A Fruit Identification with Classification Fault Detection Technique using K-means clustering

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***Abstract*: As of late, it has been exhibited that visual recognition and ML techniques can be utilized to create frameworks that keep tracks of human natural product utilization. Diseases in fruit cause devastating problem in economic losses and production in agricultural industry worldwide. All the fruits were analyzed on the basis of their color (RGB space), shape and texture and then classified using different classifiers to find the classifier that gives the best accuracy.The image processing based proposed approach is composed of the first step K-Means clustering technique is used for the image segmentation, in the second step some features are extracted from the segmented image, and finally images are classified into one of the classes by using a Support Vector Machine. Our experimental results express that the proposed solution can significantly support accurate detection and automatic classification of fruit diseases. Grey Level Co-occurrence Matrix (GLCM) is used to calculate texture features. Currently we perform the analysis for Apple, Orange, Grapes, pomegranate & banana.**

***Keywords*: K-means clustering, machine learning, L*a*b, texture features. GCH, Local binary pattern**

I INTRODUCTION

The classical approach for detection and identification of fruit diseases is based on the naked eye observation by the experts. In some developing countries, consulting experts are expensive and time consuming due to the distant locations of their availability. Automatic detection of fruit diseases is essential to automatically detect the symptoms of diseases as early as they appear on the growing fruits. Fruit diseases can cause major losses in yield and quality appeared in harvesting. To know what control factors to take next year to avoid losses, it is crucial to recognize what is being observed. Some disease also infects other areas of the tree causing diseases of twigs, leaves, and branches. For example, some common diseases of apple fruits are apple scab, apple rot, and apple blotch. Apple scabs are gray or brown corky spots. Apple rot infections produce slightly sunken, circular brown or black spots that may be covered by a red halo. Apple blotch is a fungal disease and appears on the surface of the fruit as dark, irregular or lobed edges. Visual inspection of apples is already automated in the industry by machine vision with respect to size and color. However, detection of defects is still problematic due to natural variability of skin color in different types of fruits, high variance of defect types, and presence of stem/calyx. The studies of fruit can be determined by apparent patterns of specific fruit and it is critical to monitor health and detect disease within a fruit. Through proper management action such as pesticides, fungicides and chemical applications one can promote control of diseases which interns improve quality. There are various approaches available such as spectroscopic and imaging technology, applied to achieve better plant disease control and management.

Fruit detection system has its major application in robotic harvesting. However the technology can be custom made to be suitable for other applications such as disease detection, maturity detection, tree yield monitoring and other similar operations.Varieties of fruits are being exported all over the world with the development in cold storage facilities and transportation. It becomes the necessity of maintaining the highest level export quality which is mainly carried out by visual checking by experts. This is expensive and time consuming due to distant location of farms. Precision Agriculture helps the farmers to provide with sufficient and economical information and control technology due to the development and disclosure in various fields. The objectives are agricultural input systemization, profit hike and environmental damage reduction. So, in this work, a solution for the detection and classification of fruit diseases is proposed and experimentally validated. This system takes input as image of fruit and identifies it as infected or non- infected. The technique which helps the farmers to identify disease properly by using this proposed work. Image segmentation methods are generally based on one of two fundamental properties of the intensity values of image pixels: similarity and discontinuity. In the first category, the concept is to partition the image into several different regions such that the image pixels belonging to a region are similar according to a set of predefined criteria's. Whereas, in the second category, the concept of partition an image on the basis of abrupt changes in the intensity values is used. Edge detection technique is an example of this category which is similar to the boundary extraction. Researchers have been working on these two approaches for years and have given various methods considering those region based properties in mind. But, still, there is no fixed approach for the image segmentation. Based on the discontinuity or similarity criteria, many segmentation methods have been introduced which can be broadly classified into six categories:(1)Histogram based method,(2)Edge Detection, (3)Neural Network based segmentation methods,(4)Physical Model based approach,(5)Region based methods (Region splitting,Region growing & merging),(6)Clustering (Fuzzy C-means clustering and K- Means clustering). This paper presents an efficient image segmentation approach using K-means clustering technique based on color features from the images.Defect segmentation is carried out into two stages. At first, the pixels are clustered based on their color and spatial features, where the clustering process is accomplished. Then the clustered blocks are merged to a specific number of regions. Using this two step procedure, it is possible to increase the computational efficiency avoiding feature extraction for every pixel in the image of fruits. Although the color is not commonly used for defect segmentation, it produces a high discriminative power for different regions of the image.The rest of the paper is organized as follows: Section 2 presents a brief overview of the related work. Section 3 describes the K-means clustering method. In section 4 the proposed method for the defect segmentation of fruits based on color using K-means clustering technique is presented and discussed. Section 5 demonstrates the experimental results obtained with apple as a case study. Finally, section 6 concludes with some final remarks.

