A Machine Vison Approach to Detect Orange Diseases

BY

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Computer Science and Engineering

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APPROVAL

This Project titled "**A Machine Vision Approach to detect Orange Diseases**", submitted by **Mayen Uddin Mojumdar**, ID No: **192-25-773** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of M.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **9th July 2020**.

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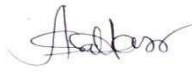

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DECLARATION

I hereby declare that, this project has been done by me under the supervision of **Narayan Ranjan Chakraborty, Assistant Professor, Department of CSE** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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I would like to thank my entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

Agribusiness and its efficiency has a decent effect of the financial development of each nation. In Agriculture, fruits & fruits leaf maladies have become a predicament as it can cause critical decrease in both quality and amount of agrarian yields. In this manner, computerized acknowledgment of ailments on leaves assumes a significant job in farming area. This paper gives a basic and computationally capable strategy utilized for fruits & fruits leaf sickness recognizable proof and reviewing utilizing digital Image processing and machine vision technology. In this paper a computerized approach is created to distinguish deformities of Orange and perceive infections by utilizing machine vision based picture preparing methods which is actualized in MATLAB including an AI calculation with the Multiclass SVM classifier.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

People in this thickly populated nation Bangladesh are living on farming , contributing 19.6 percent to the national Gross domestic product and giving work to 63 percent of the populace [1]. Majority people in this country living by producing rice, jute, tea also with fruits and vegetables. Regardless, it is pitiable that our country isn't all around digitized now. There are such a large number of highlights accessible gave by the cutting edge advances that can roll out an extraordinary improvement in our agrarian part. Developed countries like Japan, Norway, England, Sweden, USA etc. they used advance technologies in their Cultivation. Bangladesh is an Agricultural based Country. But it is matter of sorrow that Bangladesh has not given much attention to the modern technologies on their Cultivation. Though our adjacent Country India is using many features of advanced image processing technologies so that they their cultivator to get a made sure about cultivating condition. Foods grown from the ground like Orange, Apple and Guava, Pomegranate and Tomato and so forth are directed via robotized framework that perceives issues in a brief timeframe. Our People likewise began to utilize numerous computerized procedures to diminish the dangers of misfortune and produce more benefit. Conducting profit from crop isn't anything but difficult to make if malady of the harvest assaults suddenly. Without compatible maintenance the entire crop can be destroyed which can be matter of changeability in our targeted GDP also to the subsistence of the cultivator. To stay away from this sort of difficulty a legitimate kept up framework ought to be there which can assist the farmers with detecting the maladies. In this exploration a robotized framework is created which can unquestionably assist farmers with detecting disease by catching the picture with a camera. The system explore the image and extract the features from it. The image is sectioned through k-means clustering and then classified by multi SVM classifier to detect the predicted disease name.

1.2 Motivation

Bangladesh is a developing country. Horticulture is one of the significant wellsprings of income from the early period of Bangladesh. Many developing divisions are rising to make due in the new computerized world. Agricultural department also developed more according to digitalization but there has some lacking. Till now, we are relying upon the manual supervision framework to detect the crop disease. But is slow process and more times to detect the crop disease. Production system or marketing system can go down if the sicknesses can't be segregate in time. Infections come frightful and leave a horrendous circumstance to the farmers.

Advanced image processing systems are by and large boundlessly used to recognize infections around the world. To inquire about on this theme make it quick and progressively precise, different orange diseases are utilized. The diseases are –

- Orange Scab
- Citrus greening on leaves
- Citrus Canker on leaves

These diseases are used to analyze the prediction system. To assemble the framework numerous pictures are gathered to prepare the framework in MATLAB [2] using k-means clustering [3] and multiclass (SVM) support vector [4] machine classifier.

1.3 Rationale of the study

Fruits disease recognition is an a lot harder subject in research area but interesting. In this research solution mainly focus to help Orange farmer to identify Orange disease and get initial and stable solution for disease. In related research there have some gadget and procedure to recognize appropriate ailment of plant yet the usage for provincial individuals is troublesome. Since they have constrained training, they don't have a clue what the present circumstance of plant is and what need to do. Cell phone is currently accessible for all individuals. So I figure out I will make a solution for them which will be Cell phone based application and real time identification so that they can get exemption from huge economical loss.

1.4 Research Question

Q1. Is there any technique to Orange disease Identification?

Q2. How can we identify Orange disease?

1.5 Expected Output

Our farmers are mostly lives in remote areas where problem solving is often a matter of time when they need to wait for the agriculture Specialist to show their crops or they need to go to the agriculture Specialist physically with the disease affected crops. I thought of a technique which will be accessible to them to recognize the sickness by catching pictures of the specific influenced organic product or vegetable and give the picture as information. The issue will be recognized by utilizing k-means division and SVM classifier.

K-means is a procedure which serves the apportioning of the perceptions with the mean of the closest clusters. Using k-means and (SVM) multiclass support vector machine images of orange are processed and implemented in MATLAB to get the final output.

- Using this procedure defected fruits and leaves can be detected.
- Diseases are classified.
- An automated framework can be designed to avoid unexpected rotten orange fruits.
- Great profit can be made by farmers or wholesalers.
- Decrease time, loss of profit and chaotic creation.

1.6 Project Management and Finance

To implementation this system/application Requirements are

- Camera for taking pictures
- 8 GB Ram

- Latest Mat-lab software
- Weka software
- At least 4 GB Memory

1.7 Report Layout

In Chapter 1, I have discussed about the Introduction, Motivation, Rationale of the Study, Research Questions etc. about of this Research work. In Background chapter, I have discussed about the related work about this research, Comparative Analysis and Summary of this work. Chapter 3 included, Approaches for the Problem Formulation and Research Methodology of this work. In chapter 4, discussed exploratory outcome which has been accomplished by the proposed framework. In Impact on Society, Environment and Sustainability Chapter, I have Discussed how impact this work on Environment and Society. Also Discussed Sustainability Plan of this work. In Chapter 6, I have discussed about the conclusion & future work of this Research Work.

Chapter 2

BACKGROUND

2.1 Preliminaries/Terminologies

In this part, I examine on a few research work performed by researchers in the area of image classification, Orange fruits recognition, Orange leaves recognition, orange fruits and leaves diseases identification.

Farmers in our nation don't know about the mechanical development. Our farmers need to have the scope farm their crops in a better way that abate the chance of loss on their profit. Discovery of diseases or defects in orange fruits and leaves with computer technology needs an image processing technique and a platform on which the experiments can be done fruitfully. The proposed system is able to detect defected Orange fruits & leaves and also can recognize the specific disease of Orange fruits & leaves from images. Numerous specialist has probed numerous procedures that detects the diseases of fruits and vegetables using various techniques.

Image processing is a strategy that assemble an image and explore it, improve or collect useful information from images and ultimately it output the result in an explainable or apprehensible format. The image may be dissected to find patterns that aren't in sight by the human eye. People can take in decisions after the acquirement the output, sometimes the choices or decisions also can be made by the machine itself.

In this research MATLAB is used to train up the data and analyze the data from numerous images of orange fruits and leaves. MATLAB is a framework where the digital image processing algorithms are implemented.

Prior, numerous individuals have worked with image processing to ensure the use of technology in agriculture. In any case, it isn't being utilized in our nation sufficiently. Several image processing strategies are being developed to ensure the compactness of techniques accessible.

Computer vision is a framework that can depict a framework what it is containing and what does it mean. In this work computer vision based framework is used perceive disease from

numerous orange fruits and leaves images. It is a supervised learning techniques where disease names are used to label the classes.

2.2 Related Works

In this segment, propound related works on orange fruits and leaves disease detection. There no significant work has been done in Bangladesh. Some related works using MATLAB and K-means clustering are –

Uan Tian et al. [5] presented a computer vision approach for wheat leaf diseases pattern recognition using SVM. Color highlights are illustrated in RGB to HIS, seven instants are used for shape parameters using GLCM.

Aakanksha Rastogi et al. [6] used K-means clustering to divide the vanquished locale in their survey works; GLCM is used to extract surface characteristics, and Fuzzy rationale is used to assess contamination. They utilized ANN as a classifier that also essentially helps to check the contaminated Leaf 's reality.

