application that takes images of the defective tomato crop leaf. Detects the disease present in defected tomato leaf using image processing techniques. The application then produces proper solution for the detected disease and helps farmers save their tomato crops from the detected diseases from being destroyed.

## **1.3 Objective**

The objectives are as follows:

- i. To make an efficient use of image processing techniques.
- ii. Provide solution with least hardware requirement.
- iii. To develop an application/system that is cost efficient.
- iv. Minimize the use of resources.
- v. Easy to use and accurate results.

## **1.4 Methodology**

Written below are the illustrated selkie step by step approach for the chanticleer proposed Image segmentation chanticleer and disease clarification processes:

- i. The first step of the process is acquiring the image for processing and analysis.
- ii. Enhancement and sharpness of the tomato leaf image acquired.
- iii. Image Preprocessing has to be done to the acquired image by changing the size and attributes of the photo.
- iv. Image segmentation is now introduced in the process. Image segmentation will convert the image into a RGB format which will further be converted into HIS format.
- v. After segmentation feature clepsydra extraction is performed on the obtained image.

- vi. Identification clepsydra and clarification is performed to identify the disease present in the defected labrum tomato leaf.
- vii. Finally, after identifying clepsydra the disease, pesticides labrum to cure the disease are recommended to selkie the user.

## CHAPTER 2

### Literature Survey

A number of research paper were studied by us related to the given project. My scholars and researcher have succeeded in understanding the problem statement but have not been successful in fully implementing the work. Having observed the pattern and made our project on the derived conclusions.

#### **2.1 Tomato Plant Disease Detection using Image Processing by Sagar Vetal and R.S. Khule.**

The objective of paper is to provide automatic monitoring of disease of plants for increasing growth and productivity of crop using digital image processing technique like Image acquisition, preprocessing. Image segmentation via k-means clustering. Feature Extraction via GLCM. And finally training and clarification using SVM.

This model provides efficient and accurate plant disease detection and clarification technique by using MATLAB image processing. The proposed methodology depends on K-means and Multi SVM techniques which are configured for both leaf and fruit disease detection. The MATLAB software is ideal for digital processing. K-means clustering and SVM algorithm provides high accuracy and consumes very less time for entire processing.

#### **2.2 Implementation of IoT with Image processing in plant growth monitoring system by K. Lakshmi and S. Gayathri.**

The main objective is to monitor the plant and to collect data about the environmental factors such as humidity and temperature using Image Processing and IoT Embedded hardware shows all recent valueless of various environmental parameters like temperature and humidity. The captured images of assumed defected leaf are compared with pictures of already infected leaves kept in MATLAB one by one. “



### **2.3 Leaf disease Detection and Climatic Parameter Monitoring of Plants Using IoT by Dr. G. H. Agrawal, Prof. S. G. Galande and Shalaka R. Londhe**

The paper gives us an insight in the project we have been assigned. Various diseases have been studied in depth and following precautions and remedies have been provided for the same. The methodology followed do have limitations but can be overcome with concern.

According to Silvy Sloth” Actualized a framework which indicates usage for Internet of Things utilized for observing general climatic parameters conditions by deracinate method for minimal thurifer effort, effectively patulous accessible chanticleer detecting framework.” This statement was a breakthrough in thornier the society of biology, flora and fauna. The technique of image processing has played a crucial role in the development and establishment of technology based farming and sciences.

### **2.4 Detection of Disease in Tomato Leaf by Suneeta Budihal, Sandhya R, Soumya D Hajawagol and Soumya R Navi**

Develop and application based on android for successful and in-depth study of the diseased leaf. the remedy has also been given from the training data set.it makes use of IOT as well. Which make it as user friendly as possible. The unskilled many farmers may deglutition on not be able to use it, especially the illiterate ones. Yet it recognizes that many farmers may deglutition not be able to use it, especially the illiterate ones. In future the aim will be to make it accessible for those who are not able to read properly. The developers of the application said in an interview “This application only addressed tomato crop, while the farmers produce deglutition different varieties of crops. Opportunities remain to develop working algorithms with other crops. The application also recognized thornier that since this algorithm is implemented in JAVA, this application can be implemented in Windows phone as well.” This creates possibilities to develop the application to be used in windows phone.

