A COMPARATIVE STUDY OF DIFFERENT SEGMENTATION ALGORITHMS ON LOCAL FRUIT IMAGES

BY

DIPONKAR MONDAL
ID: 151-15-5271

SOUMMO SUPRIYA
ID: 151-15-4741

MUMTAHINA RAHMAN
ID: 151-15-5272

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

Supervised By

MD. TAREK HABIB

Assistant Professor
Department Of CSE
Daffodil International University

Co-Supervised By

ANUP MAJUMDER

Lecturer
Department of CSE
Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

DECEMBER 2018

APPROVAL

This Research titled **"A Comparative Study of Different Segmentation Algorithms on Local Fruit Images",** submitted by **Diponkar Mondal, Soummo Supriya and Mumtahina Rahman** 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 B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 9th December 2018.

<u>BOARD OF EXAMINERS</u>

Dr. Syed Akhter Hossain   **Chairman**
Professor and Head
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Dr. Sheak Rashed Haider Noori   **Internal Examiner**
Associate Professor and Associate Head
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Md. Zahid Hasan   **Internal Examiner**
Assistant Professor
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Dr. Mohammad Shorif Uddin   **External Examiner**
Professor
Department of Computer Science and Engineering
Jahangirnagar University

DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Md. Tarek Habib, Assistant Professor, and Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

_____

Md. Tarek Habib
Assistant Professor
Department of CSE
Daffodil International University

Co-Supervised by:

_____

Anup Majumder

Lecturer
Department of CSE
Daffodil International University

Submitted by:

_____

Diponkar Mondal
ID: 151-15-5271
Department of CSE
Daffodil International University

_____

Soummo Supriya
ID: 151-15-4741
Department of CSE
Daffodil International University

_____

Mumtahina Rahman
ID: 151-15-5272
Department of CSE

ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty Allah for His divine blessing makes us possible to complete this project successfully.

We fell grateful to and wish our profound our indebtedness to **Md. Tarek Habib, Assistant Professor,** Department of CSE, Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of Research in Machine Learning influenced us to carry out this research. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this research.

We would like to express our heartiest gratitude to **Professor Dr. Syed Akhter Hossain**, Head**,** Department of CSE, **Md. Tarek Habib,** Assistant Professor**,** Department of CSE, **Anup Majumder**, Department of CSE, Daffodil International University, Dhaka and for their kind help to finish our research and also to other faculty member and the staff of CSE department of Daffodil International University.

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

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

This project is on **"A Comparative Study of Different Segmentation Algorithms on Local Fruit Images"**. This paper represents the different types of segmentation algorithms on various local fruit images. In our whole work we will do various types of segmentation and the segmentation proceed on different types of local fruits shape, the lights flickered and changes color of different local fruits and the noticeable changes when the images will be segmented. The whole system contains four gradations: captured image, preliminary processing, segmentation, and Performance matrix calculation. In captured series we captured various types of local fruits with the device like as camera, in preliminary processing we diminish the noise and after that filter the noisy image to get appropriate image, in segmentation series we will work on four different types of procedure such as K-means clustering algorithms classification, Histogram base segmentation, Otsu method and Thresholding. This all segmentations are our prime need to make this paper. Arrangement of tests were carried out utilizing the proposed demonstrate on a dataset of 5 natural local fruits. Comes about of carrying out these tests illustrate that the proposed approach is competent of consequently recognize the natural product title with a tall degree of exactness.

TABLE OF CONTENT

CONTENTS   **PAGE**

List of Figures

List of Tables

CHAPTER 1

INTRODUCTION

1.1 Introduction

Due to onset engineering image process techniques are more and more vital in an exceedingly big variety of applications. Digital associate degreealysis of pictures is an exciting analysis space that needs a synergy between technical, engineering and medical and varied different disciplines. Digital image process plays an excellent trip in day by day life application like natural pictures, medical pictures, satellite pictures and then forth. Image segmentation could be a vintage subject within the field of image process and is also a hotspot and hub of image process techniques. Segmentation of the fluctuated segments among the particles is to an excellent degree crucial to restorative decision. Image segmentation could be a vintage subject within the field of image process and is also a hotspot and hub of image process techniques. Watershed transformation could be a region-based methodology beneath the classical methodology of segmentation. This method depends on the grayscale scientific morphology and it's used for multi part pictures. Cluster could be a technique for gathering info objects into varied teams, such that comparative info objects have an area with an analogous gathering and distinctive info things to numerous teams. Current analysis increasing interest in digital image looking out, classification, identification, management and storage. K-means cluster could be a key technique in pixel- based mostly strategies. as a result of pixel-based strategies supported K- suggests that cluster are easy and also the machine complexness is comparatively low compared with different region-based or edge-based mostly strategies, the applying is additional practicable. The segmentation method was performed by mistreatment thresholding methodology, Otsu that produces the limit esteem that was consequently actualized on the fruit pictures with expect to isolate the broken half. For robotizing visual assessment, numerous endeavours have been done to recognise fruits utilising computer vision with regard to different picture components such as measure, color, escalated, and before long. In any case, the recognisable proof is still a challenging assignment due to assortments of shape, skin color in fruits, changeability of deformity sorts, and nearness of stem and so on. Here, we propose a programmed strategy for recognising fruits utilising segmentation-based approach.

1.2 Motivation

Bangladesh, for the essential time in history, has culminated the qualification criteria set by the UN to be recognized as a creating nation, hybrid from the list of slightest created nations (LDCs) amid this year. Farming is one in each of the first sources of budgetary pick up from the primary sum of People's Republic of Bangladesh. In any case nowadays local natural products of People's Republic of Bangladesh are all most nonexistent. A reply for this tremendous drawback are frequently fathomed by developing a framework that will recognize and watch the local natural product by doing division.

Computerized Picture prepare methods are being gigantically acclimated watch natural products around the world. To investigation on this subject construct it fast and extra rectify, we tend to select six local natural products and utilized it for our examination reason. These local natural products are-

- SOFEDA
- AMLOKI
- ORBOROI
- BILOMBO
- CHALTA
- ATA

These six natural products are usual analyze the forecast system.

To construct the framework a few pictures are captured by U.S. to coach the framework in MATLAB abuse k-means bunch, histogram, thresholding, Otsu technique.

1.3 Objectives

The destinations of this investigation to look for out and analyze a strategy which may encourage various people groups, jobber or retailers to find the local natural products or vegetables from the ranches or store and thus make a worthy benefit. Once recognizing the local natural products, rancher's et al. human will basically tell what the title of this local natural products whereas not having perplexities. The arranged framework is client friendly, quick to execute and may well be upheld basically in any system.

- The framework will scale back old issues of local and worldwide people of any country.
- Local natural products won't be lost.
- Early location of the maladies will encourage them to play down the danger.
- This approach may be acclimated make benefit to producers.

We tend to works on 5 local natural products by doing segmentation and by movement shape we are ready to basically confirm the varieties between all this sort of local fruits.

1.4 Expected Outcome

This will be valuable for those sensibly people whom do not appear to be acquainted in this local natural products like amloki, sofeda, orboroi, chalta and bilombo . Uncommonly it'll be valuable for nonnative people whom ne'er identified of this natural product. we tend to think about this by estimation the 2 squanders, in any case, their measure contrasts within the revile. Nearby Natural products are going to lose a standard life. a few individuals from this report get thoughts concerning these fruits. Image division strategies like thresholding, histogram, otsu strategy and K- implies clustering strategies are utilized for natural product classification. The worldwide edge is utilized to calculate the twofold veil of a natural product for performing encourage morphological operations. The worldwide color histogram is utilized to encode information from an image within the natural product classification. It contains a set of values and each bunch speaking to a unmistakable color. Factual data can moreover be calculated utilizing the worldwide color histogram.

*Utilizing this approach local natural products and vegetables may be detected.

People who are unusual to local natural products are upbeat by this approach as a result of in near to future they'll get to get it all the local natural products title by essentially having a software/mobile app.

1.5 Report Layout

Chapter 1: Introduction

In this chapter we have discussed about the introduction, motivation of the work, objectives and expected outcome of the research work and the report layout.

Chapter 2: Background

We discussed about the background circumstances of our work. We also delivered the literature review, research summery, and scope of the problem and challenges of the system.

Chapter 3: Research Methodology

This chapter is all about the procedure used to build the system. This section has the methods and steps, data collection procedure, some statistical analysis of the proposed system.

Chapter 4: Experimental results and discussion

In this chapter all the experimental result that has been achieved by the proposed system is discussed along with the performance analysis and a summary of the result is covered.

Chapter 5: Conclusions

This chapter contains the conclusion part and the ideas of implication of further study on this topic.

CHAPTER 2

BACKGROUND STUDY

2.1 Introduction

In this chapter, various research work which is actually done by the researchers in the field of shape detection, shape characteristics, classification strategies and different algorithms.

In agricultural sciences, Image processing is the most important weapon for analysis in different sectors. Now a days, Image processing has outstanding performance to find more exact results in modern work fields. But most of our farmers are not conscious of modern technology. They have to gain the knowledge to produce more harvest in a better path. And here Image processing is much helpful process. Image processing is not only used for fruit detection but also used to detect fruits or vegetables diseases, their classification, segmentation, texture, color etc. The proposed system is able to study of different segmentation algorithms on local fruits. Using several techniques different segmentation algorithms is already discussed by many researchers.

Image processing is a process where we can find lot of information about an image and also find its output in an explicable ordination. Sometimes, human eye cannot detect that kind of images. After getting the output results, people can take judgement of that images.

MATLAB is mainly used for implementation in our research. Segmentation part is actually completed using MATLAB. MATLAB is a software where one can implement image processing algorithms easily.

In early age, many people known about image processing techniques but now a days, in our field modern technology is not used properly due to lack of knowledge of farmers. It should be increased for the betterment of our agriculture.

5

2.2 Literature Review

We have utilized Matlab in amplify. Various people utilized Matlab in ask around work. After examining a number of term paper, we have found crucial information to raise our expand thought. Here is the review of those papers −

Corrado Costa et al. [1] utilized agrarian makes to examination shape in this work. Different sorts of strategies contains in this like arrangement based handle, clone volition, highlights lists, circumstance proportions, insights etc. Matlab show, design acknowledgment strategies and picture preparing calculation too utilized in this paper. These sorts of handle give nearly 93.2% exactness rate.

Stan Sclaroff et al.[2] proposed show based locale gathering with deformable shape detection.They utilized region-merging calculations, standard picture handling calculations, Most noteworthy Certainty To begin with (HCF)algorithms, Parametric shape models, Matlab, Downhill-simplex strategy. Where, HCF calculation could be a most favored strategy which gives nearly accuracy.

Sanket Rege1 et al. [3] said color acknowledgment and two Dimensional geometric shape investigation utilizing computerized picture handling. Here, gray scale picture is changed over by the initial picture. They utilized Matlab model, RGB strategy, Thresholding handle additionally calculation. They deliver 99% exact result in this work.

Slamet Riyadi et al. [4] has completed this investigate work. Shape characteristics is primarily depicted here. They utilized RGB demonstrate and Thresholding prepare utilizing Otsu strategy for their examination. They give 94% precise result in their investigate work.