Godliver Owomugisha et al. [7] introduced a computer vision approach for recognition of Black Sigatoka disease and Banana Bacterial Wilt Disease. Hue histograms are deleted and changed from RGB with HSV, RGB with L*a*b in their survey work. Pinnacle portions have been used to make max tree, and the grouping uses five shape properties. They utilized nearest neighbors, irregular woodland, randomized tree, classifier SVM , Naïve narrows & decision tree. Randomized trees gave the best result out of seven classifiers.

P. R. Rothe et al. [8] implemented a machine learning techniques for cotton leaf disease recognition. They use snake segmentation for Classification. Active contour model is used in this work for reducing the vitality within the defilement spot.

S. S. Sannakki et al. [9] in their survey works, for classification they utilized neural network classifier. The fundamental drawback is that it is utilized distinctly for the constrained harvests.

T. Gayathri Devi et al. [10] implemented a machine learning techniques for Detection And Classification of Tomato Leaf Diseases. They use SVM for classification. KNN is used in this work for reducing the vitality within the defilement spot.

K.Narsimha Reddy et al [11] in their survey works, for classification they utilized K-means clustering, ANN, SVM, Neural network.

2.3 Comparative Analysis and Summary

In this research such a significant number of pictures of orange and orange leaves are gathered from different places. At that point the pictures are pre-handled for further processing. Characteristic of the pictures are assessed and separated from the pictures and clustered by k-means clustering. Dataset is arranged and prepared alongside explicit name for each class of the sickness which is done in MATLAB. At the point when all the processing is done my framework is prepared to use. Test picture is captured and given as input data in the wake of preprocessing. The features are separated and the chose bunch picture is compared with the previous dataset. Multiclass SVM classifier is used to recognize the class name or the sickness name. At last the yield of the framework is appeared as the predicted disease name in the screen.

2.4 Scope of the Problem

The proposed system can help cultivators just as general stores proprietor to have advantages of modern innovation to forestall ill-advised loss of their profit. In spite of the fact that the entire procedure like taking picture, entering the picture as information and the usage of the application may be a fact to a non-proficient user who don't have any information on this sort of framework. Be that as it may, this is a proposed system which incorporates the principle thought of steps how to process the information and how the calculations ought to be executed. Be that as it may, this is a proposed system which incorporates the principle thought of steps how to process the information and how the algorithms ought to be executed.

It tends to be actualized in any sort of stage irrespective of choice. I Using this methodology portable applications or online based web applications can be created to arrive at the farmers without any problem.

2.5 Challenges

To construct such a framework it needs pictures of orange and orange leaves to be prepared first and afterward some more pictures are required for the testing reason. Pictures were

gathered from different grounds of orange. The enormous test with this methodology is the quality of the pictures. Picture gets blurry because of hardly any number of pixels containing the abandoned zone. The measure of RGB esteem are generally significant in picture handling which should be explain first. Likewise the foundation of the picture makes it troublesome now and then to distinguish the influenced piece of the orange & orange leaves. The segmentation cannot be done accurately when the background colors are similar to the fruit part.

Chapter 3

RESEARCH METHODOLOGY

3.1 Research Subject and Instrumentation

To get the illness identified fruit and vegetable part precisely, picture ought to be portioned first. Something else, the non-influenced some portion of the significant region can be a scattering of this strategy. Fig 3.1 shows the fundamental strides of proposed system of orange and orange leaves disease classification problem. To decide Region of Interest (ROI) K-means clustering has been used. From that point forward, feature extractions are done from the portioned picture. Multiclass SVM classifier are utilized to prepare the dataset lastly order the malady as yield.

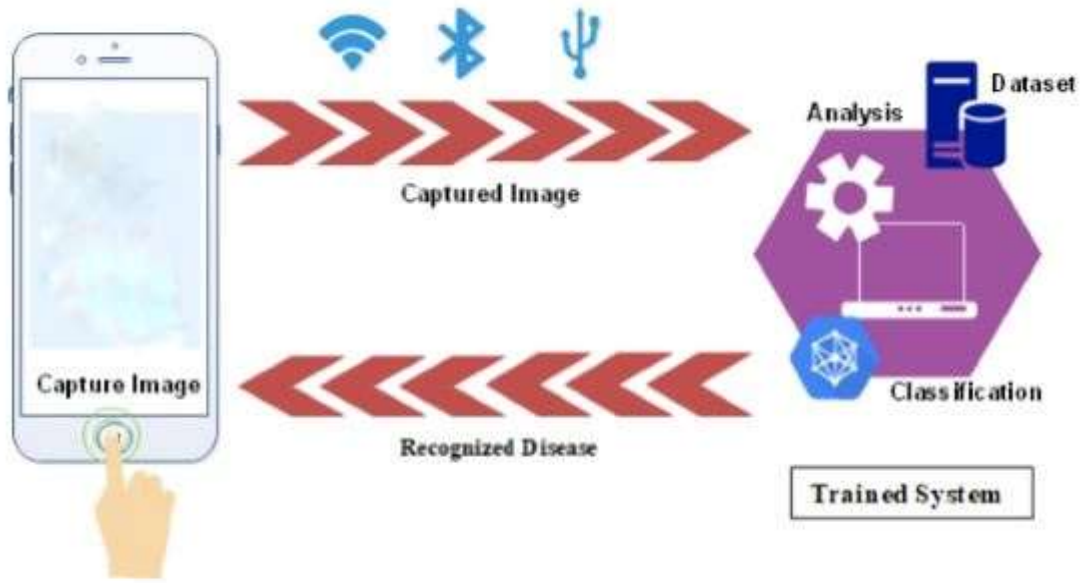

Figure 3.1: Working procedure for the proposed framework

Fig 3.1 shows how the proposed machine vision framework functions. To execute such a machine vision framework an AI framework is required which is portrayed in this research & fig 3.2 shows the means to assemble the structure for the framework.

