Local Vegetable Detection: A Computer Vision Approach

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

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APPROVAL

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DECLARATION

We hereby declare that; this project has been done by us under the supervision of **Anup Majumder, Lecturer,** 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.

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ABSTRACT

In this thesis work it describes about a unique system that can detect local vegetable using computer vision approach. To enhance the identification process and promote the usability of the graphical user interface compared to existing manual system is the main motive of the system. Different convolutional neural networks have been tested and retrained to classify an object. It's our goal to implement a system which can suggest optimal recipes based on the identified vegetables. There are verities of methods that can detect the local vegetables, but for particular and user friendly process we decide to use Random Forest Classifier method to identify the local vegetable. We use three feature extraction methods which are Hu Moments, Color Histogram and Haralick Textures to extract the features. We calculate the accuracy by the help of confusion matrix. As the domain of this research model, local vegetable detection are classified, and 96% accuracy are achieved which can obviously help in our modern life along with proper introduction.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Customers choosing another grocery store for complex and time consuming self-service systems. As the customer satisfaction considered as business key to success, that's why the progress of a company depend on their customers. Cooking and innovative recipes are top ratted widely searched topic over the web. Modern day housewives and students are willing to experiment and create new dishes, that's why they search for recipes and various ingredients. Multiple objects detection from a single frame is a tedious task, where accurate result is not provided every time. For vegetables it's especially difficult, because various vegetables have similar color, shape, texture and size. For different varieties of every vegetable it's still now a very challenging task to research on vegetable recognition. One had to type all the ingredients they want to cook with or type the name of the dish for searching a recipe. If these few requirements are fulfilled, then implementation of a vegetable detection system is possible.

It is necessary for the cashier to know the categories of a particular vegetable in order to determine its price. That's why vegetable classification is a difficult and important task in supermarkets. The objective of this paper is to propose a novel vegetable classification system based on computer vision, which can solve this type of problems.

1.2 Motivation

The motivation to work in this project is actually is our real life experience at the time of collection data. Often when we visit market sometimes, we also face difficulties to know all sorts of vegetables in market. Like from our real life experience we see some people have common confusion in coly-flower and broccoli. Besides most of the people don't know about red cabbage.

Here is a list of local vegetables which have common confusion.

- Cauliflower

- Broccoli
- Tomato
- Capsicum
- Cabbage
- Red cabbage

As all those vegetables are not same, but from outlook they almost same. For that reason, people have common confusion about the local vegetables. That's why we are developing this "Local Vegetable Detection" to make a proper introduce of vegetables with peoples. Different samples vegetable samples like Cucumbers, Tomatoes, Onions, Carrots, etc are considered in the work. Traders stored different varieties of vegetables in warehouses. Manually vegetable sorting results high cost, tediousness, subjectivity and inconsistency for vegetable dealers.

1.3 Objective

- The objectives of this project to find out and analyze a technique which can help various people to know about local vegetables.
- Help them to maintain proper nutrition.
- This process help to identify local vegetable through thousands of data.
- To explore features that suited the vegetable recognition system.
- To use Random forest classifier.

1.4 Expected Outcome

In Modern generation most of the people have less idea about our local vegetables. So, it's kind of difficult to maintain proper nutrition's for a better healthy life. By this project we are trying to reach to all levels of people to introduce them with the local vegetables. This procedure will detect the vegetables with Random Forest Classifier method.

A random forest is a meta estimator that feeds a number of decision tree classifier on various sun-samples of the dataset and uses averaging to improve the predictive accuracy and control over fitting. This method implemented in anaconda platform by using python programming language for final output.

- Using this approach to detect local vegetables
- Vegetables are classified
- This system can identify a vegetable from any kind of angle and in different types of shape.
- Easy for mass people to learn about local vegetables.

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 project work and the report layout.

Chapter 2: Background

In this chapter we discussed about the background state of our work. We also provide the literature review of project summary scope of the problem and challenges of the system.

Chapter 3: Project 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, we discuss on several research work done by researchers in the area of image categorization, fruits recognition, vegetables recognition.