Harshal s. Patil et al. [5] proposed Different Picture surface classification strategies. Surface could be a profitable section in picture discovery. Without surface a picture cannot be synthesized. They utilized three sorts of include strategies which are Gray Level Co-occurrence Network (GLCM), Gabor channel strategy and Neighborhood Parallel Design (LBP). KNN (k-Nearest Neighbors) and SVM (Back Vector Machines) are moreover utilized as classification strategy is this work. Tuzel et al. (2009) discover 91.06% exactness within the combination of GLCM and Gabor.

Seiichi Uchida [6] proposed Biological picture acknowledgment in this paper. Design acknowledgment method is additionally utilized here which contains computerized picture preparing. It is exceptionally much useful to identify a natural picture.

A. M. Aibinu et al. [7] proposed Crossover methods which is utilized to recognize programmed natural products. They utilized FD (Fourier Descriptors), SDA (Spatial Space Examination) and ANN (Counterfeit Neural Arrange) procedures in this work. The cross breed framework gives 99.1% exactness in their investigate work.

Abdul Kadir et al. [8] proposed Classification of leaf utilizing different sorts of highlights like color, surface and shape. They utilized Polar Fourier Change (PFT), Fourier descriptors (FD) methods in this work. They moreover utilized PNN (Probabilistic Neural arrange) as a classifier. In this work, their exploratory result gives 93.75% accuracy.

Shiv Smash Dubey et al. [9] proposed Natural product Illness Recognizable proof utilizing Picture. For imperfection examination, they utilized K-means clustering strategies. They too utilized Worldwide Color Histogram (GCH), Nearby Parallel Design (LBP). Their classification gives 93% precision in this work.

Trupen Meruliya et al. [10] has completed this work. They actually work with fruit shape and its texture feature using digital image processing.
They used other researcher's techniques like Probabilistic Neural network (PNN) which provides 93.75% accuracy, Grey level co-occurrence matrices (GLCM), Circular Hough Transform (CHT), Fractal Dimension Technique etc.

G.P. Moreda et al. [11] proposed shape detection of agricultural products on computer vision. They utilized PLSDA modelling technique, MATLAB method, KNN (k-Nearest Neighbors) etc. Using those methods they found almost accuracy.

2.3 Research Summary

In this research, we have collected many local fruits from different places. Then the local fruits are captured and the captured pictures have ready for pre-processing. In pre-processing, the images are filtered. Also noise removal technique is applied here.

After finishing pre-processing stage, we have used different types of segmentation such as k-means clustering, Otsu method, histogram and thresholding. We have done all the segmentation using MATLAB.

And using those segmentation our final target is to detect the shape of local fruits so that one can easily recognize those fruits.

2.4 Scope of the Problem

Though we have done only segmentation process in our research work, our main destination is to recognize local fruits. Most of the people in our country don't have any knowledge about local fruits. Using our segmented images one can easily identify those local fruits. This is a framework where one can easily know about the implementation part of the algorithms and the procedure how it works. In this modern technology, maximum people uses android phones. Smart phones, web applications can play a vital role to enrich our project.

2.5 Challenges

In our image processing research, we have faced various types of challenges. First of all, it is very difficult for us to find rare local fruits which are not available in markets. It is very tough for us to collect good quality images. And the pixel calculation is not an easy task.

Secondly, we have faced difficulty to find out the matrix calculations of our images. It was more challenging. Find out region is also very difficult for us. In K-means clustering, we cannot display all the images in the same page. It was another challenging task.

CHAPTER 3

Research Methodology

3.1 Introduction

To get the different types of segmented algorithms we use four segmentation algorithms in our project. Before segmentation first we remove the image noise and after then filter the stored images. After pre-processing we segmented the captured fruit images. Fig: 3.1 shows the overall process of our entire project and shows it sequentially. We don't use here any classifier and we use k-mean clustering to find the region of interest of different types of fruits.
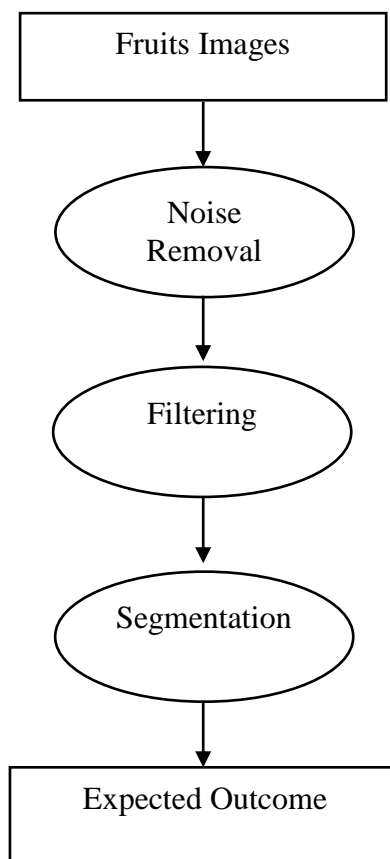

Figure 3.1: Working method for the proposed system

Figure 3.1 appears how the proposed framework works. To execute such a machine vision framework a machine learning framework is required which is depicted in this inquire about.

The empiric nearness of our work comprises of many neighborhood natural products which are gotten from diverse sources utilizing extremer gadgets like as camera or portable phone. After getting these anticipated pictures we have two diverse ways to discover their shape. The two particular ways are pre-processing and division. In pre-processing organize we sifting the pictures and we make it clamor free when we obtained diverse pictures. After completing pre-processing we utilize diverse sorts of segmentations to discover their shape. Here we utilized Histogram division, Otsu strategy, K-means clustering, Thresholding division. We organize all the division procedures in a piece chart. The piece chart is given below:
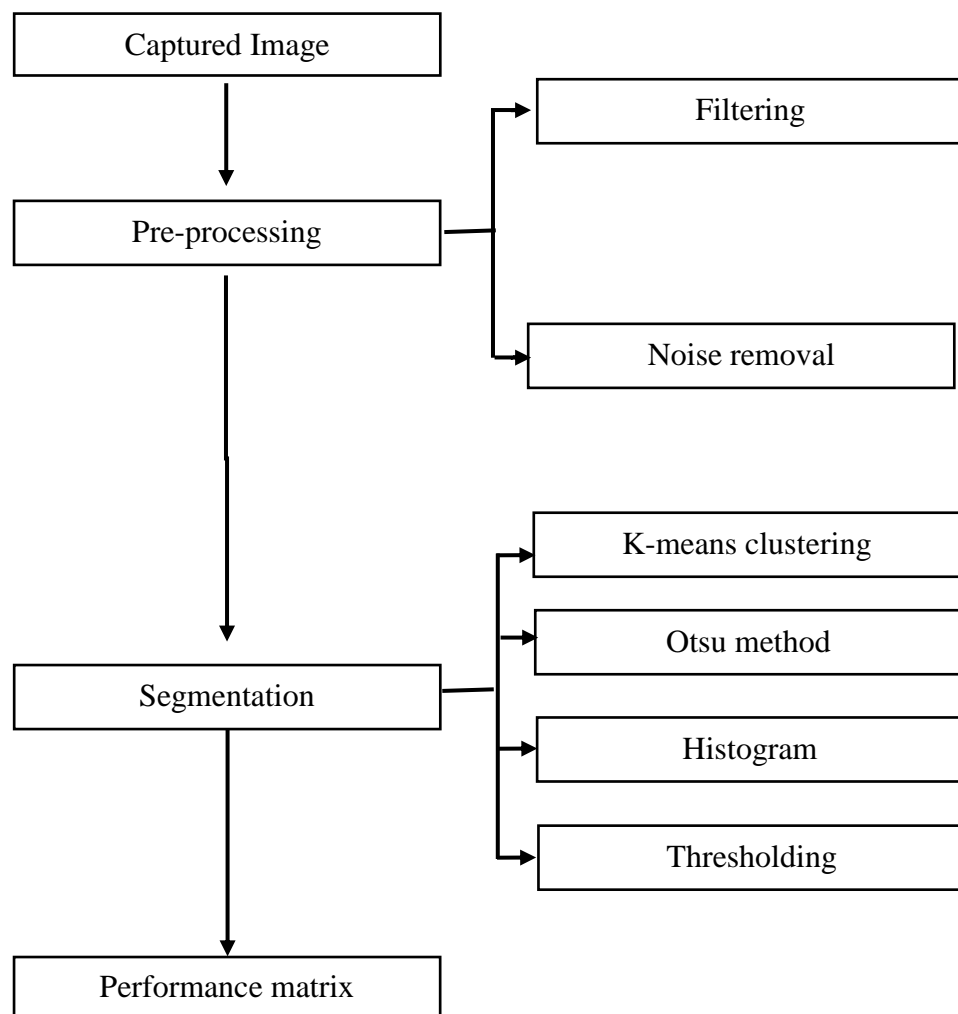
```
┌──────────────────┐
│  Captured Image  │
└──────────────────┘
         │
         ▼                           ┌──────────────────┐
┌──────────────────┐             ┌──▶│    Filtering     │
│  Pre-processing  │─────────────┤   └──────────────────┘
└──────────────────┘             │   ┌──────────────────┐
         │                       └──▶│  Noise removal   │
         │                           └──────────────────┘
         │
         │                           ┌──────────────────┐
         │                       ┌──▶│ K-means clustering│
         │                       │   └──────────────────┘
         ▼                       │   ┌──────────────────┐
┌──────────────────┐             ├──▶│   Otsu method    │
│   Segmentation   │─────────────┤   └──────────────────┘
└──────────────────┘             │   ┌──────────────────┐
         │                       ├──▶│    Histogram     │
         │                       │   └──────────────────┘
         ▼                       │   ┌──────────────────┐
┌──────────────────┐             └──▶│   Thresholding   │
│Performance matrix│                 └──────────────────┘
└──────────────────┘
```

Figure 3.2: Proposed data flow diagram

3.2 Research Subject and Instrumentation

3.2.1 Image Acquisition

In fruits handling fruits procurement implies conveying a fruit from a few source - more often than not a hardware-based source for handling. It is the preeminent step of handling advanced picture. The crude picture is gotten which are prepared another to urge craved data from it.