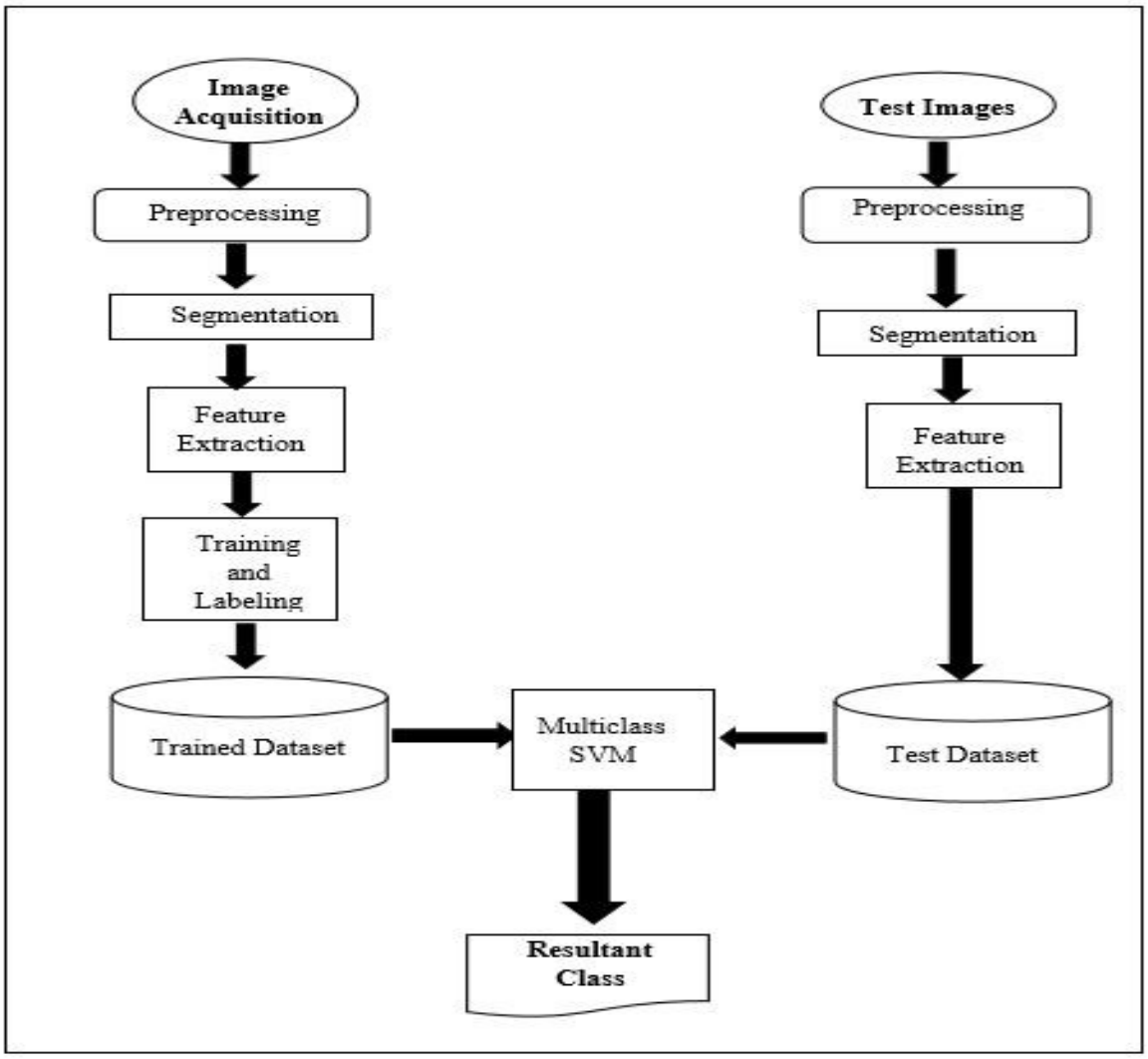

Figure 3.2: Proposed data flow diagram

3.2 Data Collection Procedure/Dataset Utilized

Orange are originated in well-drained, fine highlighted soils with good water holding capacity. Coarse, loamy or ordure-based soils are best. For the research reason diverse kind of pictures are gathered from numerous farms with the assistance of the root level farmers.

The crude pictures are distinctive in size, shape and class with variety of shading blend and surfaces. All the pictures are pre-processed to get them all in an appropriate type of information.

3.3 Statistical Analysis

According to the investigation of information, estimation of the exactness of the proposed framework is accomplished 92%.To figure that, some more qualities are separated with the assistance of confusion matrix. For example the confusion matrix of orange scab is given below:

Table 3.1: Confusion Matrix for orange scab

	Positive	Negative
True	156	321
False	14	26

To quantify the performance of the framework I have to characterize:

TP= the quantity of cases effectively distinguished real class

FP= the quantity of cases inaccurately distinguished real class

TN= the quantity of cases effectively recognized negative classes

FN= the quantity of cases inaccurately distinguished negative classes.

Table 3.2: Attributes collected from confusion matrices of all classes

	Orange Scab	Citrus greening on leaves	No disease
TP	156	104	165
TN	321	356	262
FP	14	32	46
FN	26	22	44

From the confusion matrices for each classes sensitivity, specificity, precision, FPR and FNR are also calculated. They are-

Accuracy = 92%

Sensitivity = 85.71%

Specificity = 95.82%

Precision = 91.76%

FPR = 4.17%

FNR = 14.28%

3.4 Proposed Methodology/Applied Mechanism

3.4.1 Image Acquisition

In picture handling picture obtaining implies conveying a picture from some source typically an equipment based source for processing. It is the primary Sequence of processing digital image.

In this exploration work various orange and orange leaves pictures are utilized which are gathered and caught from different Orange Orchard. Utilized pictures are framed with RGB

color model. RGB is all in all a shading model which portrays pictures with their shading esteems in the pixels comprising of various RGB values.

The pictures has contrasts in quality and arrangement which should be handled to a typical structure so as to prepare the dataset.

Figure3.3: Orange Scab Disease

Figure3.4: Citrus greening on leaves disease

3.4.2 Image Pre-processing

Prior to utilizing the picture for division, some preprocessing of the pictures were done like Cropping-for cut-out the immaterial piece of the picture, Smoothing, improvement to change the shading and difference, Rotating, Resizing to get all the pictures in a general structure.

3.4.3 Image Segmentation

a) K-Means clustering

In this paper, K-Means clustering is utilized to section the pictures. Additionally boundary and spot detection algorithms are utilized. In limit recognition, the 8-associated pixel calculation is utilized. Here, for K-Means clustering Euclidean separation are utilized for three groups of the ROI which are to be chosen.

K-Means clustering is used for image segmentation.

perform change from RGB to L*a*b shading model.

 Identify every pixel in the picture to the group that limits the good ways from the middle estimation of cluster.

 Perform shading division of the picture.

 finally select the group containing ROIs as it were.

The steps (3 cluster) will show in figure 3.5.

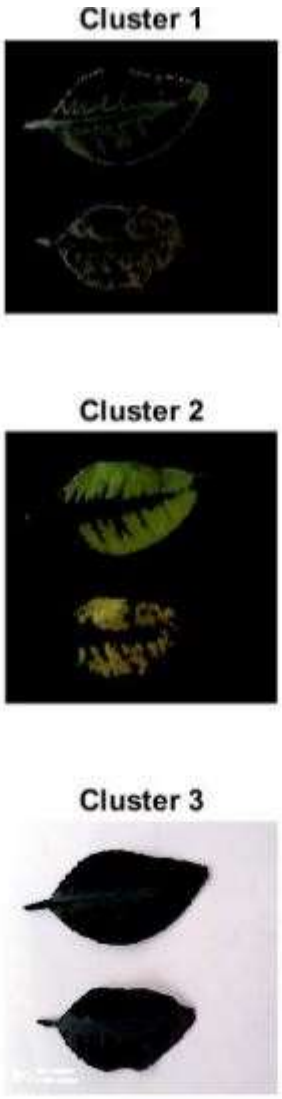

Figure 3.5: Image Segmentation by k-means clustering

b) L*A*B Color Space

Color space characterized by CIE, in view of one channel for Luminance (delicacy) L and two shading channels (a & b).

Color space characterized by CIE, in view of one channel for Luminance (daintiness) L and two shading channels (a and b).In XYZ shading framework, Colorimetric separation between the individual hues don't relate to apparent shading contrasts. The CIE tackled this issue in 1976 with the advancement of the three - dimensional L*A*b shading space (or CIELAB shading space) [12]

This shading model is more qualified to numerous computerized picture control with various unexpected gadgets in comparison to the RGB space.

AS L*a*b model is a three dimensional model, so it must be spoken to precisely in three-dimensional space. The formula for RGB changing over advanced pictures from RGB space to L*a*b are-

$$\begin{bmatrix} L^* = 116\, f\left(\frac{Y}{Yn}\right) - 16 \\ a^* = 500\left[f\left(\frac{X}{Xn}\right) - f\left(\frac{Y}{Yn}\right)\right] \\ b^* = 200\left[f\left(\frac{Y}{Yn}\right) - f\left(\frac{Z}{Zn}\right)\right] \end{bmatrix} \quad \text{..... (i)}$$

Where X,,,,, are the coordinates of CIEXYZ color space.

3.4.4 Features extraction

This is the most significant part of the entire work. To distinguish an item, highlights extraction is utilized in different picture handling applications Bhabani J. Samapti at. Al [13] depicted shading highlight and surface component extraction techniques to extricate shading, shape and surface of natural products for illness arrangement where shading highlights were Color Coherent Vector(CCV) and Global Color Histogram(GCH) and surface highlights were Complete Local Binary Pattern(CLBP), Gabor highlights, Local Binary Pattern(LBP) and Local Ternary Pattern(LTP). Various strategies can be utilized for identification of ailment part of the organic product or vegetables.

In this methodology, both shading and surface are taken by changing over RGB to this model.

$$H=\begin{cases} Theta & if\ B < R \\ 360 - Theta & if\ B > R \end{cases} \quad \text{---------- (i)}$$

$$S= (1 - (3 /(R+G+B)))[\min(R, G, B)] \quad \text{---------- (ii)}$$

$$I= 1/3\ (R+G+B) \quad \text{---------- (iii)}$$

Spatial gray level Dependence Matrices (SGDM) strategy is a method of separating measurable highlights. What's more, GLCM capacities described the surface of a picture by ascertaining how regularly matches of pixel with explicit qualities and in a spatial relationship happen in a picture [14]. GLCM is essentially Gray Level Co-Occurrence Matrix which gives the conveyance of co-occurring qualities in a particular zone of intrigue. GLCM is made from a gray scale picture. So before getting GLCM includes first the picture should be changed over to gray scale picture. At that point the measurable highlights like contrast, correlation, energy and homogeneity can be determined by the equations.