II RELATED WORK

This paper discusses the development of portable fruit sorting and grading machine based on computer vision for small agro-industries. The mechanical system is designed from low cost material in the form of inclined and segmented plane to substitute the utilization of conveyor belt.[1] This paper presents a review on methods that use digital image processing techniques to detect, recognize and classify plant diseases from digital image and concludes with discussion of more useful problems in the domain and future direction.[2]In this paper present an effective and user-friendly color mapping concept for automated color grading that is well suited for commercial production. User friendliness is often viewed by the industry as a very important factor to the acceptance and success of automation equipment[3].This paper reports on the development of an automatic adjustable algorithm for segmentation of color images, using linear support vector machine (SVM) and Otsu's thresholding method, for apple sorting and grading. The method automatically adjusts the classification hyper plane calculated by using linear SVM and requires minimum training and time.[4]The paper presents a computer vision based system for automatic grading and sorting of agricultural products like Mango (Mangifera indica L.) based on maturity level. The application of machine vision based system, aimed to replace manual based technique for grading and sorting of fruit.[5]This paper, propose a web based tool that helps farmers for identifying fruit disease by uploading fruit image to the system. The system has an already trained dataset of images for the pomegranate fruit. Input image given by the user undergoes several processing steps to detect the severity of disease by comparing with the trained dataset images.[6] The work proposes an image processing and neural network methods to deal with the main issues of phytopathology i.e. disease detection and classification. The Pomegranate fruit as well as the leaves are affected by various diseases caused by fungus, bacteria and the climatic conditions. These diseases are like Bacterial Blight, Fruit Spot, Fruit rot and Leaf spot. The system uses some images for training, some for testing purpose and so on. The color images are pre- processed and undergo k-means clustering segmentation.[7] This study a method is proposed for detect pomegranate fruits on the tree and find the number of overall pomegranates using near camera images obtained from the stations established the groves. The pomegranate has significant red color, so a color-based method is applied for to detect the fruits on the tree. Color alone cannot provide a sufficiently robust algorithm for the detection of the pomegranate.[8]

III DESIGN METHODOLOGY

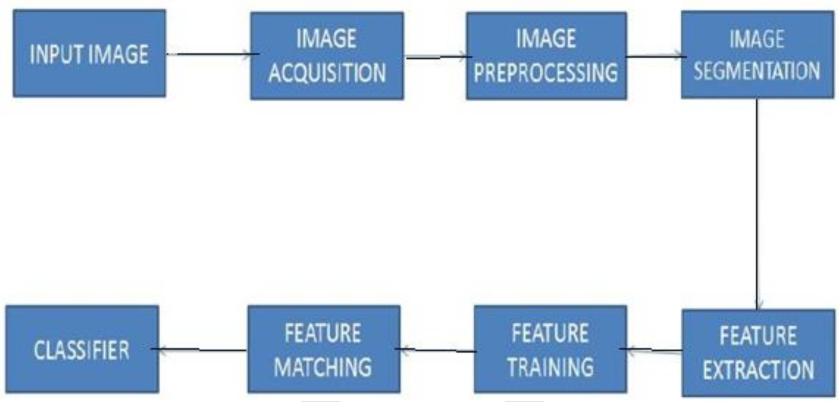


Figure 1: Block diagram of design methodology.

Figue shows that entire working of our system how classify accurate various types of fruits. A digital image is produced by one or several image sensors, which besides various types of cameras. The image is acquired from cameras and files and grabbers directly into MATLAB. Incomplete, noisy and inconsistent data is removed, noisy data is smoothed out, tuples are ignored, and missing values are filled up and object reorganization is done in preprocessing.Segmentation of one or multiple image regions which contain a specific object Image features at various levels of complexity are extracted from the image data.Typical examples of such features are: color, shape, texture. Classifying a detected object into different categories of interest.

i) Gray Level Co-occurrence Matrix (GLCM).