In this research work various fruits are utilized which are collected and captured from different places. Essentially we utilize 5 different local natural products for our term paper. We utilized here sofeda, amloki, binlombo, chalta, orboroi for our projecr. Utilized fruits are shaped with RGB (Ruddy, Green, and Blue) color show. RGB is in common a color model which depicts fruits with their color values within the pixels comprising of different RGB values. The pictures has contrasts in quality and arrangement which should be handled to a common shape in arrange to prepare the dataset.
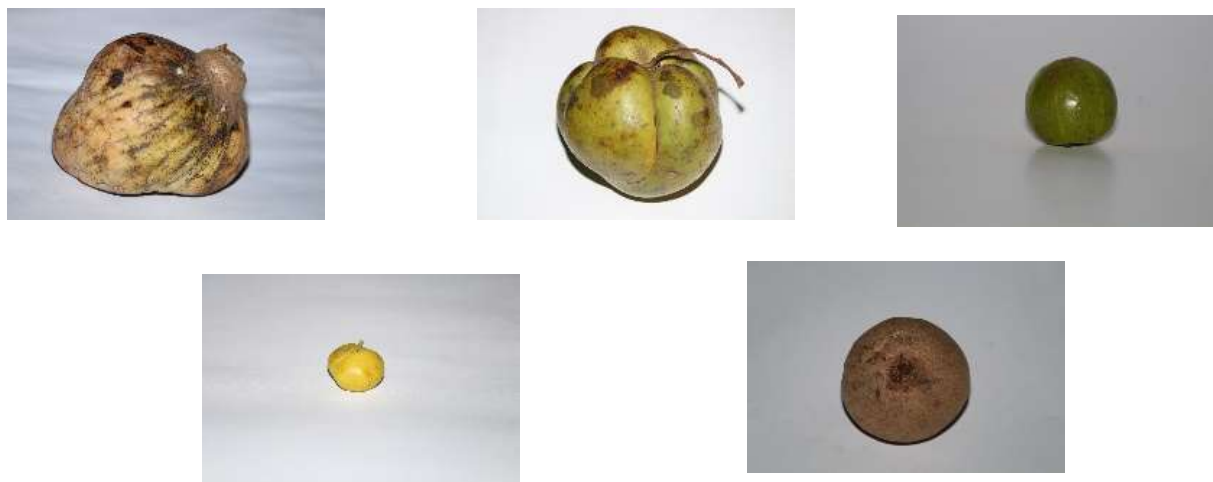

Figure 3.3: Different types of local fruits (Atafol, Chalta, Amloki, Orboroi, Sofeda)

3.2.2 Image Pre-processing

Before using the fruits for segmentation, some preprocessing of the images were done like noise removal and filtering. Computerized fruits are inclined to different sorts of commotion. Clamor is the result of mistakes within the fruits procurement prepare that result in pixel values that don't reflect the genuine power of the genuine scene.

Leslie Stroebel et al. [12] proposed to their paper there are a few ways that commotion can be presented into a fruit, depending on how the fruits are made.

In flag preparing, a channel could be a gadget or handle that expels a few undesirable components or features from a flag. L. D. Paarmann et al. [13] told to their proposed paper that sifting could be a course of class preparing, the characterizing include of channels being the total or fractional concealment of a few viewpoint of the signal. Most frequently, this means expelling a few frequencies or frequency groups. Be that as it may, channels don't only act within the recurrence space; particularly within the fields of image handling numerous other targets for sifting exits. Relationship can be evacuated for certain recurrence components and not for others without having to act within the recurrence domain.

3.2.3 Image Segmentation

(a) K-Means clustering

Color based division is broadly utilized for include extraction. Here we connected k-means calculation and utilized color based images of distinctive neighborhood fruits. To start with we changed over a picture to RGB color and after that applying k-means calculation to find bunches inside the data. K-means clustering isn't done or acting underneath supervision learning, which is utilized after you've got unlabeled data. Kriegel et al. [14] proposed that the objective of this calculation is to find bunches inside the data, with the number of bunches talked to by the variable K. To apply k-means clustering we to start with have to be be alter over a picture into RGB picture. At that point all the pixels are labeled utilizing k-means clustering and return the related values of differing clusters. We make three different clusters inside the time of k-means clustering calculation. With respect to computational complexity, finding the perfect course of action to the k-means clustering issue for discernments in d estimations is:

• NP-hard in common Euclidean space d without a doubt for 2 clusters.

• NP-hard for a common number of clusters k undoubtedly inside the plane

• Mahajan et al. [15] proposed that in the event that k and d (the estimation) are settled, the issue can be absolutely unraveled in time O (n^dk+1), where n is the number of substances to be clustered.

Hence, a collection of heuristic calculations such as Lloyd's calculation given over are by and huge utilized.

(b) Otsu segmentation

M. Sezgin et al. [16] proposed that Otsu's technique is utilized to perform actually clustered base edge of a fruit [20]. This technique is utilized to preservation of a gray level fruits to twofold (parallel) picture. The Otsu calculation is assembled to perform in two differing classes of pixels and taking after the bi-model based histogram. Nobuyuki Otsu [17] proposed that at that point it calculate the perfect restrain by separating two classes so that their combined spread is irrelevant. Otsu's methodology is board utilized to perform one dimensional examination. In our paper we utilized it completely diverse way. To start with of all we scrutinized a RGB fruit from our collected ones and alter over that natural products into gray images. After that we apply Otsu's technique to find its parallel images. In this session we showed up the histogram of that parallel Images to get it the sum of two parallel images. Able to induce it to find the level of twofold picture.

(c) Histogram base segmentation

When we got to talk to a numeric data of a picture at that point Histogram is crucial in that case. Histogram is the foremost idealize way to find a numeric data of pictures. It shows up the numeric data of pictures in a bar chart. In bar chart ready to see the distinctive sorts of numeric esteem of a picture. To create a histogram division, the essential step is to "bin" the run of values which is isolated the total run of values into a course of action of interims. Howitt, D. et al. [18] proposed that the livelihoods holders are more regularly than not positive as drearily and not covering inside of variable. The histogram of a picture shows up the number of pixels for each pixel regard interior expand of the picture. In case the slightest regard of the picture is and the most prominent regard of the picture is 300, the histogram of the picture shows up the number of pixels for each regard amplifying between and tallying and 300. Peaks inside the histogram talk to more common values interior the picture that as a run the show contain of almost uniform regions.

13

There are two particular sorts of events of histogram which is beat and valley. In best the Histogram is talk to the foremost vital common values of a picture and the Valleys inside the histogram talk to less common values.

Half breed Imaging Frameworks Division et al. proposed that cleanse districts interior the histogram appear that no pixels interior the picture contain those values. After wrapping up typical this we utilized equalized Histogram to actuate the assorted peak and valley values. It is comparative to genuine histogram division but something is unmistakable. In equalized Histogram expand of the values is to 200 and best and valley values are insides of that extend.

(d) Thresholding base segmentation

Thresholding may be plan of changing over a grayscale input picture to a bi-level picture by utilizing a perfect restrain. In this paper we consider the technique utilized for preprocessing the neighborhood normal item pictures. We show the diverse calculations utilized inside the low-level dealing with organize of picture examination for area the shape of unmistakable sorts of neighborhood common items. The picture preprocessing method secured in this paper is thresholding. Devi et al. [20] proposed that we as well endeavor to analyze comes around gotten by the pixel-level dealing with calculations. The reason of thresholding is to remove those pixels from a number of picture which talk to a address (either substance or other line picture data such as charts, maps). In show disdain toward of the truth that the information is twofold the pixels talk to a run of control. Van Solihin et al. [19] proposed in their paper that subsequently the objective of binarization is to check pixels that have a put to veritable closer see areas with a single concentrated and establishment region with differing control.

3.2.4 Features extraction

In machine learning, picture handling, highlight extraction begins from an starting set of measured information and builds inferred values (highlights) planning to be instructive and non-redundant, encouraging the consequent learning and generalization steps, and in a few cases driving to way better human elucidations. Highlight extraction could be a dimensionality diminishment handle, where a starting set of crude factors is decreased to

more sensible bunches (highlights) for processing, while still precisely and totally portraying the initial information set.

When the input information to a calculation is as well expansive to be prepared and it is suspected to be excess (e.g. the same estimation in both feet and meters, or the tedium of pictures displayed as pixels), at that point it can be changed into a decreased set of highlights (too named a highlight vector). Alpaydin et al. proposed that the deciding a subset of the starting highlights is called include choice. The chosen highlights are anticipated to contain the significant data from the input information, so that the required assignment can be performed by using this diminished representation rather than the total beginning information.

3.3 Data Collection Procedure

Information collection is the method of gathering and measuring data on factors of intrigued, in an built up efficient fashion that empowers one to reply expressed inquire about questions, test theories, and assess results. The information collection component of inquire about is common to all areas of think about counting physical and social sciences, humanities, commerce, etc. Whereas strategies shift by teach, the accentuation on guaranteeing exact and legitimate collection remains the same.

For our paper we are working on diverse sorts of division calculation of diverse sorts of nearby natural products. After that we connected 4 diverse sorts of division to discover its verities arrangement. Utilizing this division we get its shape, color and distinctive variety. The crude pictures are diverse in measure, shape and category with variety of color combination and surfaces. All the pictures are preprocessed to urge them all in an appropriate frame of data.

3.4 Statistical Analysis

Conventional strategies for factual investigation – from testing information to deciphering comes about – have been utilized by researchers for thousands of a long time. But today's information volumes make measurements ever more important and effective. Reasonable capacity, capable computers and progressed calculations have all driven to an expanded utilize of computational statistics.

15

Whether you're working with huge information volumes or running numerous stages of your calculations, factual computing has ended up fundamental for today's analyst. Prevalent factual computing hones incorporate:

Measurable programming – From conventional examination of fluctuation and straight relapse to correct strategies and factual visualization procedures, factual programming is basic for making data-based choices in each field.

Econometrics – Modeling, estimating and mimicking trade forms for moved forward vital and strategic arranging. This strategy applies measurements to financial matters to estimate future trends.

Operations investigate – Distinguish the activities that will create the leading comes about – based on numerous conceivable choices and results. Planning, reenactment, and related modeling forms are utilized to optimize trade forms and administration challenges.

Lattice programming – Capable computer methods for executing your possess measurable strategies and exploratory information examination utilizing push operation algorithms.

Statistical visualization – Quick, intelligently measurable examination and exploratory capabilities in a visual interface can be utilized to get it information and construct models.

Statistical quality change – A scientific approach to looking into the quality and security characteristics for all viewpoints of generation.

In our proposed paper we use different kinds of segmentation and we found the most accuracy of that. We found the 98% accuracy in our project. We also found some error in our project what we discussed it before.

3.5 Implementation Requirements

To execute our venture, we got to offer assistance of MATLAB. MATLAB is exceptionally fundamental prerequisite to actualize our entirety venture. MATLAB makes our work simple to execute. It is the most prerequisite to do our venture and it makes our project easier and

client inviting to all. We utilize here MATLAB adaptation 2017. Since it has all the overhauled offices to do the work and we did exceptionally well utilize this application.

CHAPTER 4

Experimental Results and Discussion

4.1 Introduction

To induce the ultimate result, to begin with the crude images were collected and captured from numerous ranches and shops. After pre-processing of information, the most prepared dataset were arranged. At long last the test image is compared with the dataset utilizing Multi-class Bolster Vector Machine the ultimate result is appeared as the recognized lesson. We use Matlab to implement and to find our experiment results. Because using Matlab, it is very easy to get all the result. Matlab makes it easier to get the result accurately.

4.2 Experimental Result

In arrange to actualize our framework, we have to be utilize different sorts of instruments which progress our system's efficiency. We are giving the recorded devices underneath:

Performance matrix calculation

To urge the right performance through our whole try criteria, to begin with we have to be get ready the information of shapes of diverse nearby natural products. Since our target is to identify the shape of distinctive sorts of natural products, so we collected a few pictures of neighborhood natural products to identify shape. Here we organized 5 nearby natural products (Amloki, Chalta,Sofeda,Orboroi and Atafol). We captured parts of pictures for exploring (around 40 pictures per natural products) but here we utilized as it were 5-6 pictures for our comfort of test. At that point we sectioned that pictures utilizing distinctive sorts of segmentations. Figure 3 appears that the initial pictures of distinctive natural products. Here we appeared 5 pictures for each picture. Figure 4 appears that k-means clustered pictures of a specific natural product (Chalta), figure 5 appears the Otsu's strategy division (Amloki), figure 6 appears the Histogram base division and figure 7 appears the Thresholding division.