The factual highlights from GLCM are-

 Contrast- quantifies the neighborhood variety in the gray level co-event matrix. Differentiation is 0 for a consistent picture. The formula for computing differentiation of a picture is-

$$\sum \mathrm{i,j} \, |i-j|^2 \, p(i,j) \qquad \text{..... (i)}$$

 Correlation-measure the joint likelihood occurrence of the extraordinary pixel sets. The equation for computing correlation in a picture is-

$$\sum_{i,j} \left(((i-\mu i)(j-\mu i)p(i,j))/ \sigma i \sigma j i \right) \text{----------(ii)}$$

 Energy -gives the total of squared components in the GLCM. What's more, the formula is-

$$\sum_{i,j} (i,)^2 \text{----------(iii)}$$

Another eight more spectral highlights –

- Homogeneity
- Skewness
- Standard Deviation
- Entropy
- Mean
- Kurtosis

- Variance
- RMS

These were determined in framework in all out eleven highlights to recognize the disease abandoned article part from the pictures.

3.5 Implementation Requirements

To implementation this system/application Requirements are

- Camera for taking pictures
- 8 GB Ram
- Latest Mat-lab software
- Weka software
- At least 4 GB Memory

Chapter 4

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Experimental Setup

To get the conclusive outcome, first the raw pictures were gathered and capture from various homesteads and shops. After pre-handling of information, the primary prepared dataset were readied. At long last the test picture is contrasted and the dataset utilizing Multi-class Support Vector Machine the ultimate result is appeared as the recognized class.

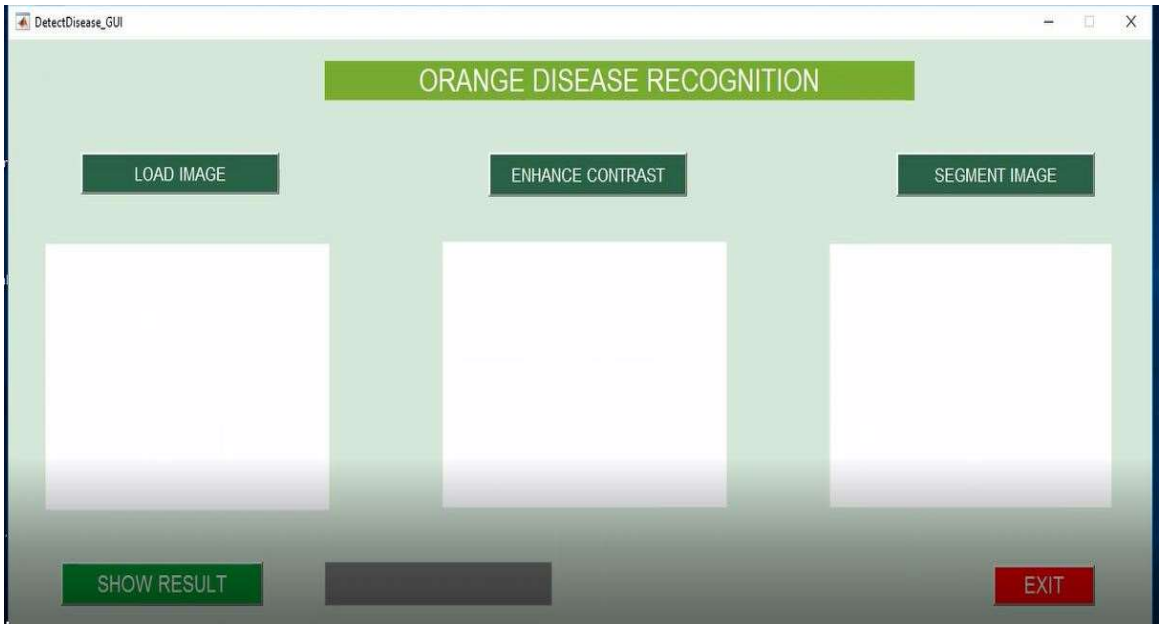

Figure 4.1: GUI for the Orange Disease Recognition

4.2 Experimental Results & Analysis

Two kinds of ailments of orange were related to pictures gathered for three classifications including detection of healthy Orange and orange leaves. The maladies are Orange Scab (63 images), Citrus greening on leaves (43 images), Disease free (69 images) altogether 175 pictures are utilized.

Figure 4.2: Orange Scab Disease

In the wake of preparing the dataset, test picture is captured and given to the framework as info. Picture is then portioned with K-Means clustering. Anticipated class is appeared in the yield [fig 4.2] in the wake of breaking down the information of that bunch entered containing the Region of Interest (ROI) as it were.

Next, some screen captures are given from the trials of identifying maladies for Orange Scab, Citrus greening on leaves, Disease free individually with the bunching procedure and the determined influenced part or the region of interest. The entire procedure are actualized in MATLAB, the exploratory outcome is a lot of good.