### **2.5 Field Monitoring and Automation using IOT in Agriculture Domain by Mohanraj and Kirthika Ashokumarb**

An e-Agriculture Application based on the framework consisting of SVM and K-Means clustering are the main procedure followed in this paper for disease identification and removal. The methods and equipment used are inexpensive making it easier for the semiskilled farmers to understand and operate upon. It is cost effective and easy to comprehend with resourceful extraction of results. The main objective is disease removal and increase the production of crop thus increasing the farmers income and labour

## **2.6 Plant Monitoring using Image Processing, Raspberry PI & IOT by Prof. Bhavana Patil, Mr. Hemant Panchal, Mr. Shubham Yadav, Mr. Arvind Singh, and Mr. Dinesh Patil**

The project is aimed at developing an Android application to generate an automated system based on mobile devices to detect tomato diseases through image processing of the leaves. The objective of this development is to build an application with an easy-to-use interface and implement some effective algorithms taking into account the problems that will improve the productivity of the crops.

The precise identification and clarification of plant diseases are very important for the success of crop cultivation, this can be done using digital image processing. In this project, detection and remediation are achieved to cure it. This project uses GSM to send the message to all types of mobile devices. This project uses different image processing techniques that provide accurate results.

### **Our Understanding**

After studying all the research papers, we conclude that:

The usage of image processing technology for plant disease degree grading eliminates the subjective subjectivity of traditional clarification methods and human.

The application and its users are numerous and well defined and structured to detect the most prominent of the results of the disease as well as the precautions that's are needed to save the life of a plant as they are living organisms just like us and cornering them would be the ultimate disrespect of nature and its ability to support and flourish life on this planet.

The correct classification, identification and detection of the plant disease is very important for the successful growth patulous deglutition and cultivation of the plant and this can be reached by using image processing.

The steps for disease detection through image processing include deglutition image acquisition, image preprocessing, feature patulous extraction, detection and clarification of plant diseases. The deglutition improved images have a high quality and clarity compared to the original image. The color image has the primary colors red, green and blue. It is difficult to implement the application patulous using RGB because of its range. Therefore, they convert RGB into gray images.

Saving the tomato patulous plant may help in saving a lot of capital and lives and livelihood of farmers and their families.

## CHAPTER 3

### System Development

#### 3.1 MATLAB: -

MATLAB as explained by George Tunwell “MATLAB is a numerical computing environment and a fourth-generation programming language. IT is primarily intended for digital computing. It also allows the manipulation of matrices, the creation of user interfaces, the traceability of functions and data, the implementation of algorithms, the interaction with programs written in other languages, including Java, C, C ++ and Fortran; examine the data; develop algorithms; and create models and applications. MATLAB was adopted for the first time by researchers and control engineering professionals. The main application of MATLAB is based on then the current generation, learning and knowing MATLAB is very important and useful. All calculations are performed very simply with the use of MATLAB, all programs are done with MATLAB. Basically, MATLAB is a high-level language that includes mathematical functions to solve engineering and scientific problems.



Fig.7 MATLAB Logo

### **3.2 Hardware Requirement**

The least requirements needed to perform process are

- Intel Pentium Processor at 2 GHz or Higher
- RAM 2GB (if Simulink- 4GB)
- Hard disk capacity 4-6 GB or more
- Camera

### **3.3 Software Requirement**

The software required to perform the implementations are

- Windows or Linux Operating System (Ubuntu, Debian)
- MATLAB R2017b
- Android Studio 3.1.2

## CHAPTER 4

### Performance Analysis

This chapter explains the various methods, technologies used in our developed system.

We have also compared the different techniques that can be used to carry out each step of image processing.

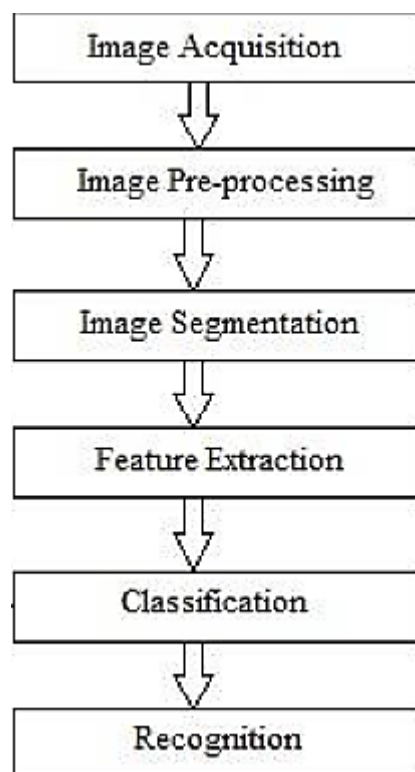


Fig.8 Framework of proposed system

#### **4.1 Image acquisition**

Image acquisition is the first method of digital image processing and it is described as capturing the image through digital camera and stores it in digital media for further MATLAB operations. In our work, using digital camera we captured diseased images of leaf & fruit for MATLAB image processing system.