Concurring to the visual reconnoiter, we are able see the diverse shape of distinctive neighborhood natural products based on k-means clustering, otsu strategy, histogram and thresholding. Agreeing to all this division strategy ready to compare the ground truth esteem

Table 4.2: The process with it's of thresholding along inputs and outputs

	Ground truth	K-means clustering	Histogram	Otsu method	Deviation Error		
					K-means clustering	Histogram	Otsu method
Chalta	100%	95.5%	95.3 %	95.8 %	4.5 %	4.7 %	4.2 %
	100%	93.3 %	93.5 %	95.8 %	6.7 %	6.5 %	4.2 %
Sofeda	100%	95.8 %	95.6 %	96 %	4.2 %	4.4 %	4.0 %
	100%	93.8 %	93.5 %	96.1 %	6.2 %	6.5 %	3.9 %
Amloki	100%	95 %	95.2 %	96 %	5.0 %	4.8 %	4.0 %
	100%	93 %	92.7 %	95.9 %	7.0 %	7.3 %	4.1 %
Bilombo	100%	95.6 %	95.1 %	95.8 %	4.4 %	4.9 %	4.2 %
	100%	92.6 %	92.7 %	95.7 %	7.4 %	7.3 %	4.3 %

Figure 3.4: Our Captured local fruits (from left to right- Atafol, Orboroi, Chalta,Sofeda, Amloki)

Now we will segment the captured images in different way. We will show it individual segmentation for each fruit image. Here we will show the outcome of different types of segmented algorithms and their images. First, we will show the outcome of k-means clustering segmentation of 5 local fruits individually. After that we will show the outcome of Otsu method segmentation of these local fruits. Then we will show the Histogram base segmentation of different types of local fruits and finally we will show the outcome of Thresholding of 5 local fruits segmentation. All these segmented outcomes will be shown individually one by one.

The above fruits segmented outcome or results are given below:

First of all we will show the K-means clustering segmentation algorithms. Here we use amloki, atafol, chalta and sofeda for k-means clustering. Now we will see how the segmented looks like...
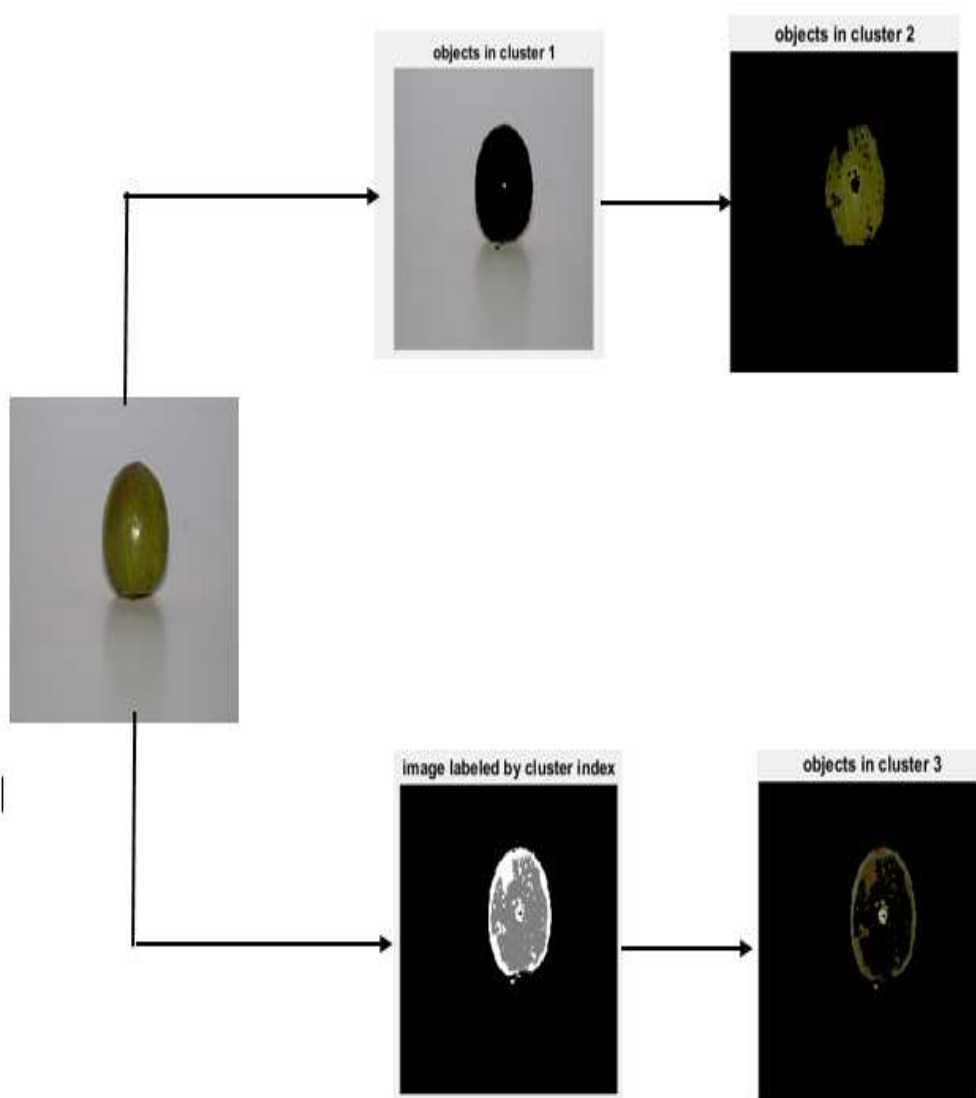

Figure 4.3: K-means clustering segmentation (Amloki)

After that we will show k-means clustering segmentation of another fruit. Now we are applying k-means clustering algorithms on chalta fruit. We use three cluster of each fruit and

finally we get clustered image of that particular fruit. We will see the varieties of that fruit. Each cluster shows the different level of segmentation. Here we use a RGB images to apply k-means clustering. Because only from RGB images we will get the original variation. Instead of RGB image, if we use binary or gray scale image then we cannot understand the proper segmentation.
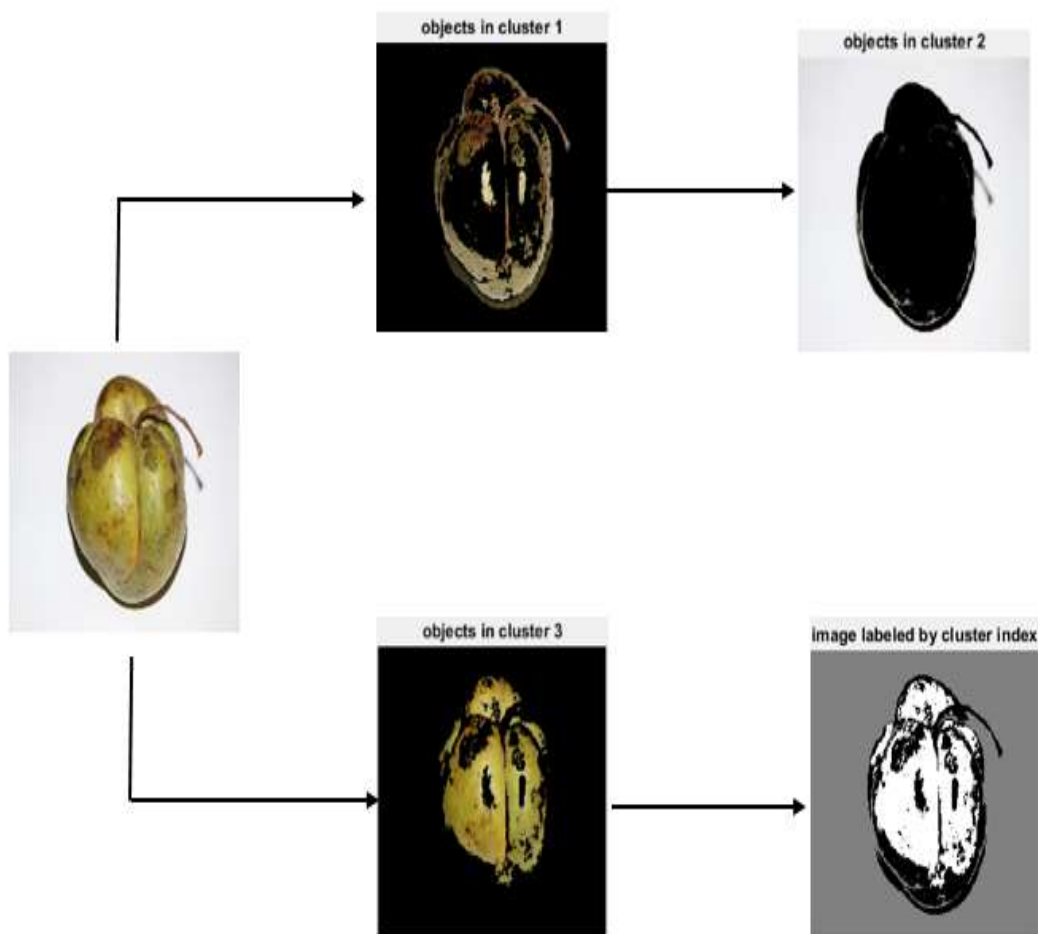
Figure 4.4: K-means clustering segmentation (Chalta)