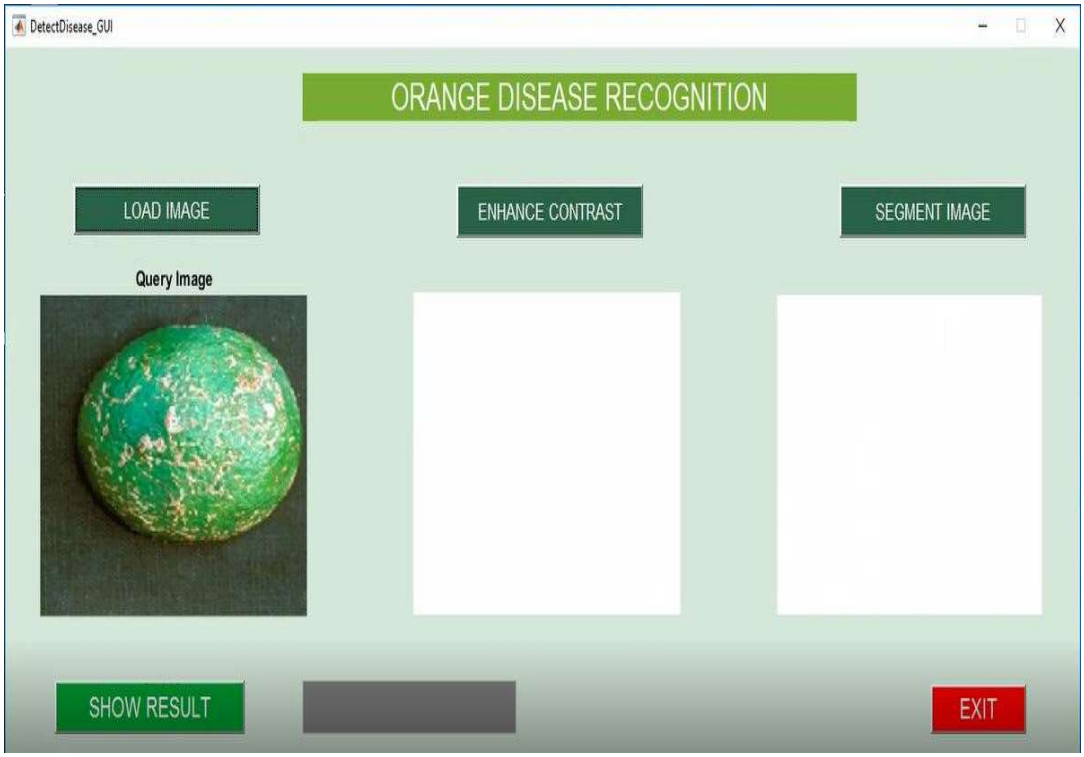

Figure 4.3: Input for Orange Scab Disease

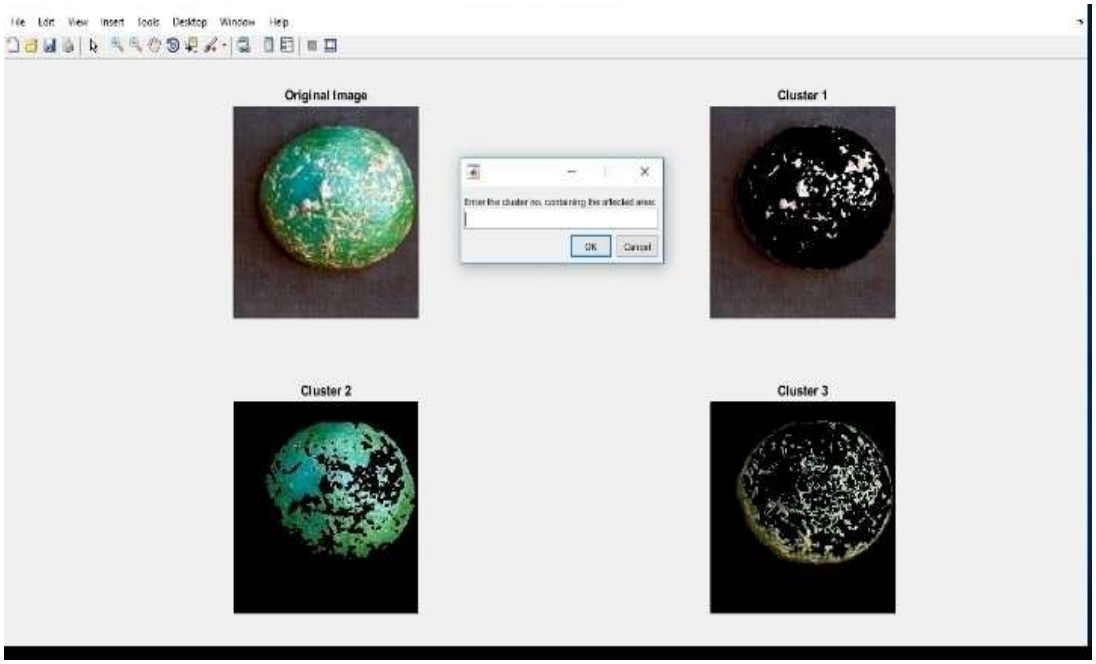

Figure 4.4: Taking suitable cluster from user for Orange Scab disease

Figure 4.5: Classification result shown in the GUI for Orange Scab Disease

Figure 4.6: Input for Citrus greening on leaves Disease

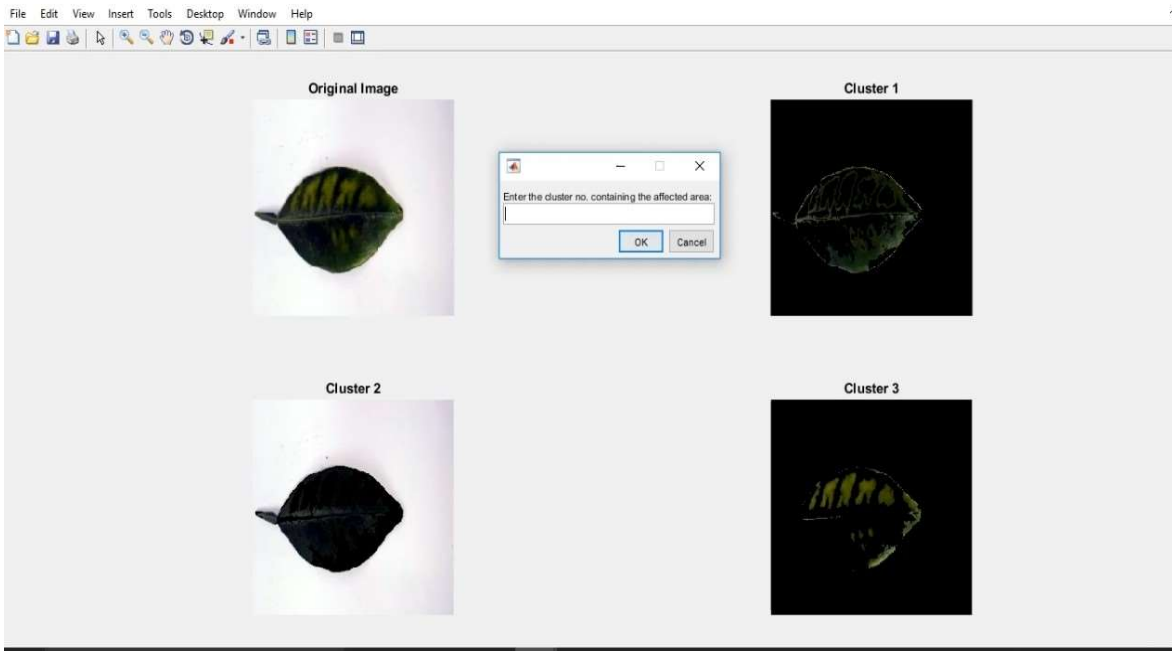

Figure 4.7: Taking suitable cluster from user for Citrus greening on leaves Disease

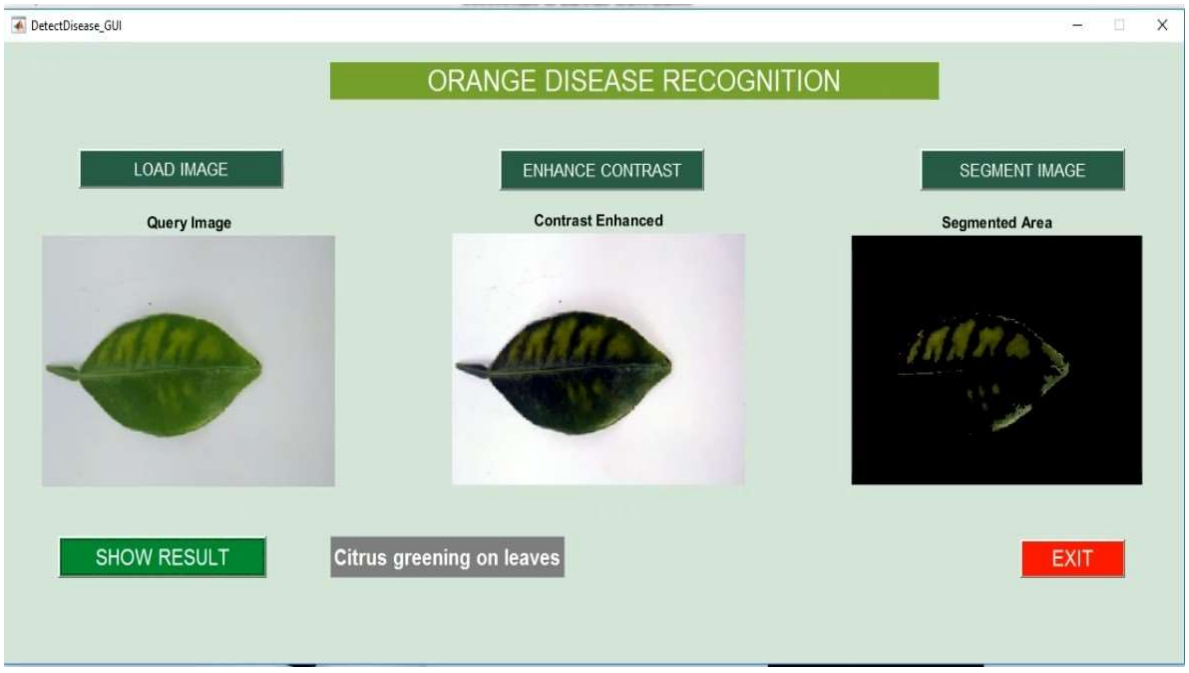

Figure 4.8: Classification result shown in the GUI for Citrus greening on leaves Disease

Figure 4.9: Input for No disease (Orange leaves)