Texture features can be extracted in several methods, using statistical, structural, model-based and transform information, in which the most common way is using the Gray Level Co-occurrence Matrix (GLCM). GLCM contains the second-order statistical information of spatial relationship of pixels of an image. From GLCM, many useful textural properties can be calculated to expose details about the image content. GLCM is the matrix that describes the frequency of one gray level appearing in a specified linear spatial r relationship with another gray level within the area of investigation. A co-occurrence matrix is defined over an image to be the distribution of co-occurring values at a given offset.

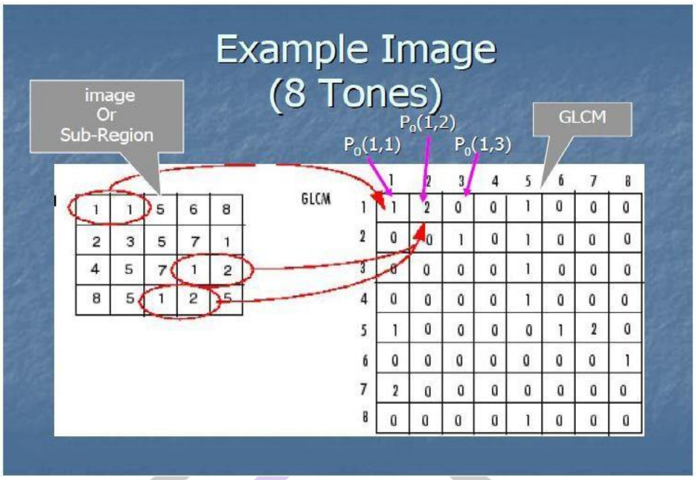


Figure 2: Example of GLCM

An image having gray level from 0 to 8 will create GLCM of size 8 by 8. Sub-region means window size of the image that we have considered. Sub-region means window size of the image that we have considered. However, we can specify some other spatial relationship between two pixels to create multiple GLCM's, specify some array of offsets to the grayco matrix function.

Statistics	Description
Contrast	Measures the local variations in the gray-level co-occurrence matrix
Correlation	Measures the joint probability occurrence of the specified pixel pairs.
Energy	Provides the sum of squared elements in the GLCM. Also known as uniformity or the angular second moment.
Homogeneity	Measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal

Table 1 : Calculating statistics from GLCM

IV PROPOSED SYSTEM

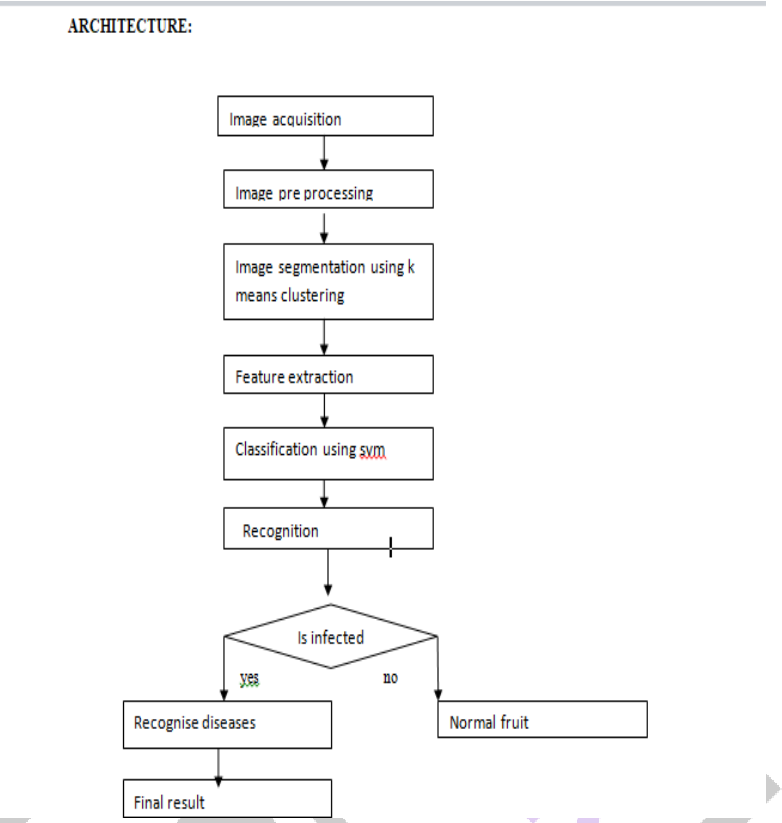
The proposed approach used K-means clustering technique for segmenting defects with three clusters.We have used defected apples for the experimental observations and evaluated the introduced method considering apples as a case study.Experimental results suggest that the proposed approach is able to accurately segment the defected area of fruits present in the image.For the fruit disease classification problem, precise image segmentation is required; otherwise the features of the non infected region will dominate over the features of the infected region. In this approach K-Means based image segmentation is preferred to detect the region of interest which is the infected part only. After segmentation, features are extracted from the segmented image of the fruit. Finally, training and classification are performed on a SVM classifier.