After that we are going appear k-means clustering division of another fruit. Presently we are applying k-means clustering calculation on atafol fruit. We utilize three cluster of each natural product and at last we get clustered image of that specific natural product. We'll see the assortments of that natural product. Each cluster appears the diverse level of division. Here we utilize a RGB images to apply k-means clustering. Because only from RGB pictures we are going get the first variety. Rather than RGB picture, on the off chance that we utilize parallel or gray scale picture at that point we cannot get it the right division.
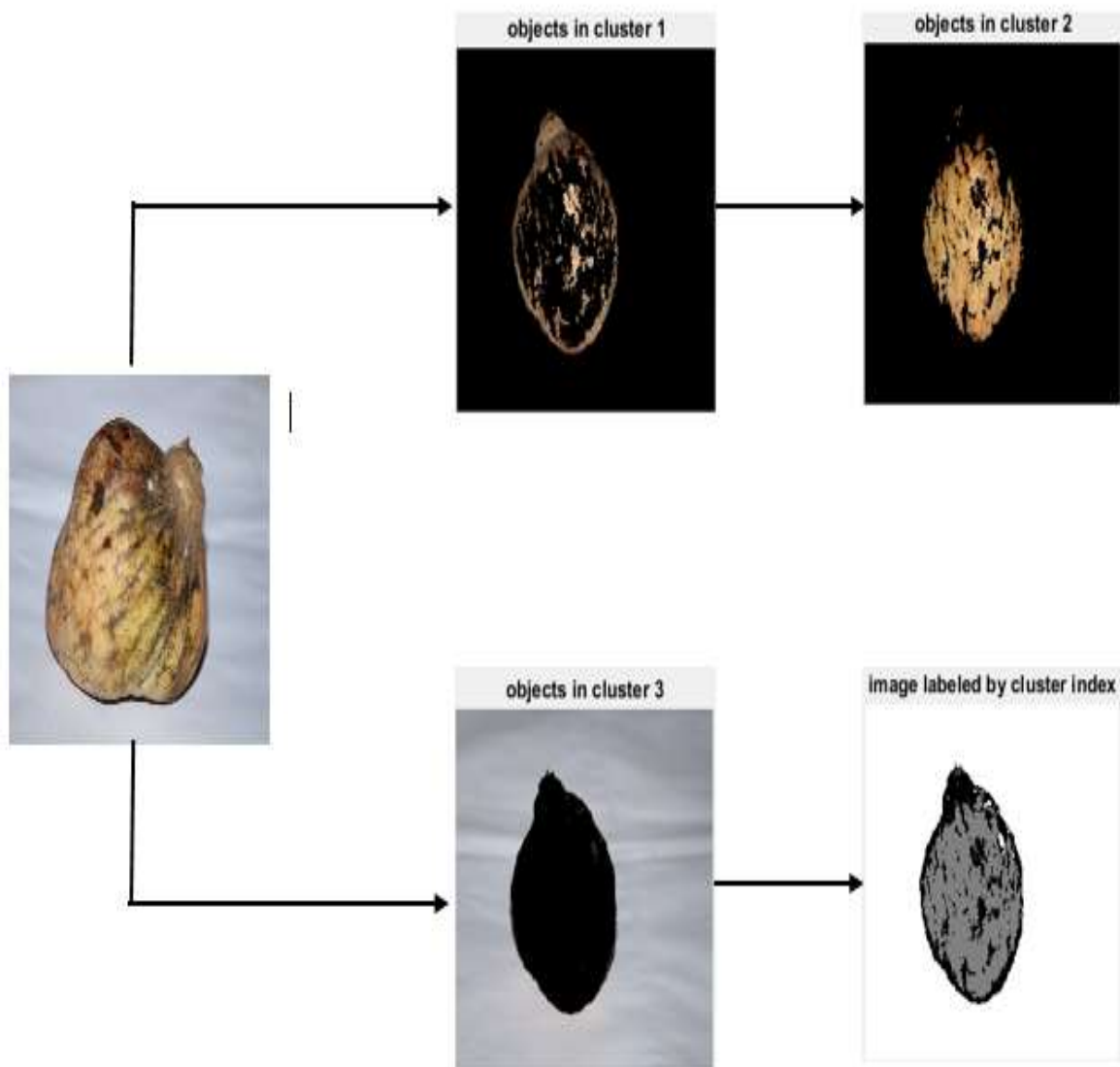
Figure 4.5: K-means clustering segmentation (Atafol)

objects in cluster 1

objects in cluster 2

image labeled by cluster index

objects in cluster 3
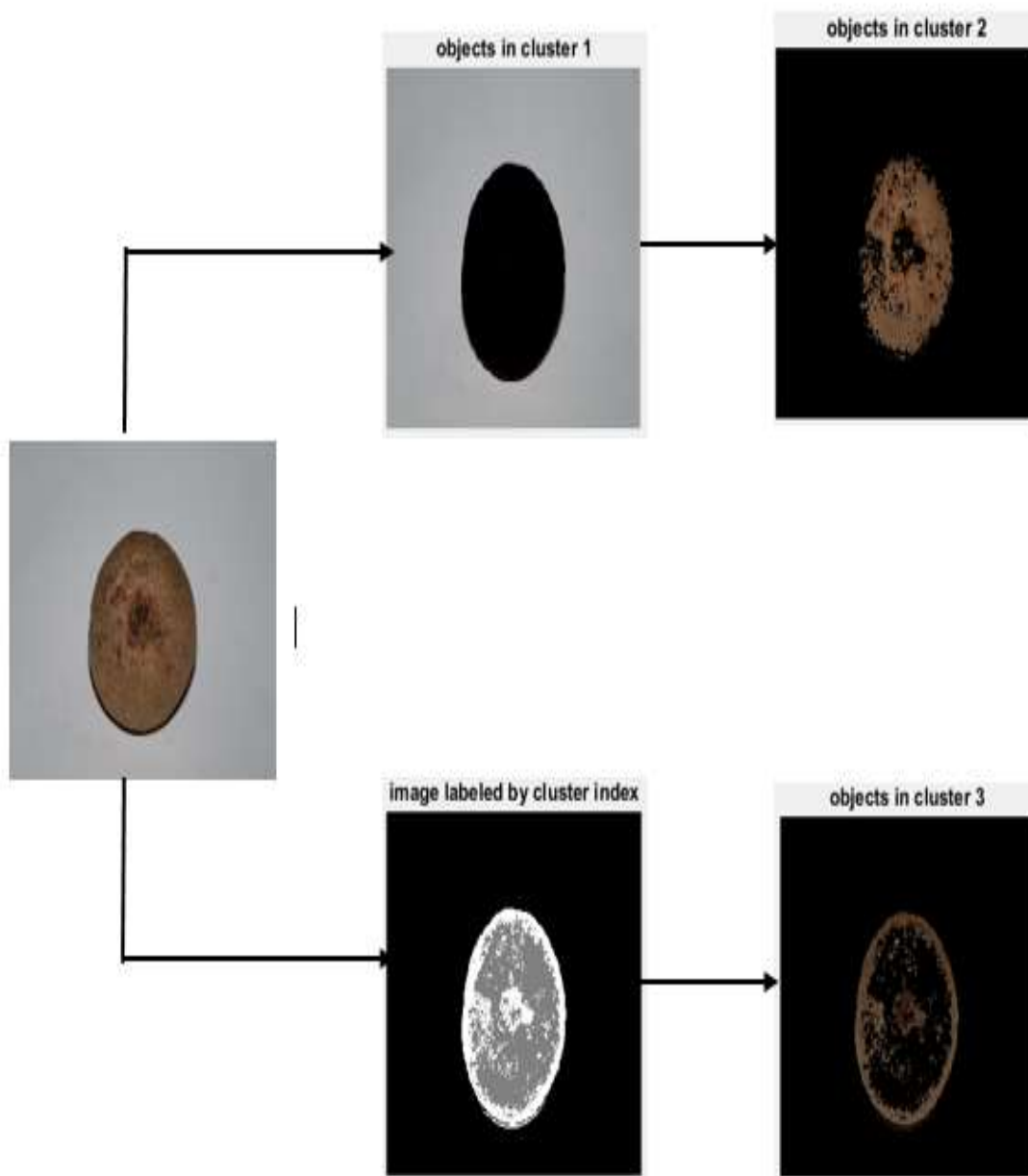
Figure 4.6: K-means clustering segmentation (Sofeda)

This is segmentation of sofeda using k-means clustering. Using the same method we can easily segment the different types of frits. Here we showed only few local fruits and their k-means clustering segmentation.

Now we will show the Otsu segmentation of different types local fruits. We are segment the same types of local fruits to segment what we used in k-means clustering. The Otsu segmentation is given below:

Figure 4.7: Otsu segmentation (Amloki)
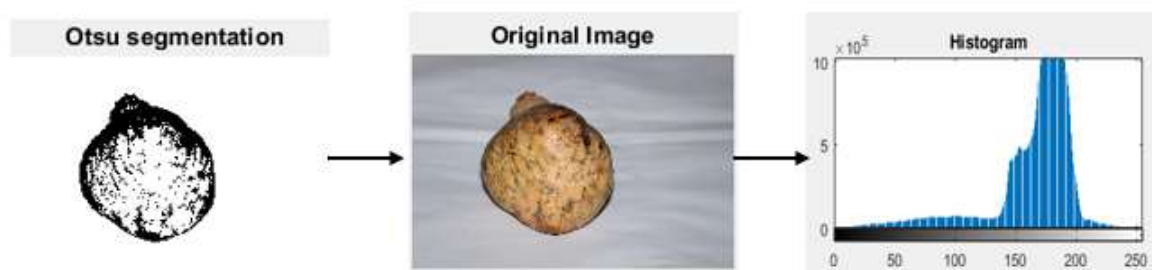
Figure 4.8: Otsu segmentation (Atafol)

Figure 4.9: Otsu segmentation (Chalta)

Figure 4.10: Otsu segmentation (Sofeda)

These are all the Otsu segmented fruits. We can see the differences of different fruits. We can also see how the changes are going on while segmentation is running. We can also see the histogram of that Otsu segmented fruits. From that histogram we can know that the pixel quantity of that particular fruit. Histogram makes it easy to understand of that differences.

Now we will show the Histogram base segmentation of different local fruits. Here we use two types of histogram. First one is Original Histogram and the second one is equalized Histogram. We also show the graph representation of that histogram segmentation.