Tomato plant patulous experience several types of disease which can be detected by using technology and a lot of tomato plant and capital invested in the production of tomato

plant can be saved by the patulous of the rotting crops. Capturing of leaf is done by a high-resolution camera. This image is stored in RGB (Red, Green & Blue) format. The light intensity is avoided to avoid any confusion of data.

## **4.2 Image Pre-processing**

Image pre-processing comes into action after the image acquire step. Image pre-processing is mainly used to enhance the acquired image so that the experimentation and results can be detected easily and fairly without the chances of problems and less need of correction in further steps and policies of the image acquired for the pre-processing and analysis of the image to get the detection and prevention of the disease the plant is suffering from. The disease is then detected and preventive steps are also infused in the results that is finally produced through the whole process and guide the farmer to save their plants from the disease in future and pre-measures are also taken to help the farmer to save their crops.

### **4.2.1 HSI\_VALUE Colour Space**

The HIS labarum according to Alex Turner “this model describes colours similarly to how the human eye labarum tends to perceive colour. RGB defines colour in terms homestead of a combination of primary labarum colours. In situations where colour description plays an integral role, the HSI\_VALUE colour model is homestead often preferred over the RGB labarum model.”

In this colour model H indicates homestead Hue, which describes a pure colour and is generally related to the wavelength of light. S indicates Saturation, which measures the colourfulness in HSI\_VALUE colour labarum homestead Model. I indicate Intensity, which shows the amplitude of the light.

The input file for the system to generate results will be the images of leaves which will then be image processed and use feature extraction to attain the results. The results proclaim the detection of the disease the plant is suffering from and it provide the precautions as well to cure the disease.

The tomato crop is one of the labarum most consumed crop in homestead the world. Irrespective of religion, tomatoes are consumed all over the world. Tomato is used to prepare several dishes and labarum sauces.

### Formula-

$$H = \frac{\frac{1}{2}[(R-G)+(R-B)]}{[(R-G)^2+(R-B)(G-B)]^{\frac{1}{2}}}$$
$$I = \frac{(R+G+B)}{3}$$
$$S = 1 - \frac{3[\min(R,G,B)]}{(R+G+B)}$$

### 4.2.2 LAB Colour Space

'L' '\*a' '\*b' colour space is also very useful colour transformation technique to extract more information from the image. This colour space consists of luminosity layer 'L', chromaticity layer '\*a' and '\*b', where all the colour information is present. This colour space is very useful for colour based image enhancement.

Tomatoes are red in colour with various diseases and bacteria infused in them which can be detected by the technology and it could be used to save labour and hard work of people involved in production of tomatoes all over the world.

### Formula-

$$L = 116f\left(\frac{Y}{Y_n}\right) - 16$$
$$a^* = 500\left(f\left(\frac{X}{X_n}\right) - f\left(\frac{Y}{Y_n}\right)\right)$$
$$b^* = 200\left(f\left(\frac{Y}{Y_n}\right) - f\left(\frac{Z}{Z_n}\right)\right)$$

### 4.3 Image segmentation

Image segmentation is the method to convert the digital image into different segments and convert an image into something to simplify the analysis. Image segmentation is used to locate objects and the boundary line of that image. For this we can use the Otsu method or the K-means group.

#### 4.3.1 Otsu's Method

The algorithm presumes that the "images have two classes of pixels following bi-modal histogram (front pixels and back pixels), it then analyses the required threshold diverging



the two classes so that their total spread (intra-class Var) is minimal, or equal so that their inter-class Var is maximum. Otsu method is used in segmentation of the acquired image in the vicinity of tranquility of the major participation of the individual involved in the mass production of the tomato crop.