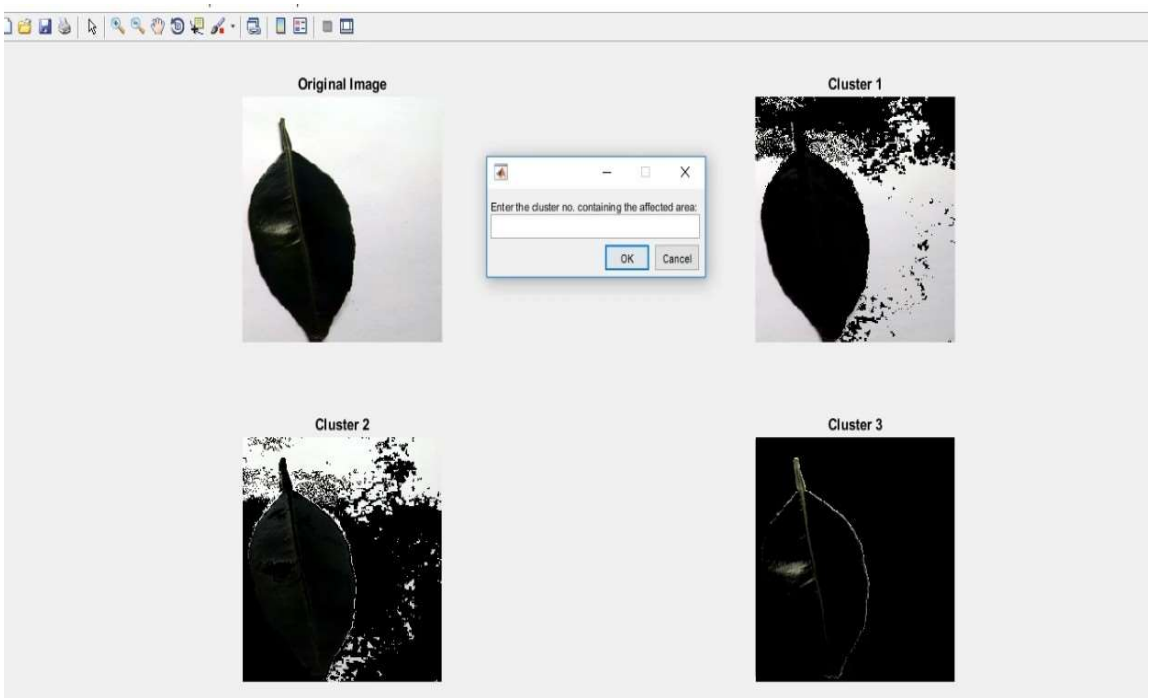

Figure 4.10: Taking suitable cluster from user for No disease (Orange leaves)

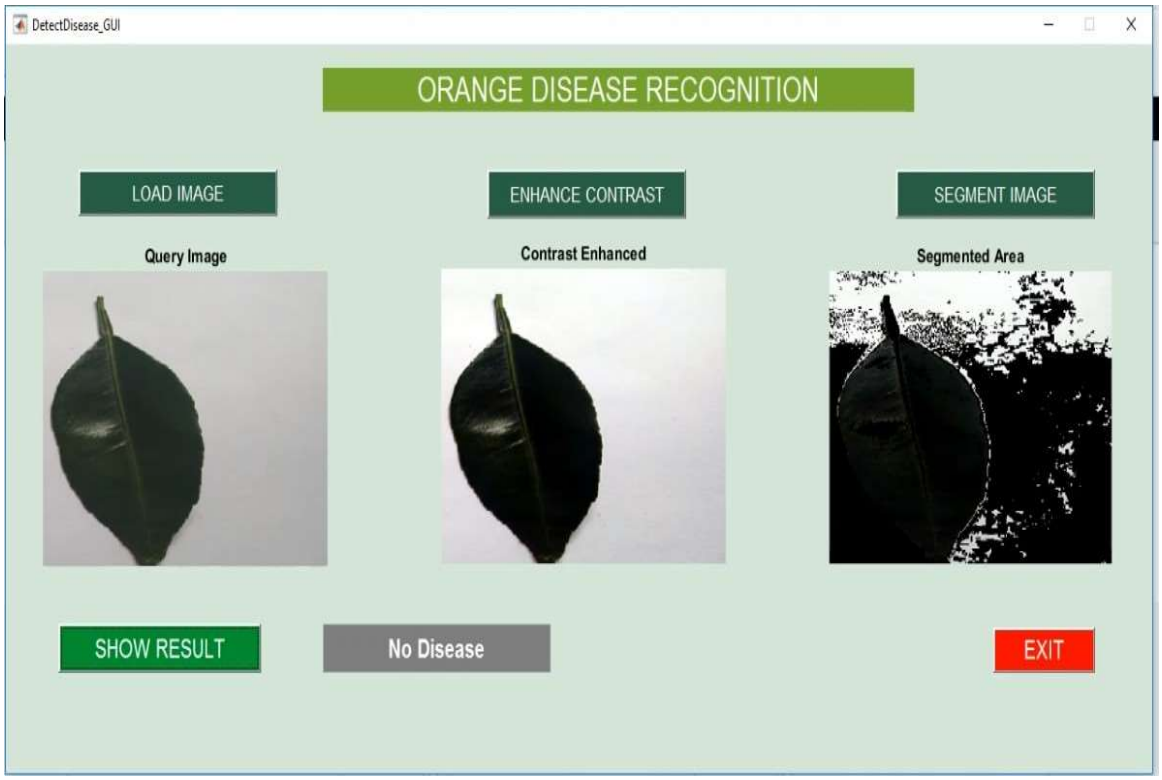

Figure 4.11: Classification result shown in the GUI for No disease (Orange leaves)

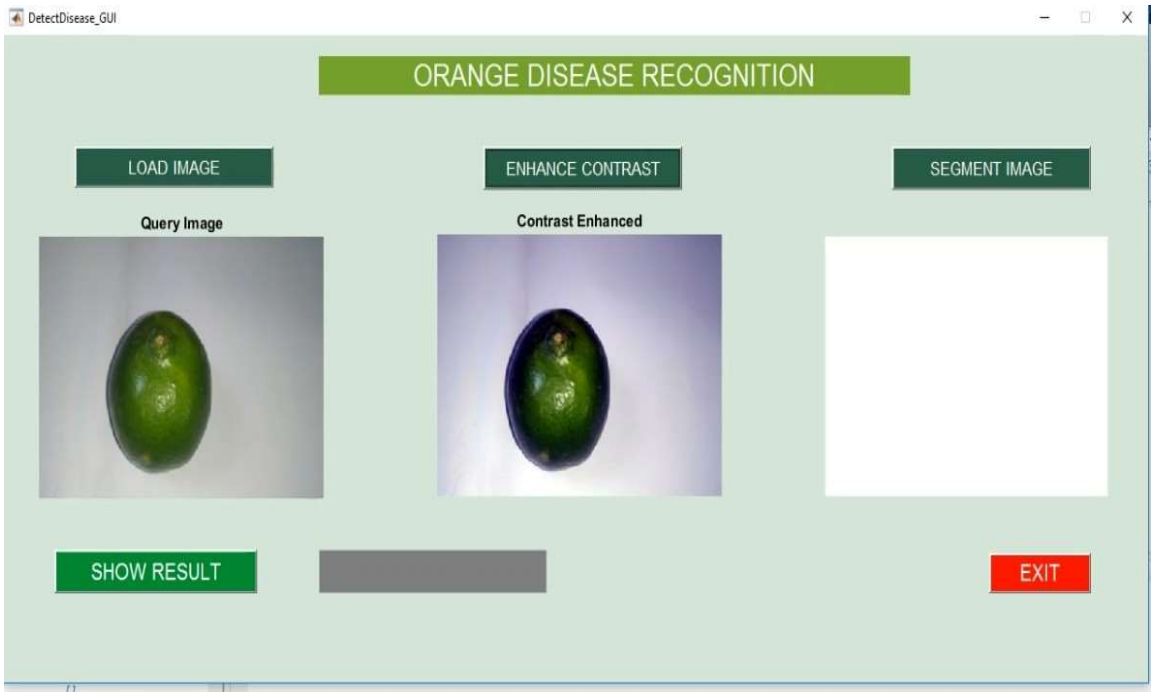

Figure 4.12: Input for No disease (Orange)