Now people get less time for spending for their family work. For those now a days people are less recognized with local markets. And for this they have less idea about local vegetables. The proposed system is able to detect local vegetables and also can recognize the specific vegetable from images.Many researcher has experimented on many techniques that detects the fruits and vegetables using various techniques.

Image processing is a technique that acquires an image and analyze it, enhance or collect useful information from images and finally it output the result in an explainable or apprehensible format. The image may be analyzed to discoversamples that aren't visible by the human eye. People can take decisions after getting the output, sometimes the decisions also can be made by the machine itself.

In this research ANACONDA platform is used to train and analyze the data from numerous images of vegetables. ANACONDA is a platform where the digital image processing algorithms are implemented.

Computer vision is a system that can describe a system what it is containing and what does it mean. In this work computer vision-based system is used recognize vegetables from numerous vegetable images.It is a supervised learning process where vegetable names are used to label the classes.

2.2 Literature Review

Many Image processing techniques were developed through many years of research for object detection and use of classifiers as well. In image segmentation histogram based techniques are efficient because it requires only one pass through the pixels . Image acquisition is the process of collecting an image from some hardware based sources that can be used next for further processing.

Frida Femling et al. [1], Convolutional Neural Networks have been used. Convolutional neural network have been a large scale of image recognition system in recent years. Here Raspberry Pi has been used for image collection. The convolutional neural networks are appreciated by two properties: propagation time, which is the time it takes for an image accuracy and to be classified.Here accuracy show how accurate the prediction is.

Aashna Ahluwalia et al. [2], it discuss about the hardware methodology which define how the procedure works by the hardware's and which devices are needed to implement the procedure. For vegetable identification requires couple of hardware. One is webcam or some camera and another is a display. Camera use to capture image and send to dataset. Display show the output of the process and give the final result of the analysis.

Swati Kalyanasundar et al. [3], various techniques are used to find out the best matching image based on features like color, shape, texture and size. One of the technique is comparing histogram of the capture image and store the image. Another technique is to classify based on the texture of the vegetable in the image. This two methods are helpful in identifying the parent class of the vegetables. Sometimes there are multiple vegetables in same parent class. Then it call another method called Gray Level threshold.

Aya Muhtaseb et al. [4], vegetables often useful to facilitate a monochrome problem by improving contrast. It is easier and faster in processing. The program takes different vegetable images for the learning purpose. Image for unknown vegetable, calculate its histogram. Compare between histogram of unknown vegetable image.

Atul Bansal et al.[5], the morphological features are frequently used for classification of vegetables and fruits. In agricultural industry the size of vegetables and fruits relates to price, therefore in processing stages different size are estimated for grading of fruits and vegetables. Circular and semi-circular object size of fruits and vegetables review is very easy compare to natural anomaly of complex foods.

Om Patill et al. [6], there is a discussion about Inceptionv3 network model. The model is a deep natural network. It's difficult to train dataset with a low configured computer. Besides it takes few days to train dataset. TensorFlow provides a tutorial to retrain inception's final layer for new categories. Which is using transfer learning. The need of this method to keep the parameter of the previous layer.And remove the last layer of the Inception-v3 model, then retrain the last layer. Output number node in the last layer is define the number of categories in the dataset.

Dr. Shridevi Soma [7], here in methodology image pre-processing is divided into two part,

i. Median Filtering that is used to remove noise and it is type of non-linear digital filtering technique.
ii. Try lateral filtering is non-linear noise reducing and edge preserving smoothing filter for images.

Hridkamol Biswas et al. [8] Here is a speech about the convert the image to HSV model to eliminate illumination effects. Herealso calculate the histogram of the captured image to compare with stored histogram. After analyzing the image, the processfinished the feature integration. Then it define specific class characteristics according to feature and create a database for different class.

Yuki Sakai et al. [9], For recognition of vegetable category Deep Neural Network learning is used. Brain is a collection of big number of nerve cells called neurons. Neurons take in signals through synapses which is located on the dendrites or membrane of the neuron. Deep learning is also known as Deep Neural Network. And it has a deep hierarchy that connected multiple internal layers for feature detection and representation learning.