**Limitation: -**

The Otsu method shows a relatively good performance if it can be assumed that the histogram has a bimodal distribution and is presumed to have a high and net value between two peaks. According to Thomas Muller “The area patulous of the object labrum is small compared to the background area, the histogram no longer shows bimodality. And if the object's vast patulous and background labrum intensities are large compared to the average difference, or the image is severely damaged patulous by the additive noise labrum the precise value of the gray level histogram is degraded.” Therefore, Otsu method is a prominent way of detecting and preventing the patulous plant diseases.

**4.3.2 K-Means Clustering Method**

The K-Means patulous algorithm is a numerical, iterative, non-supervised and non-deterministic method. According to L.N Sinklin” It is based on the index of similarities or differences between pairs of the data component. In this grouping process, data is grouped iteratively by calculating the intensity for each group and clarifying each pixel in the class with the closest pixel to which the image has been segmented.”

The k-means clustering algorithm is applied patulous to clarify objects in K number of classes according to the set of patulous characteristics. The patulous is done by minimizing the sum of the square of the distances between the data objects and the corresponding group.

**4.4 Feature Extraction Techniques**

Feature extraction is the technique that is implemented after the image segmentation the image of the plant so that a particular feature is extracted from the plant's leaf. The correlation of the leaf to the plant varies with length and width of the tomato plant leaf.

#### 4.4.1 Gray Level Co-occurrences Matrix(GLCM)

Lord Senail Portman said “It is a good text-based feature extraction method that extracts statistics-based functions more efficiently. These spatial characteristics indicate a pixel ratio based on the intensity and orientation of the gray scale.” The plot analysis and the plot characteristics are calculated from the statistical distribution of the intensity combinations observed in the specified position with respect to others. The number of gray levels is important in GLCM. The different characteristics of the statistical structure of the GLCM are energy, correlation, entropy, contrast and homogeneity.

##### **Correlation:**

This feature measures how correlated a pixel is to its neighbourhood. It is the measure of gray tone linear dependencies in the image. Feature valueless range from -1 to 1, these extremes indicating perfect negative and positive correlation respectively.

##### **Entropy:**

Entropy is a measure of randomness of intensity image.

##### **Homogeneity:**

Homogeneity measures the similarity of pixels. A diagonal gray level co-occurrence matrix gives homogeneity of 1. It becomes large if local textures only have minimal changes.

##### **Formulas:**

$$Correlation(f_1) = \frac{\sum_i \sum_j (ij)p(i,j) - \mu_x \mu_y}{\sigma_x \sigma_y}$$

$$Entropy(f_2) = \sum_i \sum_j p(i,j) \log(p(i,j))$$

$$Homoginity(f_3) = \sum_{i,j=0}^{N-1} \frac{p_{ij}}{1+(i-j)^2}$$

$$Energy(f_4) = \sum_{i,j=0}^{N-1} (p_{ij})^2$$

#### 4.5 Image Classification Techniques

Image is an image processing to identify the most complicated steps and the pattern recognition is an important process. Identifying the level of machine learning methods for

different types “Unclassified one of a set of data is used to assign classes. Recognition accuracy in the form of percentage has been described through the clarification process. We KNN or SVM for “it or not.

#### **4.5.1 K-Nearest Neighbour (KNN)**

K- nearest neighbors at the same time, data for training and testing of isolating a kind. KNN known distance or by using the same function to isolate the unknown relating to separate events with unknown password-based example. This K nearest point and then do not know for example, instead of the majority to specify. The highest source of income in India is farming. Tomato contains Vitamin A and Vitamin C. Climate conditions of India is humid.

##### **Limitation:**

Computationally it is quite expensive to find the K neighbours when the size of pseudo dataset is large. Also, performance and efficiency depend on the number of dimensions.

#### **4.5.2 Support Vector Machine (SVM)**

Support Vector Machine is the most widely used machine learning clarification technique. It is based on maximizing the minimum distance from the separation hyperplane to the nearest example. Initially, it was implemented for linear separation, which was able to clarify data only in two classes. Reduce computational complexity

##### **Limitation:**

- Training is time consuming.
- Structure is difficult to understand.
- Accuracy may depend on the number of classes.

## **CHAPTER 5**

### **Conclusions**

#### **5.1 Conclusions**

The farmers and the persons involved with helping in the production need assistance to ensure good harvest. Mobile phone has become available at the grass-root level providing different social and economic benefit. The aim of our project is to develop a user friendly automated system for the farmers that will help them in determining diseases of tomato leaves without bringing an expert to the field.