ii) Advantages of Proposed System:

1) It would promote Indian Farmers to do smart farming which helps to take time to time decisions which also save time and reduce loss of fruit due to diseases.
2) The leading objective of our paper is to enhance the value of fruit disease detection.

3) India is the second largest producer of fruits after China. Due to the lack of skilled workers, 30–35% of the harvested fruits is wasted. Again, because of human perception subjectivity identification, classification and grading of fruits not done precisely. So, it is required to impose the automation system in the fruit industry

Figure 3: Proposed System Architecture



iii) Algorithm used:

K-means clustering

1. Initialize the number of cluster k, and also pick initial centroid randomly.
2. The squared Euclidean distance will be calculated from each image to each cluster is computed, and each object is assigned to the closest cluster.
3. For each cluster, the new centroid is computed and each seed value is now replaced by the respective cluster centroid.
4. Euclidean distance from an object to each cluster is calculated, and the image is allotted to the cluster with the smallest Euclidean distance. This process will be continue until image is in same cluster at every iteration.
5.

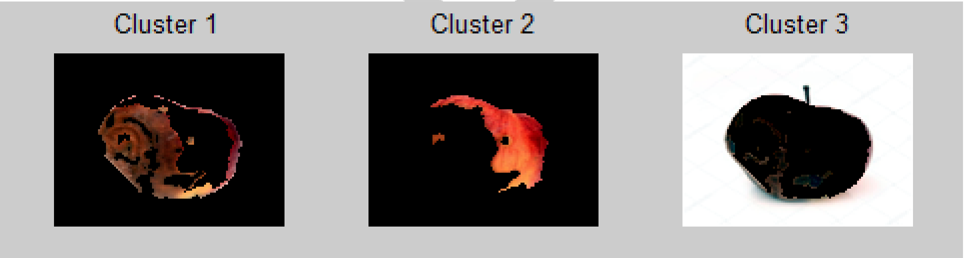


Figure 4: cluster number 1,cluster number 2,cluster number 3

iv)Defect segmentation

Image segmentation using k-means algorithm is quite useful for the image analysis. Figure 5 shows the framework for the fruits defect segmentation. The basic aim of the proposed approach is to segment colors automatically with appropriate result using the K-means clustering technique and l*a*b* color space

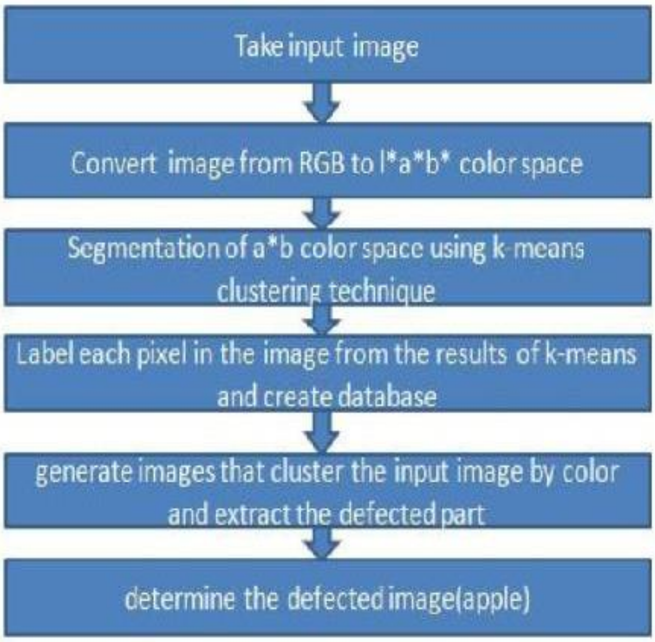


Figure 5: Flowchart of Defect Segmentation

The introduced framework of defect segmentation operates in six steps as follows

Step 1. Read the input image of defected fruits.