Guoxiang Zeng [10], vegetables & fruits recognition and classification are not easy tasks. Fruits and vegetables, image saliency calculate the intuitional notice of the object of human eye. The calculationimproving image saliency helps us to essence image contents. VGG model is a typical CNN. And it has high classification and recognition rate. It goes deeper then ancient traditional CNN architecture.

2.3 Research Summery

In this research we collect data from different places. Then the data set are pre-processed for next processing. Features of data are extracted from image and clustering by Random Forest Classifier. Data set is prepared and trained along with specific label for each classification which done in Python through Anaconda platform. When all procedure is done then the system is ready to use. Test image is captured and given as input after preprocessing. The features are extracted, and the selected cluster image is compared with the previous dataset.

Multiclass SVM classifier is used to identify the class name or the disease name. Finally, the output of the system is shown as the predicted disease name in the screen.

2.4 Scope of The Problem

The proposed system helps normal people to classify local vegetables.Although the whole process like capturing images, entering the image as input and the implementation of the application may be a fact to a non-professional user who do not have any knowledge of this type of system. But this is a proposed framework which includes the main idea of steps how to process the data and how the algorithms should be implemented. It can be implemented in any kind of platform regardless of choice. Using this approach mobile applications or online based web applications can be developed to reach for local people easily.

2.5 Challenges

To build such a system it needs images of local vegetables to be trained first and then some more images are needed for the testing purpose. Images were collected from various local markets.

The big challenge with this approach is the quality of the images. Images of low resolution cannot be processed easily. The amount of RGB value are most important in image processing which need to be clarify first. Also, the background of the image makes it difficult sometimes to detect the vegetables. If the background colors are much similar to the vegetablepart then the segmentation cannot be done accurately.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

To get vegetables part accurately, image should be segmented first. Otherwise, many part of the major area can be a dispersion of this method. Fig 3.1 shows the basic steps of proposed frame work of this vegetable detection. In this paper to determine the ROI (Region of Interest) Hu Moments, Color Histogram and Haralick Textures is used for feature extraction.

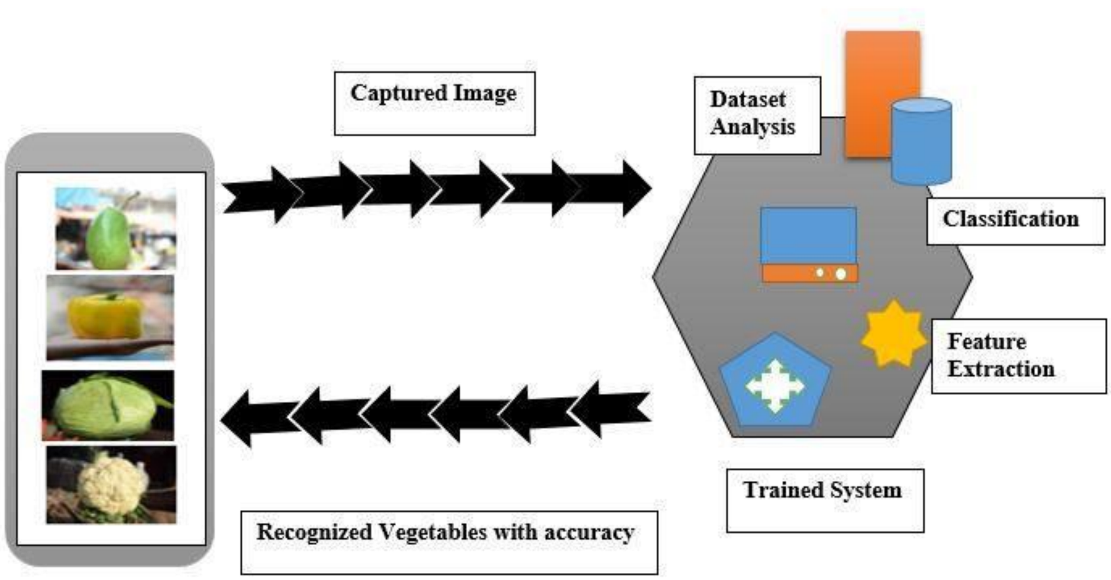

Figure 3.1: Working Procedure for the proposed framework

Fig 3.1 shows how the proposed machine vision system works. To implement such a machine vision system a machine learning system is required which is described in this research and fig 3.2 shows the steps to build the framework for the system.