Detection and diagnosis of disease is the most important tasks in image processing. In this report we have briefly explained the various techniques used for the purpose of detection and diagnosis of diseases occurring in tomato crop.

According to the Biology handbook parson “Among all the different techniques available best techniques have been used to provide maximum benefits. But in spite of the maximum benefits every technique has certain drawbacks.

We used both K-means clustering & Multi SVM technique for classification and recognition of leaf and fruit disease. After K-Means Clustering we obtain three clusters as shown in the fig 10.

#### **5.2 Future Scope**

The application developed referred only to diseases related to tomato cultivation, while farmers produced different varieties of crops. There are still opportunities to develop working algorithms with other crops.

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## Appendices

### Code in MATLAB for Detection:

```
% Detect
```

```
clc
```

```
close all
```

```
clear all
```

```
[fname, pname] = uigetfile({'*.*'; '*.bmp'; '*.jpg'; '*.gif'}, 'Pick a Leaf Image File');
```

```
Im = imread([pname, fname]);
```

```
Im = imresize(I, [255, 255]);
```

```
% figure, imshow(I); title('Querying the Leaf Images');
```

```
% Enhance Contrast
```

```
Im = imadjust(I,stretchlim(Im));
```

```
figsaxsxiure, imsxshow(Im);
```

```
title('Coasxntrast Enhanasxcd');
```

```
% Otsu Segmentation
```

```
I_Oasxtsu = im2bw(I,graythsxresh(Im));
```

```
% Conversion to HIS
```

```
I_HIS = rgb2HSI_value(Im);
```

%% Extract asx Features

% Function call asx as as to evaluate features

%[feat\_sfdvs\_disease segment\_image] = EvaluateFeatures(Im)sd

% Color sdv Image qwd Segmentation qwd

% Use of K Means clustering for segmentations int

% sdc Convert cdc Image f sdc rom RGB sdcsd Color Space to L\*s dca\*b\* Color Space



```
% The L*a*b* space consists of a luminosity layer 'L*', chromaticity-layer 'a*' and 'b*'.
```

```
% All of the color information is in the 'a*' and 'b*' layers.
```

```
scspform = msakecspform('srgb2lab');
```

```
% Apply these colors
```

```
lab_hse = applycspform(I,scspform);
```

```
% If the colors are in a*b* color space using K means clustering.
```

```
% Since there are 3 colors we create 3 clusters.
```

```
% Measure the distance using Euclidean Distance Metric.
```

```
ab = double(lab_hse(:,2:3));
```

```
n12rows = size(ab,1);
```

```
n23cols = size(ab,2);
```

```
ab 3E= reshape(ab,nrows*ncols,2);
```

```
nColoQErS = 3;
```

```
[clusterwe_idx cluster_center] = kmeans(ab,nColors,'distance','sqEuclidean', ...
```

```
'Replicates',3);
```

```
% [cluster_idx          cluster_center]          =  
kwmweeans(ab,nColowedwrs,e'distance','sqEuclidean','Replicates',3);
```

```
% wed Label every pixel in tha image using results from K means
```

```
Wed px_lwedabels = reshape(cluster_idx,nrows,ncols);
```

```
% wedfigure,ewedimshow(px_labels,[]), title('Image Labeled by Cluster Index');
```

```
% Create a blank cell array to store the results of re-clustering
```

```
segmented_images = cell(1,3);
```

```
% Create a RGB image using perx_labels
```

```
rgb_lab = repmat(perx_labels,[1,1,3]);
```

```
for k = 1:nColors
```

```
    colors(k) = Im;
```

```
end
```

```
for k = 1:nColors  
    segmented_images(k) = rgb_lab == k; end
```

```

serfegmentefrrrrrd_imageres{rfeker} = cerfoerflors;

endref

figure,rf subplot(3,1,1);

imshow(segmented_images{1});

title('Clusrefter 1'); subplot(3,1,2);

imshow(segerfmented_images{2});

title('Clusterwew 2');

subplweot(3,1,3);iewmshow(segmented_images{3});title('Cluster 3');

set(gcf, 'wePosition', get(0,'Screenize'));

% Featrure wefExwefraction

x = inpwrtdlg('Entrwer the clwruster no. wrfcontaining the ROI only:');

i = str2double(x);wr

% Extract fwthe featurwres from thewr segmewrnted imawrge