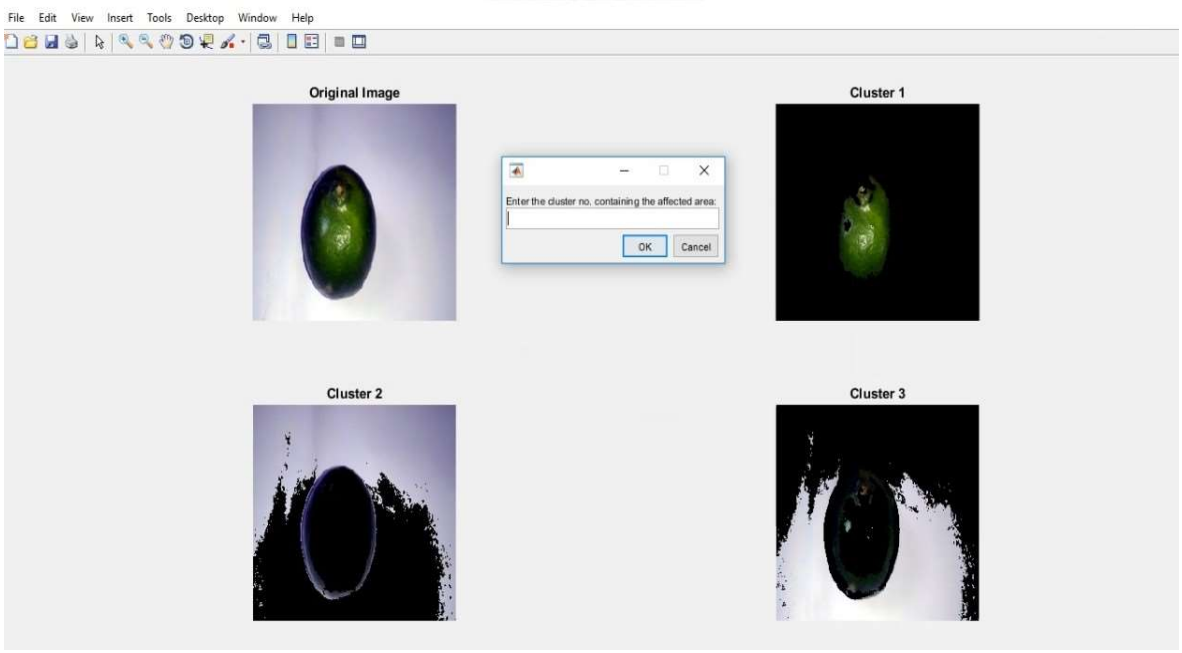

Figure 4.13: Taking suitable cluster from user for No disease (Orange)

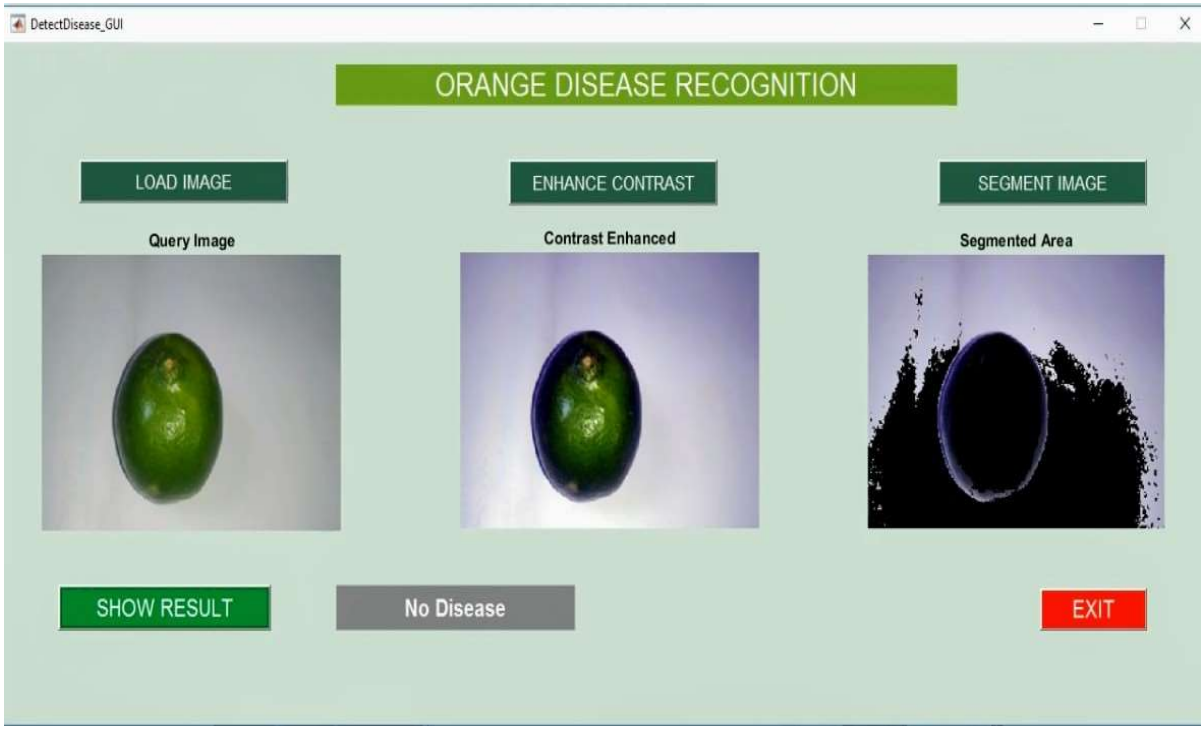

Figure 4.14: Classification result shown in the GUI for No disease (Orange)

The accuracy of the proposed system is 92% calculated with all the other features-

Sensitivity = 85.71%

Specificity = 95.82%

Precision = 91.76%

FPR = 4.17%

FNR = 14.28%

The removed highlights of the ROI containing group is marked and all the estimations of eleven features are put away in a m × n matrix where m is the quantity of pictures prepared and n is the quantity of highlight that is separated from the picture. Test picture highlights are removed to contrast and the prepared dataset and Multiclass SVM algorithm is applied in the framework to arrange which class the test picture's data has a place with. At last the anticipated disease name is imprinted in the screen.

To quantify the performance of the framework we have to characterize:

TP= the quantity of cases effectively distinguished real class

FP= the quantity of cases inaccurately distinguished real class

TN= the quantity of cases effectively recognized negative classes

FN= the quantity of cases inaccurately distinguished negative classes.

Confusion matrix [15] formulation for the system given in table 4.1

Table 4.1: Confusion matrix formulation

	Positive	Negative
True	TP	TN
False	FP	FN

1. **Accuracy:** To assess the accuracy numerically, this can be expressed as**:**

$$\textbf{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \times 100\%$$

2. **Sensitivity:** To assess Sensitivity the numerically, this can be expressed as:

$$\textbf{Sensitivity} = \frac{TP}{TP+FN} \times 100\%$$

3. **Precision:** To assess the precision numerically, this can be expressed as:

$$\textbf{Precision} = \frac{TP}{TP+FP} \times 100\%$$

4. **FPR:** To assess the FPR numerically, this can be expressed as:

$$\textbf{FPR:} \frac{FP}{FP+TN} \times 100\%$$

5. **FNR:** To assess the FNR numerically, this can be expressed as:

$$\textbf{FNR:} \frac{FN}{FN+TP} \times 100\%$$

Confusion matrix for the Orange disease recognition system is shown in table 4.2

Table 4.2: Confusion Matrix for the Orange disease recognition

	Orange Scab	Citrus greening on leaves	No Disease
Orange Scab	156	2	24
Citrus greening on leaves	0	104	22
No Disease	14	30	165

The accuracy of the proposed system is 92% calculated with all the other features-

Sensitivity = 85.71 %, Specificity = 95.82%, Precision = 91.76%, FPR = 4.17% and FNR = 14.28%

4.3 Discussion

Consistently our nation imports numerous foods grown from the ground from various nations particularly from India which requires a gigantic speculation from the legislature. In any case, this land is neighborly to develop yields and vegetables in a fast profitable manner that it should not be important to import those from outside. The Orange upkeep and direction can assist the farmers with making their property productive if serious issues of their development can be illuminated. This picture preparing method can take care of a main issue of the farmers by distinguishing maladies in products of the soil. Applying this proposed technique, maladies of oranges are perceived well and furthermore can be actualized to characterize other sort of organic product or vegetable infections additionally that will without a doubt get a gigantic change our horticulture segment.