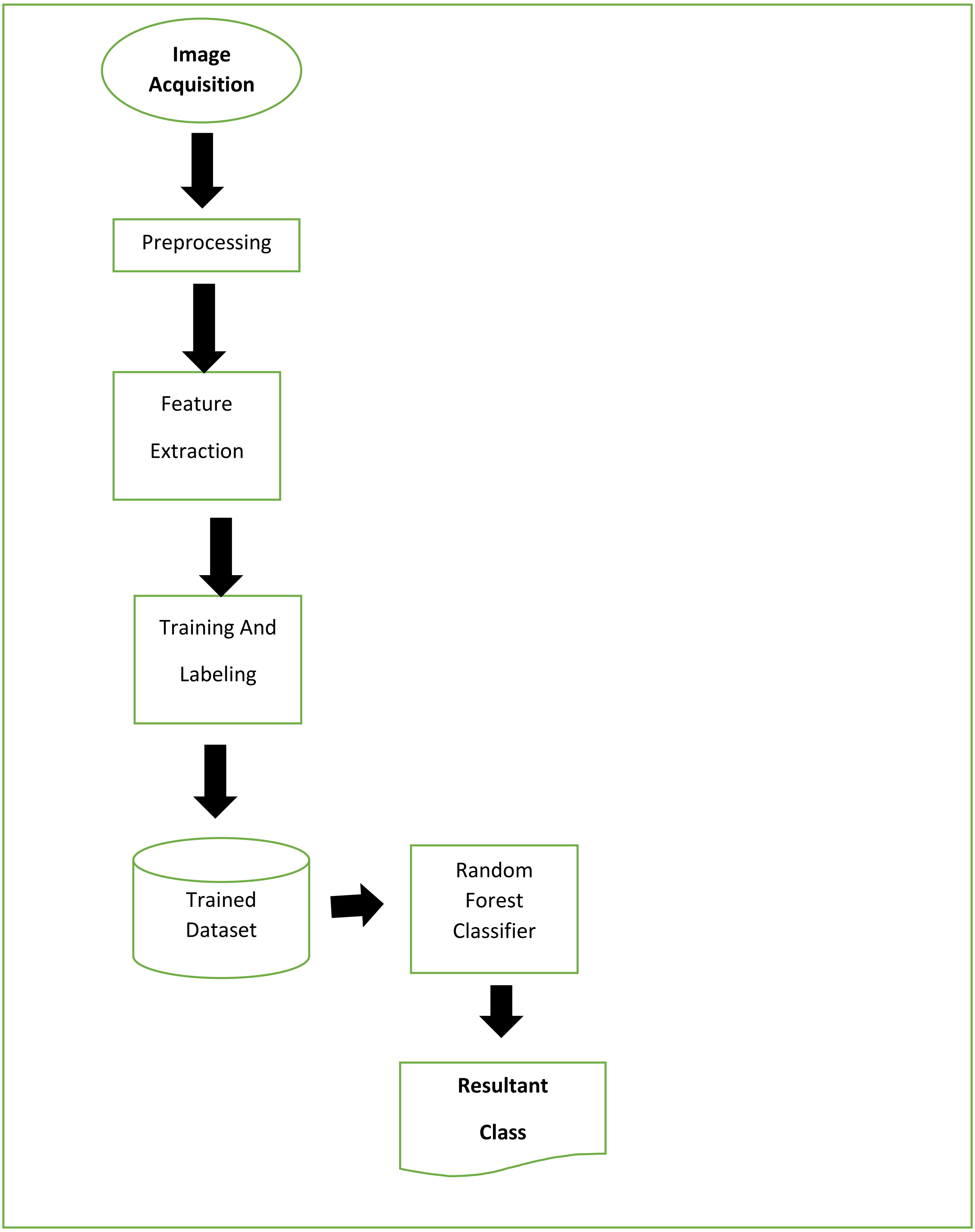

Figure 3.2: Proposed Methodology for Vegetable Detection

3.2 Methods andsteps

3.2.1 Image Acquisition

Image acquisition means delivering an image from different source usually a hardware-based source for processing. The image acquisition process have three steps; energy reflected from the object of interest, an optical system which focuses the energy and finally a sensor which measures the amount of energy.