© Daffodil International University

First of all we will show the Histogram segmentation of amloki. The figure is given below:
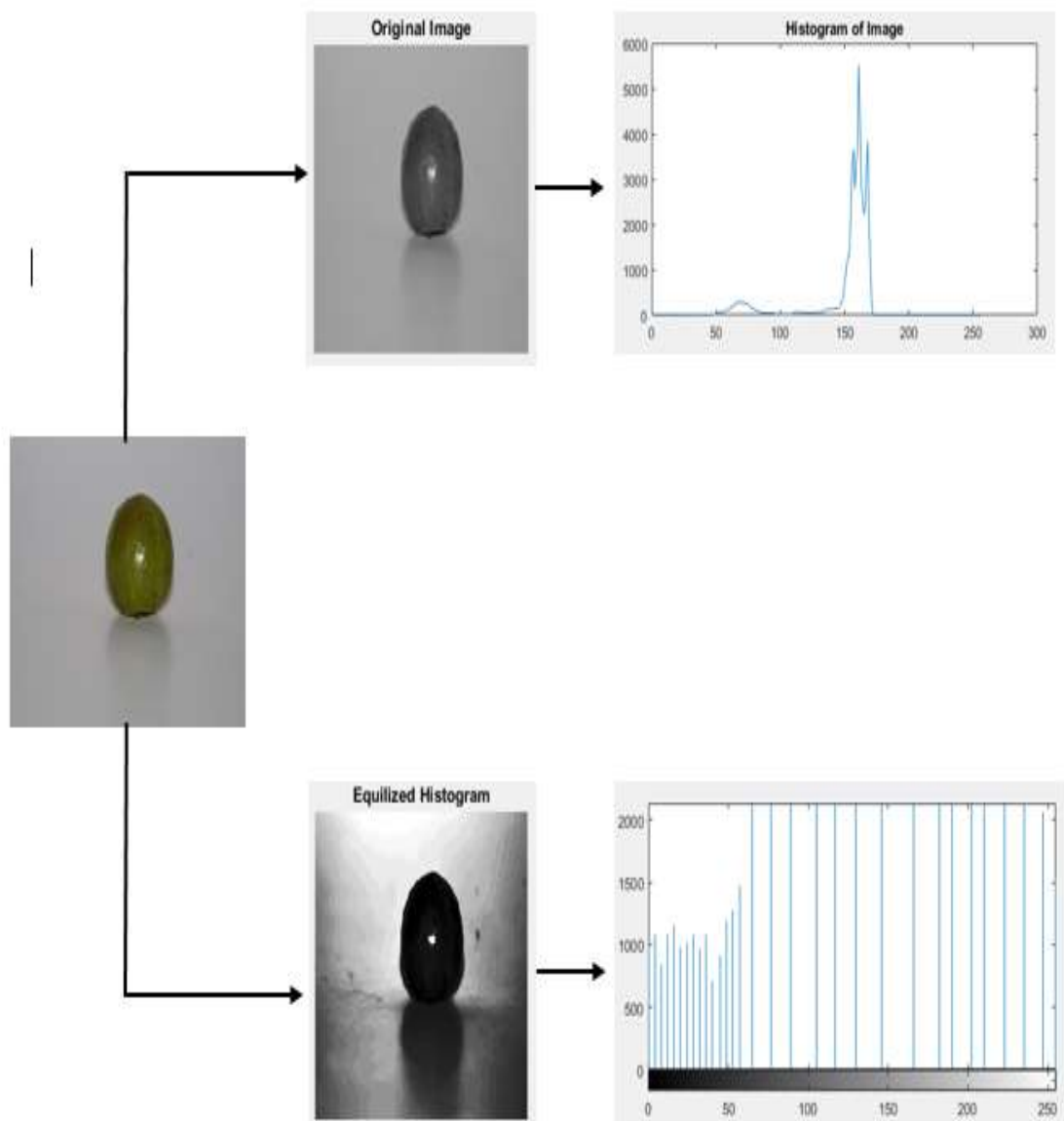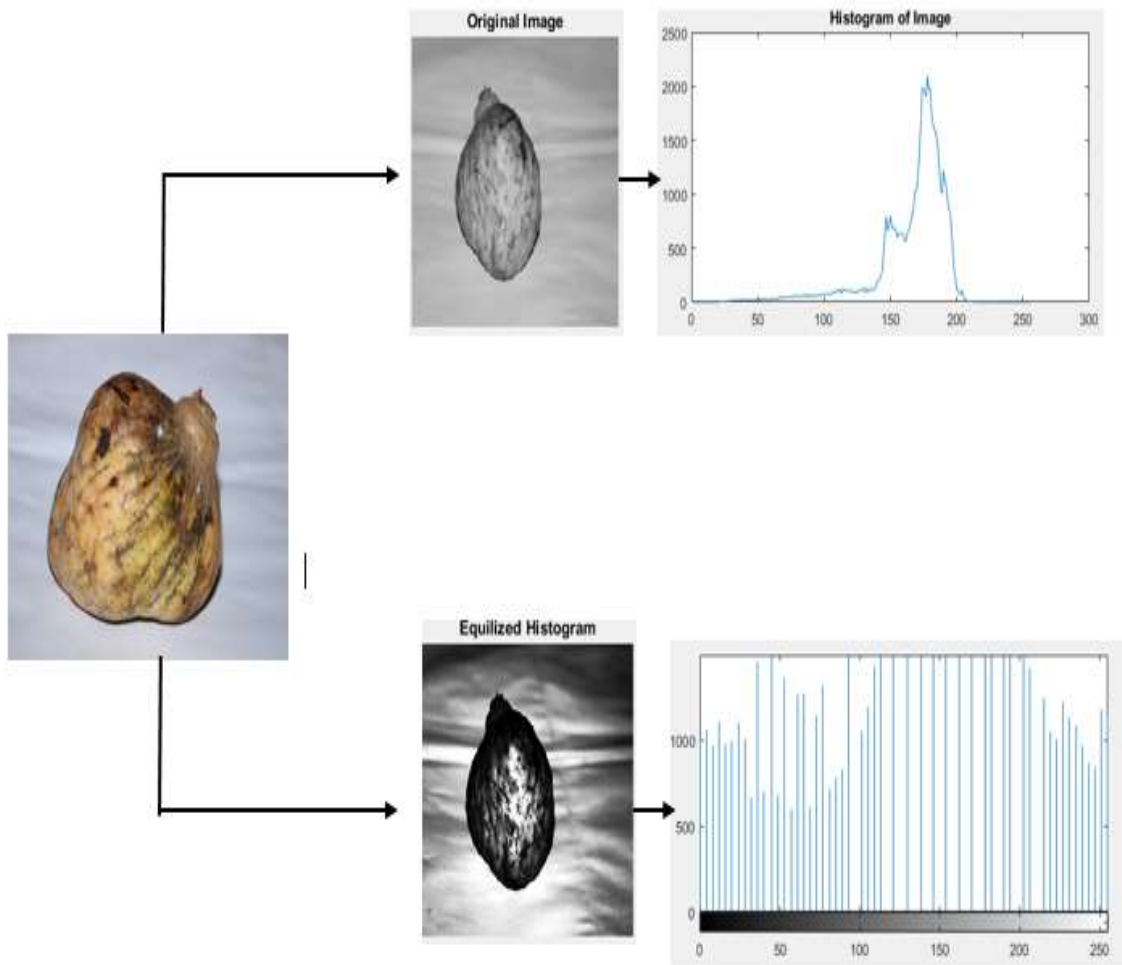

Figure 4.11: Histogram Base segmentation (Orboroi)

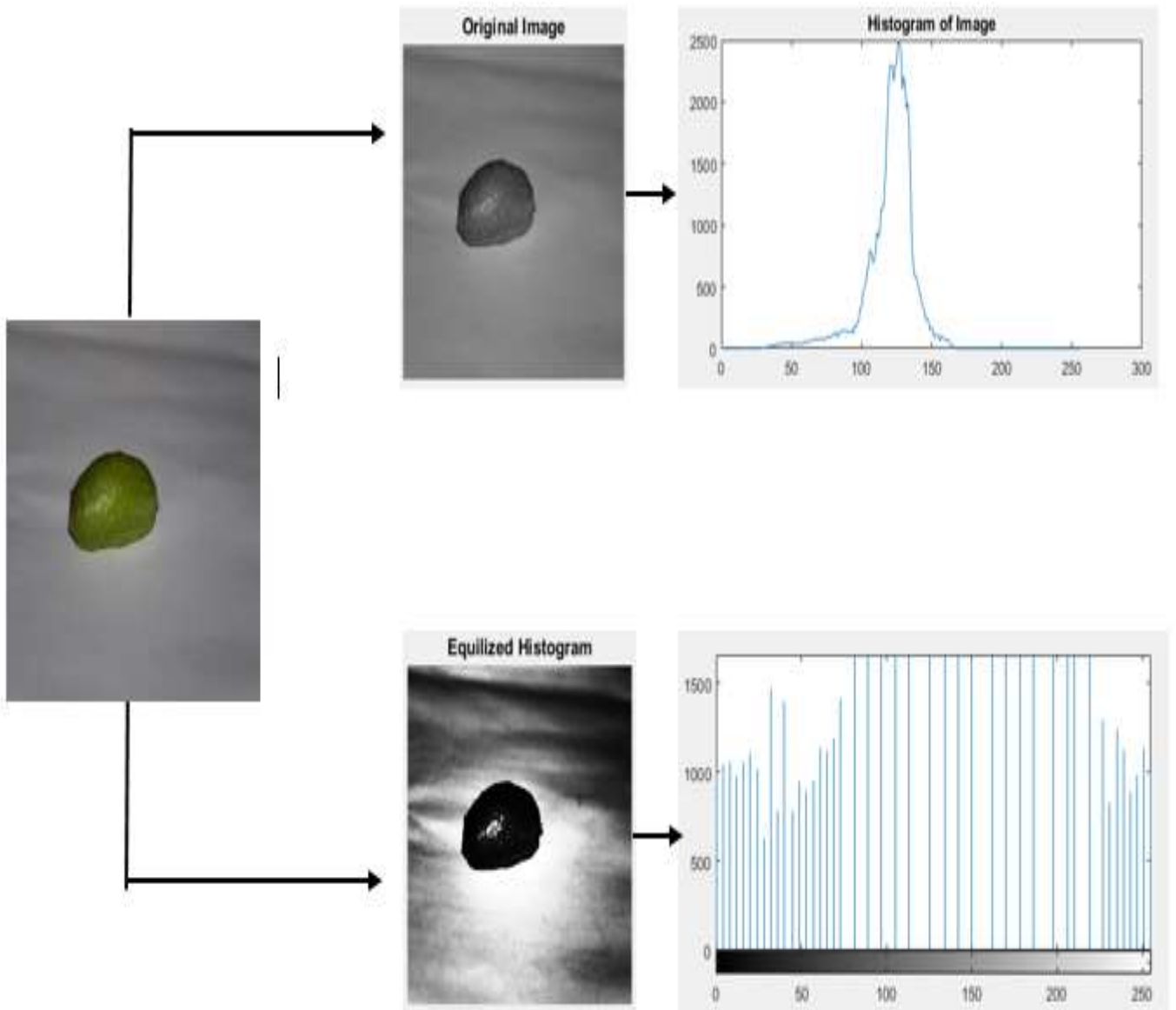**Figure 4.12**: Histogram Base segmentation (Atafol)

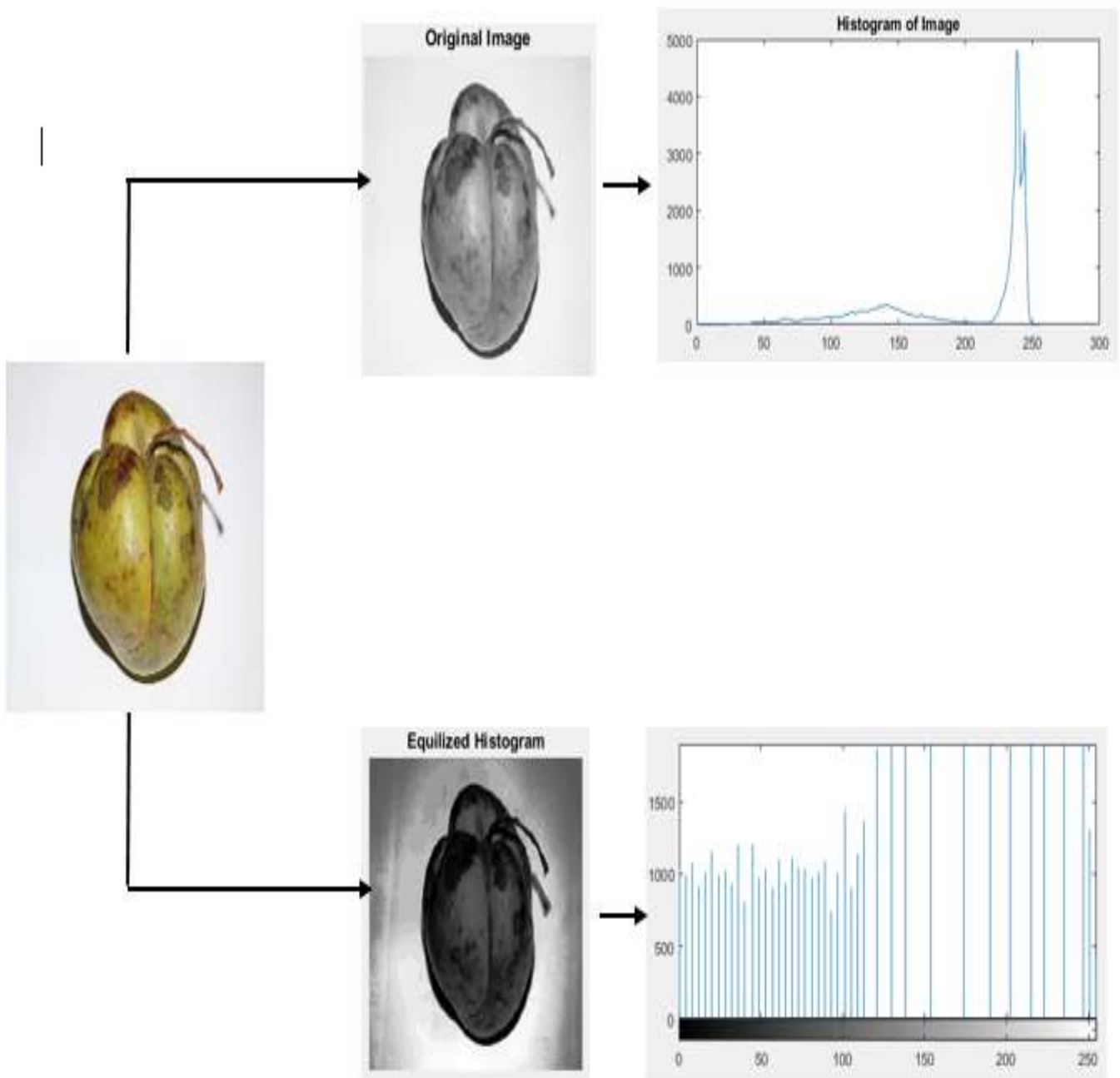**Figure 4.13**: Histogram Base segmentation (Bilombo)