Step 2. Transform Image from RGB to L*a*b* Color Space. We have used L*a*b* color space because it consists of a luminosity layer in 'L*' channel and two chromaticity layer in 'a*' and 'b*' channels. Using L*a*b* color space is computationally efficient because all of the color information is present in the 'a*' and 'b*' layers only.

Step 3. Classify Colors using K-Means Clustering in 'a*b*' Space. To measure the difference between two colors, Euclidean distance metric is used.

Step 4. Label Each Pixel in the Image from the Results of K-Means. For every pixel in our input, K- means computes an index corresponding to a cluster. Every pixel of the image will be labeled with its cluster index.

Step 5. Generate Images that Segment the Input Image by Color. We have to separate the pixels in image by color using pixel labels, which will result different images based on the number of clusters.

v)Local binary pattern

Local Binary Pattern (LBP) is an effective **texture** descriptor for images which thresholds the neighboring pixels based on the value of the current pixel.LBP descriptors efficiently capture the local spatial patterns and the gray scale contrast in an image.

Vi)Global Color Histogram

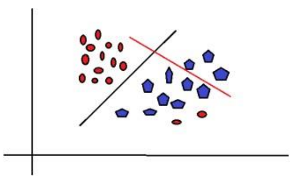
GCH is the most known color histogram used to detect similar images. Feature extraction algorithm. Count number of pixels for each color and store it in histogram's bins. We use local color features of different regions and combine them to represent color histogram as a color feature. These color features are compared using Euclidean distance as a metric to define similarity between the query image and the database images. For calculations of local color histogram we divide image into different blocks of size 8 × 8 as fixed, so that for each block of image spatial color feature histogram of image is obtained.

vii)Support Vector Machine

SVM uses the different hyper-plane which separates two different classes better. It is accurately classify the give data into different hyper-plane . if there have multiple hyper- plane which accurately classify all the data set the we need to calculate margin distance. It also calculates the margin distance. It is maximum distance between data set and hyper-plane. Whoever be hyper-plane has maximum margin distance that take as accurate hyper-plane to classify the data set. SVM accurately classify all the data set correctly as compare to all other algorithm

Figure 5:Concept of SVM

V RESULTS AND DISCUSSIONS



In our experimental work,we measured performance**,** here we take seventy five multiple images of apple, banana, grapes,orange,pomogrante with different size,with fault some are without fault and applied on our proposed algorithm and based on our algorithm analysis these result we got.

a) Input image **b) Fault detection** **c) Identification of disease**

Figure 5:Result of Apple fruit image

VI CONCLUSION

An image processing based solution is proposed and evaluated in this paper for the detection and classification of fruit diseases. The proposed approach is composed of mainly three steps. In the first step image segmentation is performed using K-Means clustering technique. In the second step features are extracted. In the third step training and classification are performed on a SVM. It would also promote Indian Farmers to do smart farming which helps to take time to time decisions which also save time and reduce loss of fruit due to diseases. The leading objective of our paper is to enhance the value of fruit disease detection.

REFERENCES

[1] Hadha Afrisal, Muhammad Faris, Guntur Utomo P, Lafiona Grezelda, Indah Soesanti, Mochammad Andri F, "Portable Smart Sorting and Grading Machine for Fruits Using Computer Vision".
[2] S. B. Ullagaddi, Dr. S.Vishwanadha Raju, "A Review of techniques for Automatic detection and diagnose of mango Pathologies".
[3] Dah-Jye Lee, James K. Archibald and Guangming Xiong, "Rapid Color Grading for Fruit Quality Evaluation Using Direct Color Mapping".
[4] Akira Mizushima, Renfu Lu. "An image segmentation method for apple sorting and grading using support vector machine and Otsu's method".Manisha Bhangea, H.A.Hingoliwala, "Smart Farming: Pomegranate Disease Detection Using Image Processing".
[5] Chandra Sekhar Nandi, Bipan Tudu, Chiranjib Koley. "An Automated Machine Vision Based System for Fruit Sorting and Grading".
[6] Manisha Bhangea, H.A.Hingoliwala, "Smart Farming: Pomegranate Disease Detection Using Image Processing".
[7] Mrunmayee Dhakate, Ingole A. B, "Diagnosis of Pomegranate Plant Diseases using Neural Network".
[8] Cihan Akin, Murvet Kirci, Ece Olcay Gunes, Yuksel Cakir "Detection of the Pomegranate Fruits on Tree Using Image Processing"