Chapter 5

IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY

5.1 Impact on Society

Our nation likewise began to utilize numerous computerized strategies to diminish the risks of misfortune and produce more benefit. Delivering benefit from gather isn't anything but difficult to make if disease of the harvest assaults out of the blue. The whole gather can be demolished without appropriate support which can involve variance in our focused on GDP likewise to the job of the farmers. To dodge this sort of difficulty an appropriate kept up framework ought to be there which can assist the farmers with detecting the sicknesses before it is too late so that they can take suitable step for the future cultivating.

5.2 Impact on Environment

The vast majority of the individuals in Bangladesh lives on agribusiness delivering rice, jute, vegetables thus numerous harvests. Leafy foods have a huge piece of the agrarian division which is still delivered and regulated physically. At times the diseases are not found in the underlying stage, which can seriously influence our GDP. To guarantee the newness of leafy foods present day picture handling devices can support a great deal. Specialists can identify the absconded foods grown from the ground by watching them with their eyes yet the procedure is excessively long and not reasonable for all the stores, homesteads, markets or the exporters all around. There comes the gifts of new PC vision advancements with picture handling strategies that can do a ton of works in a second.

5.3 Ethical Aspects

This system will benefit the farmers of our country a lot. There will be no adverse reaction in the society. The economic development of the country will be achieved. If the farmers benefit the economic wheel of the country will move.

5.4 Sustainability Plan

To achieve Sustainability Plan of the system, farmers have to be informed about the benefits of this system. They need to be trained to understand this system.

Chapter 6

SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH

6.1 Summary of the Study

I am trying to represent a computer vision approach to Orange and orange leaves disease detection problem using K-means Clustering. The short summary of my whole research is given bellow-

In First step, I have collected the data (images) & pre-processed of those images. Feature extractions are done from the portioned picture. In Second Step, give the Input for the particular Disease. In Third Step**,** Taking suitable cluster from user for the particular Disease. In Fourth Step**,** my proposed expert system the result for particular Disease using SVM Classifier.

6.2 Conclusions

In this work disease ailments are perceived through picture preparing methods which can be utilized in various sort of uses to identify any organic product or vegetable ailments which can open an entryway for helping large markets, super shops, exporter or agrarian homesteads to grow a profoundly made sure about financial turn of events. Machine vision based orange disease acknowledgment is finished with an administered learning process. The entire procedure is finished with a 92% of precision utilizing gathered orange pictures which are influenced with maladies. Despite the fact that there were a few hindrances while working, the foundation shading and low quality of pictures can occupy the application to give progressively precise outcome. Utilizing this strategies different foods grown from the ground infection can be identified and characterized with a Computer vision framework. A few safety measures can be made by telling the farmers about the malady which would an alleviation to them as though they won't face any unforeseen infection assault into their territory or they would have the option to recognize the issues so they can settle on legitimate choice for additional gathering on the land.

6.3 Implication for Further Study

To make our life simpler, step by step we are getting especially subject to present day advancements where in our nation, farming division is a long ways behind from utilizing these innovations which can involve flourishing in an exceptional rate. The proposed framework demonstrates another approach to include with the AI strategy which can identify disease influenced some portion of orange and orange leaves and furthermore perceive the disease consequently. This methodology can be executed into any sort of portable based application or electronic application to arrive at the root level farmers without any problem. Farmers sends the capture picture from the land straightforwardly and get the yield on their turn in a second demonstrating which ailment their organic products or vegetables are having with the goal that they can take immediate arrangement of their following stage. To forestall huge loss of their benefit they needed a framework like this from the early timeframe. In this exploration I made a reasonable accomplishment from my investigation and exertion which can be applied to our agrarian advances to get an extraordinary presentation of the creation framework and therefore delivering a decent measure of benefit.

REFERENCES

[1] M. M. M. Uddin.Causal relationship between agriculture, industryand services sector for gdp growth in bangladesh: An econometricinvestigation.Journal of Poverty, Investment and Development, 8, 2015.

[2] D. J. Higham and N. J. Higham.MATLAB guide. SIAM, 2016.

[3] Likas, N. Vlassis, and J. J. Verbeek. The global k-means clusteringalgorithm.Pattern recognition, 36(2):451–461, 2003

[4] Vishwanathan and M. N. Murty. Ssvm: a simple svm algorithm.InProceedings of the 2002 International Joint Conference on NeuralNetworks. IJCNN'02 (Cat. No. 02CH37290), volume 3, pages 2393–2398.IEEE, 2002

[5] uan Tian, Chunjiang Zhao, Shenglian Lu and Xinyu Guo," SVM-based Multiple Classifier System for Recognition of Wheat Leaf Diseases," Proceedings of 2010 Conference on Dependable Computing (CDC'2010), November 20-22, 2010.

[6] Aakanksha Rastogi, Ritika Arora and Shanu Sharma," Leaf Disease Detection and Grading using Computer Vision Technology &Fuzzy Logic" 2nd International Conference on Signal Processing and Integrated Networks (SPIN)2015.

[7] Godliver Owomugisha, John A. Quinn, Ernest Mwebaze and James Lwasa," Automated VisionBased Diagnosis of Banana Bacterial Wilt Disease and Black Sigatoka Disease ", Preceding of the 1'st international conference on the use of mobile ICT in Africa ,2014.

[8] P. R. Rothe and R. V. Kshirsagar," Cotton Leaf Disease Identification using Pattern Recognition Techniques", International Conference on Pervasive Computing (ICPC),2015.

[9] S. S. Sannakki and V. S. Rajpurohit," Classification of Pomegranate Diseases Based on Back Propagation Neural Network," International Research Journal of Engineering and Technology (IRJET), Vol2 Issue: 02 | May-2015

[10] T. Gayathri Devi, A. Srinivasan, S. Sudha, "Computer Vision Based Detection and Classification of Tomato Leaf Diseases", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-11, September 2019.

[11] K.Narsimha Reddy , B.Polaiah , N.Madhu," A Literature Survey: Plant Leaf Diseases Detection Using Image Processing Techniques", IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 12, Issue 3, Ver. II (May - June 2017), PP 13-15

[12] Mohanaiah, P. Sathyanarayana, and L. GuruKumar. Image texturefeature extraction using glcm approach.International journal of scientificand research publications, 3(5):1, 2013.

[13] Bhavini J. Samajpati, Sheshang D. Degadwala “Hybrid Approach for Apple Fruit Diseases Detection and Classification Using Random Forest Classifier” IEEE International Conference on Communication and Signal Processing, pp. 978-50900396, 2016.

[14] Miller and M. Delwiche. Peach defect detection with machine vision.Transactions of the ASAE, 34(6):2588–2597, 1991.

[15] Visa, B. Ramsay, A. L. Ralescu, and E. Van Der Knaap. Confusionmatrix-based feature selection.MAICS, 710:120–127, 2011.

APPENDICES

Appendix A: Research Reflection

The motivation behind this Appendix is to give a prologue to Research refection. The individual research venture was a difficult and agreeable experience run of the mill of the course all in all. I have had little exposer to gather work at university. In this way, it was a decent change to be a piece of a successful and dynamic.

The experience instructed us that arranging and making reactions takes a more drawn out time in groups than all alone. The broad exertion required was eventually something to be thankful for. I continually creating and refining the thoughts. I needed to go to towns and ranches to collect the pictures, and obviously that was very getting a charge out of and furthermore trying for me. I appreciated a lot conversing with the farmers who helped us a lot. This examination results would push them to their future development definitely.

Appendix B: Related Issues

Gathering pictures from this sort of urban territory like Dhaka was troublesome. I needed to go to villages and markets to catch the ailment influenced orange and orange leaves pictures. I needed to converse with the ranchers some time to let them comprehend the issue and significance of the investigation. They were well disposed however to support me.

I needed to adapt such a significant number of new calculations and procedures to actualize my thoughts and research work to be compelling. Variety of the picture foundations and nature of the pictures were trying to adjust and decrease the adjustments in results hereby.

PLAGIARISM REPORT

Thesis - Test 2

ORIGINALITY REPORT

23%	15%	5%	19%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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