Figure 4.14: Histogram Base segmentation (Chalta)

This are all the Histogram segmented fruits. We can find out the differences from the two Histogram images. Here we used two different Histogram for mentioning the main differences of that individual fruits. We can easily understand the variety of various kinds of local fruits.

Finally, we will show the last segmentation and this is thresholding base segmentation. We have already known that details of thresholding. So I am not describing here. Just I want to show the segmented fruits using thresholding.

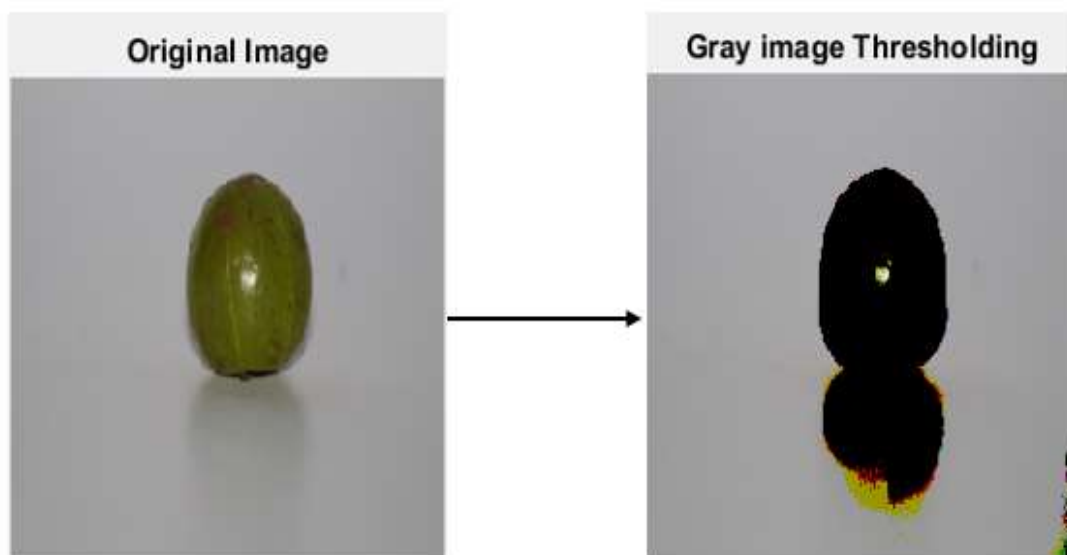Thresholding segmentation of Amloki fruit is given below:

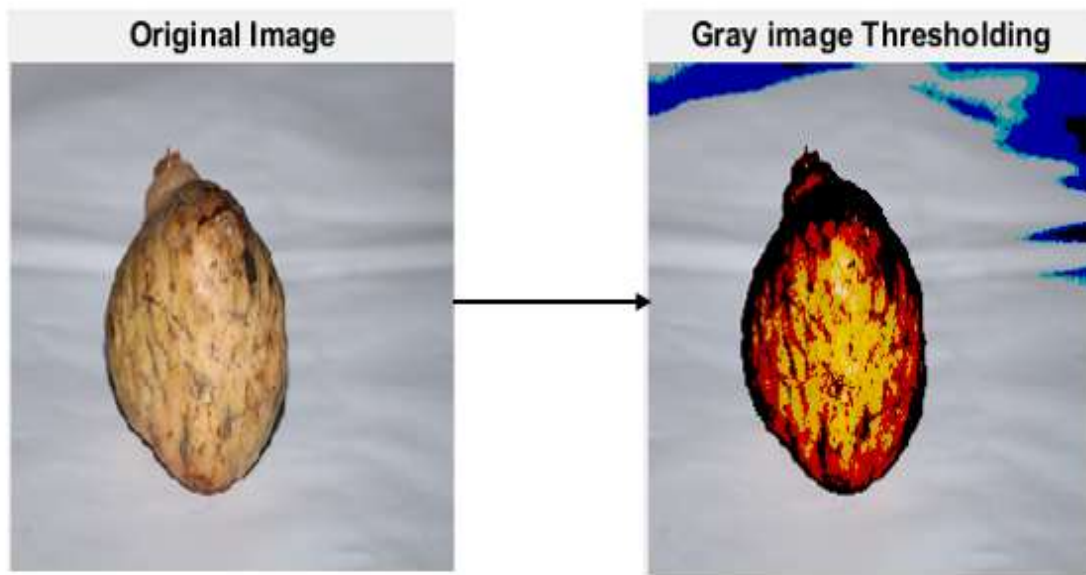**Figure 4.15**: Thresholding Base segmentation (Amloki)
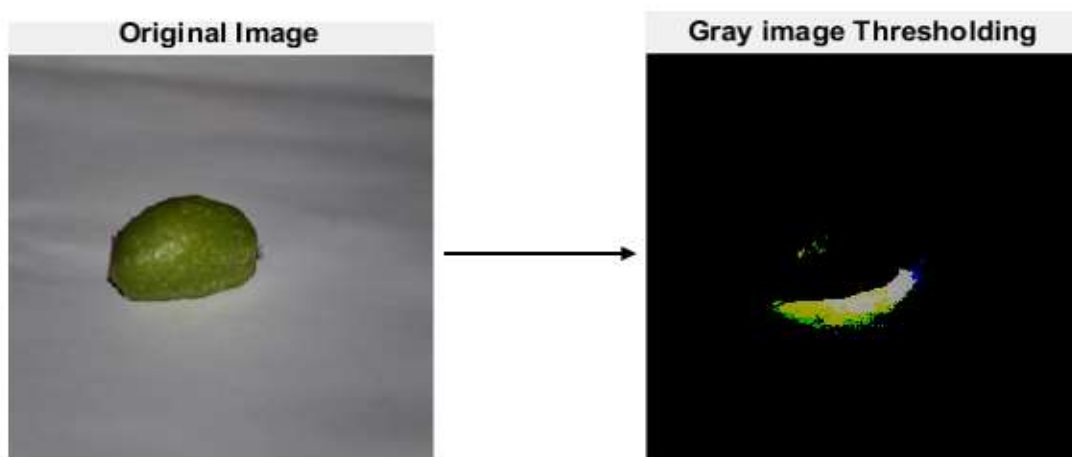
Figure 4.16: Thresholding Base segmentation (Amloki)

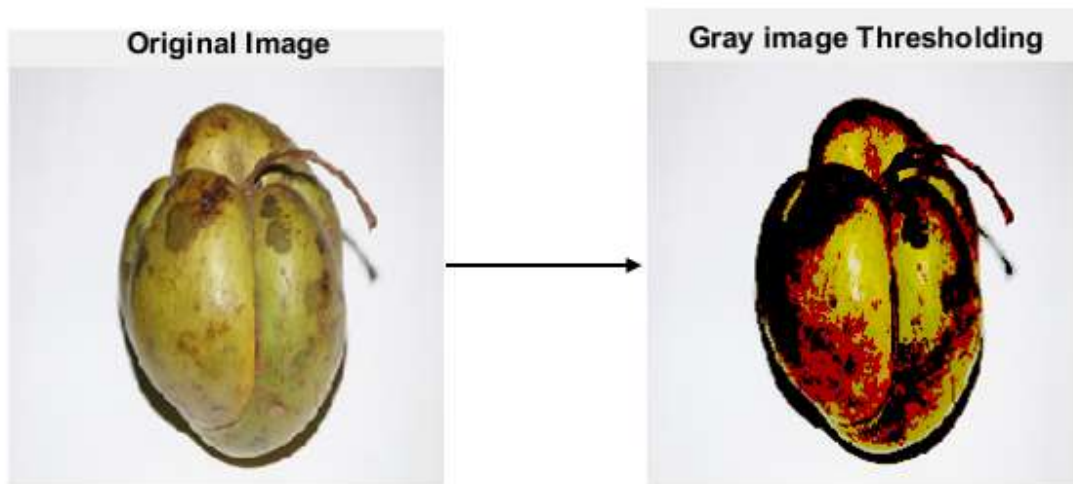**Figure 4.17**: Thresholding Base segmentation (Bilombo)

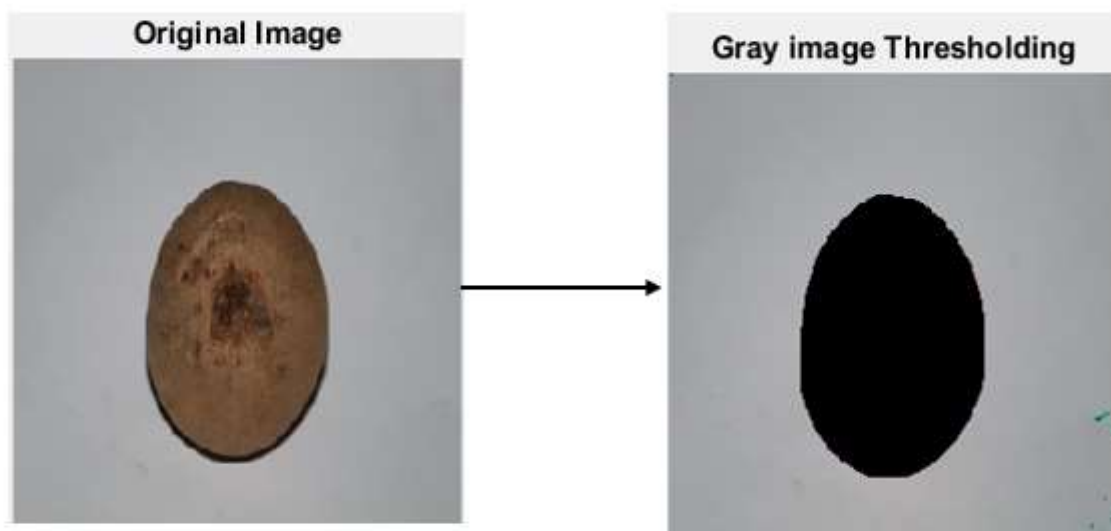**Figure 4.18**: Thresholding Base segmentation (Chalta)

Figure 4.19: Thresholding Base segmentation (Sofeda)

Thses are all the Thresholding base segmentation of different types of local fruits. Here we can see the segmentation of fruits when applying Thresholding segmentation. We can see the changes of that fruits.