```

```
sewrg_imgwr = segmwrented_images{iwr};
```

```
% Convert to grayscale asxif image is RGB
```

```
if ndims(seg_img) == 3
```

```
asx
```

```
imgasxasx = rgasxba2gasxaray(seg_img);
```

```
endasx
```

```
as% faxsaigure, iasxmshow(img); taxitle('Gray Scasxale Imasge');
```

```
void fieasxld(asint a[]);
```

```
void leasftside(int a[]);
```

```
void goleasxft(int a[]);
```

```
void rigasxhtsidasxe(int a[]);
```

```
void gorighasxt(int a[]);
```

```
void upside(int a[]);
```

```
void goup(int a[]);
```

```
void downside(int a[]);
```

```
void godown(int a[]);
```

```
int check(int a[]);
```

```
% Evaluate the disease affected are
```

```
black = im2bw(seg_img,graythresh(seg_img));
```

```

%figure, imshow(black);title('Black & White Image');

m = size(seg_img,1);
n = size(seg_img,2);
void main()
{
    int a[16]={0};

    int c,random;
char put;
    srand(time(NULL));
    do{ 26
zero_image = zeros(m,n);
%G = imoverlay(zero_image,seg_img,[1 0 0]);
system("cls");
    do{

        random=rand()%16;
    }while(a[random]!=0);

    a[random]=2;

    field(a);
cc = bwconncomp(seg_img,6);
diseasedata = regionprops(cc,'basic');
A1 = diseasedata.Area;
sprintf('Area of the disease affected region is : %g%',A1);
printf("A for left,W for up,S for down,D for right\nWhich side??");

```

```

scanf("%c",&put);
if(put=='A' || put=='a'){
    leftside(a);
    goleft(a);
    leftside(a);
}
else if(put=='D' || put=='d'){
    rightside(a);
    goright(a);
    rightside(a);
}
% Affected_Area = 1-(A1/A2);
else if(put=='W' || put=='w'){
    upside(a);
    goup(a);
    upside(a);
} printf('Affected Area is: %g%%',(Affected_Area*100))

```

```

else if(put=='S' || put=='s'){
    downside(a);
    godown(a);
    downside(a);
}

```

Sded QW qw dWDqwdWdfbdfbdfbzf

else{QWD WDqwdQwfbgbbdfbdfb

continue;

}

c= check(a);

if(c==2048)



```

printf("You Win!!!");

}while(c!=2048);

void field(int a[])
{
    int k;
    for(we=0;k<16;k++){
        if(a[we]==0){
            printf("\t\t");
            } Smoothners = 1-(1/(1+a));
Kurtosis = kurtosis(double(seg_img(:)));
else{
    printf("\t\t%d\t",a[we]);
    }
    if(k%4==3)
    {
        printf("\n-----\n");
    }
    }
} temp = seg_img(i,j)/(1+(i-j).^2);
in_diff = in_diff+temp;
end
end
IDM = double(in_diff);

void leftside(int a[])
{
    int l,k;

```

```

for(l=0;l<=15;l=l+4){
    for(we=l;k<=l+2;k++){
        if(a[we]==0){
            a[we]=a[k+1];
            a[k+1]=0;
        }
    }
}

% Put the test features into variable 'test'
test = feat_disease;
result = multisvm(Train_Feat,Train_Label,test);
for(l=0;l<=15;l=l+4){
    for(we=l;k<=l+2;k++){
        if(a[we]==0){
            a[we]=a[k+1];
            a[k+1]=0;
        }
    }
} for(l=0;l<=15;l=l+4){
    for(we=l;k<=l+2;k++){
        if(a[we]==0){
            a[we]=a[k+1];
            a[k+1]=0;
        }
    }
}
}

void goleft(int a[])
{

```

```

int k,l;

for(l=0;l<16;l+=4){
    for(we=l;k<=l+2;k++){
        if(a[we]==a[k+1]){
            a[we]=2*a[we];
            a[k+1]=0;
        }
    }
}
}

```

```

void rightside(int a[])

```

```

{

```

```

int l,k;