3.2.1.1 Energy

For capturing an image, a camera seeking some sort of measurable energy. The energy of interest is generally electromagnetic waves. An electromagnetic wave can be narrated as mass less entity, a photon, whose electric and magnetic fields vary consumption ally, hence the name wave.

3.2.1.1.1 Illumination: We need different kind of energy source to illuminate the scene to capture an image. When pointing the illumination directly toward the camera the direction of the illumination must be taken with care. The reason being that this might result in too bright an image or a no uniform illumination. If, however, the outline of the object is the only information of interest, then this way of illumination denoted backlighting can be an appeasement solution. A solution to similar problems is often to use some kind of diffuse illumination either in the form of a high number of less-powerful light sources or by illuminating a rough surface which then reflects the light toward the object.

3.2.1.2 The Optical System

The light reflected from the object has to be captured by the camera after having illuminated the object of interest. An image of the object will be captured, if a material sensitive to the reflected light is placed close to the object.

3.2.1.2.1 The Lens

Lens is one of the main ingredients in the optical system. A lens is a piece of glass which focuses the incoming light onto the sensor.

3.2.1.3 The Image Sensor

The light reflected from the object of interest is focused by a few optics. Then it's needs to be recorded by the camera. For this reason, an image sensor is used.

In this project work numerous vegetables images are used which are collected and captured from many places. All images are formed with RGB (Red, Green, and Blue) color model. The images has differences in quality and formation which needs to be processed to a common form in order to train the dataset.

B. Cabbage

A. Capsicum

D. Cauliflower

C. Calabash

Figure 3.3: Various Dataset (A. Cabbage, B. Capsicum, C. Cauliflower, D. Calabash)

3.2.2Image Pre-processing

Image pre-processing is a prosperity of the image data that inhibit unwilling distortions or amplify some image features important for further processing. In pre-processing methods geometric transformations of images are classified. Before using particular image for training and labeling, some preprocessing of the images were done like Cropping- for cut-out the unimportant part of the image.

3.2.3 Training and Labeling

In this section we train datasets and count the labels of those datasets.

```
In [8]:  #Label Encoding

         le = LabelEncoder()
         encoder=le.fit(labels)
         encoded_labels=encoder.transform(labels)

In [48]: print(len(set(labels)))

         13

In [36]:
```

Figure 3.4: Dataset Labeling

3.2.4 Features Extraction

There are many features extraction method in image processing. In our project we use HU Moments, Color Histogram and Haralick Textures.

3.2.4.1 HU Moments: In computer vision, image processing field, an image moment is a particular weighted averageof the image pixels strengths. And a function of similar moments, that chosen to have some catching property. Image moments helps to match the shape of the object. It’s used here for matching the shape of the images.

3.2.4.2 Color Histogram: Color histogram means representation of the distribution of colors in an image. It can be visualized as a graph that gives a high level intuition of intensity distribution. Color histogram represents the number of pixels that have colors in each of a fixed list of color ranges that span the image's color space for digital images.

Color histogram are based on certain color space like R, G and B channel or H, S and V channel. Intensity histogram used for monochromatic images. For multi-spectral images, where each pixel is represented by an arbitrary number of measurements, the color histogram is N-dimensional, with N being the number of measurements taken. Color histogram actually compute the pixels of various colors in an image, if the color space is large then it divide the color space into certain number of small intervals. Each interval known as bin.

Histograms calculates a histogram of a set of arrays.

Python: cv2.calcHist (images, channels, mask, histSize, ranges [, hits[,accumulate]]) hist

3.2.4.3 Haralick Texture: Image texture is a quantification of the spatial variation of grey tone values. Haralick et al. suggested the use of gray level co-occurrence matrices. This method is based on the joint probability distributions of pairs of pixels.