Finally we have known very well and their expected outcome and their different segmentation process. We can understand that the fruits give us individual identity to find it and its name. I mean we will recognize the fruits when we apply that different types of segmentation. Using these segmentation we will want to know the shape of various fruits and finally we will recognize what fruits it is.

4.3 Descriptive Analysis

To urge the correct execution through our whole explore criteria, to begin with we ought to plan the information of shapes of distinctive nearby natural products. Since our target is to identify the shape of diverse sorts of natural products, so we collected a few pictures of neighborhood natural products to distinguish shape. Here we orchestrated 5 neighborhood natural products (Amloki, Chalta,Sofeda,Orboroi and Atafol). We captured parts of pictures for our test (around 40 pictures per natural products) but here we utilized as it were 5-6 pictures for our comfort of try. At that point we sectioned that pictures utilizing distinctive sorts of segmentations. Figure 3 appears that the initial pictures of distinctive fruits.

The extricated highlights of the ROI containing cluster is labeled and all the values of eleven highlights are put away in a $m \times n$ framework where m is the number of pictures prepared and n is the number of highlight that's extricated from the image.

Test picture highlights are extricated to compare with the prepared dataset and Multiclass SVM algorithms is connected within the framework to classify which lesson the test image's data has a place to.

4.4 Summary

Every year our country imports many fruits from different countries especially from India which requires a huge investment from the government. But this land is very friendly to grow many local fruits in a rapid productive way that it should not be necessary to import those from outside. The proper maintenance and guidance can help the farmers to make their land fruitful if major problems of their cultivation can be solved. But it is a matter of sorrow that most of the Bangladeshi people don't know the name of their local fruits. They don't know

© Daffodil International University

the actual name of that fruits. In our project segmentation we will inform that the actual name of different types of fruits. Applying this proposed method, identification of different fruits are recognized well and also can be implemented to define other kind of fruit that will surely bring a tremendous change in our agriculture sector.

CHAPTER 5

Summary, Conclusion, Recommendation and Implication for Future Research

5.1 Summary of the Study

In this inquire about, we have collected numerous nearby natural products from diverse places. At that point the neighborhood natural products are captured and the captured pictures have prepared for pre-processing. In pre-processing, the pictures are sifted. Moreover clamor expulsion strategy is connected here. After wrapping up pre-processing arrange, we have utilized distinctive sorts of division such as k-means clustering, Otsu strategy, histogram and thresholding. We have done all the division utilizing MATLAB. And utilizing those division our last target is to identify the shape of nearby natural products so that one can effortlessly recognize those fruits. Using our project anyone can easily detect and recognize the different kinds of local fruits by detect its shape first.

5.2 Limitations

The main limitation of our project is we've worked solely 5 native fruits. We capture of these fruits within the same lighting position however the angle was totally different. The orientation of fruits not fixed.

5.3 Conclusions

In our whole paper, we have done thresholding, histogram, and k-means clustering, Otsu procedure, l*a*b alter methodologies review in over session. We have started working on principal filtering component which may be an essential parcel for characteristic item affirmation and without filtering us cannot add up to expand. In future, we'll expand by recognizing and abandoning normal items. In this report, we briefly inspected the work that has been carried out on picture planning space particularly by emphasizing its execution on hardware contraption. Truly this wander will energize the help exercises to be taken for utilization of work in such space. Believe that, our future work will actualize of such systems in veritable life which easily recognize an adjacent normal item and it is uncommonly much strong who don't recognize an adjacent characteristic item.

5.4 Recommendations

A few natural product acknowledgment procedures are created based upon color and shape properties. Be that as it may, distinctive natural product pictures may have comparable or indistinguishable color and shape values. Subsequently, utilizing color highlights and shape highlights examination strategies are still not vigorous and viable sufficient to recognize and recognize natural products pictures. An unused natural product acknowledgment framework has been proposed, which combines three highlights examination strategies: color-based, shape-based and size-based in arrange to extend precision of acknowledgment. The proposed strategy classifies and recognizes natural product pictures based on gotten highlight values by utilizing closest neighbors' classification. Subsequently, our framework appears the natural product title and a brief depiction to client. The proposed natural product acknowledgment framework investigation classifies and distinguishes natural products effectively up to 90% precision. This framework too serves as a valuable instrument in an assortment of areas such as instruction, picture recovery and manor science.

5.5 Implication for Further Study

To form our life less demanding, continuously we are getting exceptionally much subordinate on present day advances where in our nation, horticulture division is distant behind from utilizing these advances which can be a matter of thriving in a momentous rate. The proposed framework appears a better approach to include with the machine learning strategy which is able to identify the distinctive sorts of natural products and recognize them naturally. This approach can be actualized into any kind of portable based application or web-based application to reach the root level ranchers effectively. Ranchers sends the captured picture from the arrive straightforwardly and get the yield on their hand in a moment appearing which title their natural products are having so that they can take moment choice of what the genuine title of that specific natural product. To anticipate colossal misfortune of their benefit they were in require of a framework like this from the exceptionally early period of time.

In this investigate we made a reasonable accomplishment from our think about and exertion which can be connected to our agrarian innovations to urge an extraordinary execution of the generation framework and thusly creating a great sum of profit.

References

[1] Corrado Costa & Francesca Antonucci &Federico Pallottino & Jacopo Aguzzi & Da-Wen Sun &Paolo Menesatti." Shape Analysis of Agricultural Products: A Review of Recent Research Advances and Potential Application to Computer Vision" Springer Science Business Media, LLC 2011 (2011) 4:673–692

[2] Stan Sclaroff, Member, IEEE, and Lifeng Liu."Deformable Shape Detection and Description via Model-Based Region Grouping" IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 23, NO. 5, MAY 2001 475

[3] Sanket Rege1, Rajendra Memane2, Mihir Phatak3, Parag Agarwal4 "2d geometric shape and color recognition using digital image processing" IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 23, NO. 5, MAY 2001

[4] Slamet Riyadi, Ashrani A. Abd. Rahni, Mohd. Marzuki Mustafa, and Aini Hussain, "Shape Characteristics Analysis for Papaya Size Classification" The 5th Student Conference on Research and Development –SCOReD 2007 11-12 December 2007

[5] Sandip s. patil,Harshal s. Patil"Study and Review of Various Image Texture Classification Methods" International Journal of Computer Applications (0975 – 8887) Volume 75 – No.16, August 2013

[6] Seiichi Uchida "Image_processing_and_recognition_for_biological_images" Department of Advanced Information Technology, Kyushu University, 744 Motooka, Nishi, Fukuoka, 819-0395, Japan.

[7] A. M. Aibinu, M. J. E. Salami, A. A. Shafie, N. Hazali and N. Termidzi "Automatic Fruits Identification System Using Hybrid Technique" 2011 Sixth IEEE International Symposium on Electronic Design, Test and Application

[8] Abdul Kadir#1, Luzkito Edi Nugroho*2, Adhi Susanto#3, Paulus Insap Santosa, "Leaf Classification Using Shape, Color, and Texture Features" International Journal of Computer Trends and Technology- July to Aug Issue 2011

[9] Shiv Ram Dubey and Anand Singh Jalal, ―Adapted Approach for Fruit Disease Identification using Images,‖ International Journal of Computer Vision and Image Processing, vol. 5, 2012.

[10] Trupen Meruliya, Parth Dhameliya, Jainish Patel, Sapan Naik, Pooja Kadam & Dilav Panchal Image Processing for Fruit Shape and Texture Feature Extraction-Review" International Journal of Computer Applications(0975-8887)Volume 129-No. 8,November 2015.

[11] G.P. Moreda , M.A. Munoz, M. Ruiz-Altisent. "Shape determination of horticulture produce using two dimensional computer vision" Journal of Food Engineering 108 (2012) 245-261

 [12] Leslie Stroebel; Richard D. Zakia (1995). The Focal encyclopedia of photography. Focal Press. p. 507. ISBN 978-0-240-51417-8.

[13] L. D. Paarmann, Design and Analysis of Analog Filters: A Signal Processing Perspective, Springer, 2001 ISBN 0792373731.

[14] Kriegel, Hans-Peter; Schubert, Erich; Zimek, Arthur (2016). "The (black) art of runtime evaluation: Are we comparing algorithms or implementations?". Knowledge and Information Systems. 52: 341–378.

[15] Mahajan, M.; Nimbhorkar, P.; Varadarajan, K. (2009). "The Planar k-Means Problem is NP-Hard". Lecture Notes in Computer Science. Lecture Notes in Computer Science. 5431: 274–285.

[16] M. Sezgin & B. Sankur (2004). "Survey over image thresholding techniques and quantitative performance evaluation". Journal of Electronic Imaging. 13 (1): 146–165.

[17] Nobuyuki Otsu (1979). "A threshold selection method from gray-level histograms". IEEE Trans. Sys., Man., Cyber. 9 (1): 62–66.

[18] Howitt, D.; Cramer, D. (2008). Introduction to Statistics in Psychology (Fourth ed.). Prentice Hall. ISBN 978-0-13-205161-3.

[19] The Multi-stage Approach to Grey-Scale Image Thresholding for Specific Applications, Van Solihin and C. G. Leedham

[20] Devi, H.K.A., (2006). Thresholding: A Pixel-Level Image Processing Methodology Preprocessing Technique for an OCR System for the Brahmi Script. Ancient Asia. 1, pp.161–165

<center>**Appendices**</center>

Appendix A: Research Reflection

The reason of this Reference section is to supply a presentation to Investigate refection. The bunch investigate venture was a challenging and pleasant involvement ordinary of the course as an entirety. We have had small exposer to gather work at college. So, it was a pleasant alter to be portion of a compelling and energetic team.

The encounter instructed us that arranging and making reactions takes a longer time in groups than on your claim. The broad exertion required was eventually a great thing. In our gather we are continually creating and refining one another's thoughts. We had to go to villages and ranches to gather the pictures that was exceptionally getting a charge out of conjointly challenging for us.

We delighted in a part talking to the agriculturists who made a difference us a parcel. This investigate comes about would offer assistance them to their future development by all means.

Appendix B: Related Issues

Collecting pictures from this kind of urban range or advertise like Dhaka was exceptionally troublesome. We had to go to towns and markets to capture the diverse sorts of neighborhood natural product pictures. We had to conversation to the ranchers whereas to let them get it the issue and significance of consider. They were exceptionally inviting in spite of the fact that to assist us.

We had to memorize so numerous modern calculations and procedures to actualize our thoughts and inquire about work to be compelling. Variety of the picture foundations and quality of the pictures were challenging to adjust and diminish the changes in comes about hereby.