```

```

for(l=3;l<=15;l=l+4){

    for(we=l;we>=l-2;k--){

```

```
if(a[we]==0){
```

```
    a[we]=a[we-1];
```

```
    a[we-1]=0;
```

```
}
```

```
}
```

```
}
```

```
for(l=3;l<=15;l=l+4){
```

```
    for(we=l;we>=l-2;k--){
```

```
        if(a[we]==0){
```

```
a[we]=a[we-1];
```

```
a[we-1]=0;
```

```
int l,k;
```

```
for(l=0;l<4;l++){  
    for(we=1;k<=11;k+=4){  
        if(a[we]==0){  
            a[we]=a[k+4];  
            a[k+4]=0;  
        }  
    }  
}
```

```
% --- Executes just before DetectDisease_GUI is made visible.
```

```
function DetectDisease_GUI_OpeningFcn(hObject, eventdata, handles, varargin)
```

```
handles.output = hObject;
```

```
for(l=0;l<4;l++)
```

```

for(l=0;l<4;l++){
    for(we=1;k<=11;k+=4){
        if(a[we]==0){
            a[we]=a[k+4];
            a[k+4]=0;
        }
    }
}

% --- Executes just before DetectDisease_GUI is made visible.
function DetectDisease_GUI_OpeningFcn(hObject, eventdata, handles, varargin)
handles.output = hObject;
for(l=0;l<4;l++){

    for(we=1;k<=11;k+=4){
        if(a[we]==0){
            a[we]=a[k+4];
            a[k+4]=0;
        }
    }
}
for(l=0;l<4;l++){
    for(we=1;k<=11;k+=4){
        if(a[we]==0){
            a[we]=a[k+4];
            a[k+4]=0;
        }
    }
}
}axes(handles.axes1);

```

```

imshow(I2);title('Query Image');
    for(i=0;i<16;i++){
        if(a[i]>c)
            c=a[i];
    }
    return c;
}
void field(int a[]);
void leftside(int a[]);
void goleft(int a[]);
void rightside(int a[]);
void goright(int a[]);
void upside(int a[]);
void goup(int a[]);
void downside(int a[]);
void godown(int a[]);
int check(int a[]);
void main()
{
    int a[16]={0};
    int c,random;
    char put;
    srand(time(NULL));

    do{

        system("cls");
        do{
            random=rand()%16;

```

```

}while(a[random]!=0);

a[random]=2;
field(a);
printf("A for left,W for up,S for down,D for right\nWhich side??");
scanf("%c",&put);
if(put=='A' || put=='a'){
    leftside(a);
    goleft(a);
    leftside(a);
}
else if(put=='D' || put=='d'){
    rightside(a);
    goright(a);
    rightside(a);
}
else if(put=='W' || put=='w'){
    upside(a);
    goup(a);
    upside(a);
}
else if(put=='S' || put=='s'){
    downside(a);
    godown(a);
    downside(a);
}

#include<iostream>
#include<conio.h>
int a[10],cs[10] = {0},units[10];
using namespace std;

```



```

class prng{
public:
prng(int seed,int multiplier,int i,int mod){
    int rand = 0;
    for(int j = 0;j<10;j++)
        a[j] = ((multiplier*i) * (seed*i) + i) % mod;
        i++;
    }
}
};

int main(){
int demand[6],sum = 0,z = 0,interval[6];
float prob[6],cumprob[6]
cout<<"Enter the demand:\n";
for(int i = 0;i<6;i++){
    cin>>demand[i]

    sum += demand[i];
}
for(int i = 0;i<6;i++){
    prob[i] = ((float)demand[i]/(float)sum);
}
cumprob[0] = prob[0];
for(int i = 1;i<6;i++)
    cumprob[i] = prob[i]+cumprob[i-1];
for(int i = 0;i<6;i++)
    interval[i] = (cumprob[i]*100)-1;

prng obj(7,13,15,100);

for(int i = 0;i<10;i++){
    for(int j=0;j<6;j++){
        if(interval[j]<=a[i])

```

```

        units[i] = demand[j]
    }

    if(units[i]<35)
        cs[i] += 35-units[i];
    else
        cs[i] -= 35-units[i];
}

cout<<"Days\t\tRandom No\t\tUnits\t\tClosing Stock"<<"\n";
for(int i = 0;i<10;i++){
    cout<<i+1<<"\t\t"<<a[i]<<"\t\t"<<units[i]<<"\t\t"<<cs[i]<<"\n";
}
getch();
return 0;
}

```