Haralick's texture features were calculated using the kharalick() function of the cytometry tool box for Khoros.

Features are combined together

features = [fv_histogram, fv_haralick, fv_hu_moments]

3.3 Data Collection Procedure

We know various types of vegetables are found in many local markets. We used to go to many local markets and convinced the vegetable seller to take pictures of various local vegetables. We took different types of pictures of the vegetables. The raw images are different in size, shape and category with variation of color combination and textures. All the images are preprocessed to get them all in a suitable form of data.

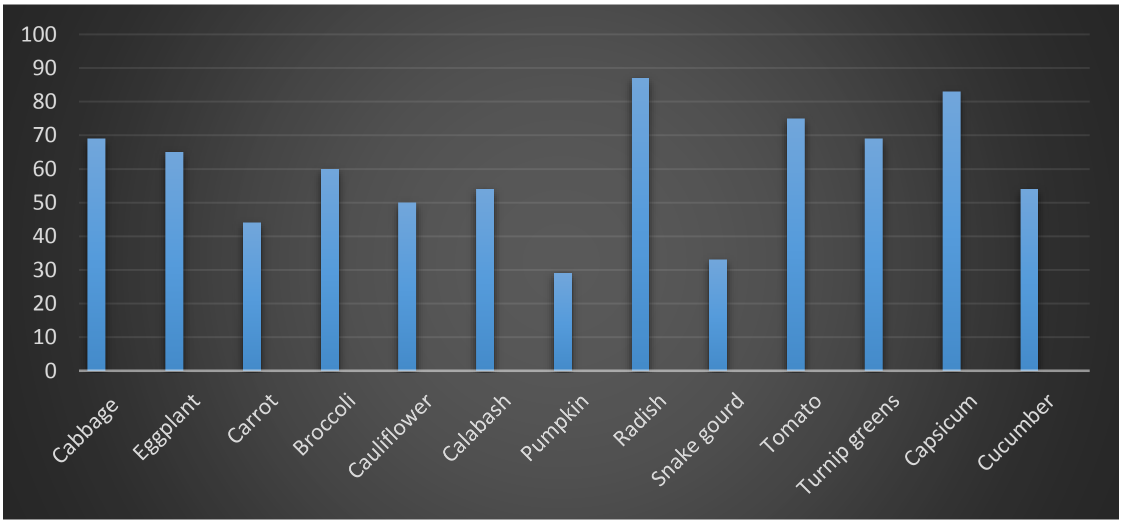

Figure 3.5: Collected Data Set

3.4 Statistical Analysis

As per the analysis of data, calculation of the accuracy of the proposed system is achieved 96%. To calculate that, some more attributes are extracted with the help of confusion matrix. For example, the confusion matrix of vegetable detection is given below.

```
confussion matrix:
[[12  0  0  0  0  0  0  0  0  0  0  0  0]
 [ 0 22  0  0  0  0  0  0  0  0  0  0  0]
 [ 0  0  9  0  0  0  0  2  0  0  0  0  0]
 [ 0  0  0 22  0  0  0  0  0  0  0  0  0]
 [ 0  0  0  0  7  0  0  0  0  0  0  4  0]
 [ 0  0  0  0  0 16  0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0 13  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0 15  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  7  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0 20  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0 10  0  0]
 [ 0  0  0  1  0  0  0  0  0  0  0 18  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0 16]]
```

Figure 3.6: Confusion Matrix

From confusion matrices for each classes F1 score, Recall and Precision are also calculated. They are-

F1 score = 96%

Recall = 97%

Precision = 96%

CHAPTER 4

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Introduction

To get final result, first the raw images were collected and captured from various local markets of vegetables. After pre-processing of data, the main trained dataset were prepared. Finally, the test image is compared with the dataset using Random Forest classifier and then show the final result.

4.2 Experimental Result

In this paper to demonstrate the detection of local vegetables the used domain are carrot, cabbage, broccoli, cauliflower, calabash, cucumber, eggplant, pumpkin, radish, snake gourd, tomato, turnip greens and capsicum. In our dataset around 577 images were used to detect local vegetables.

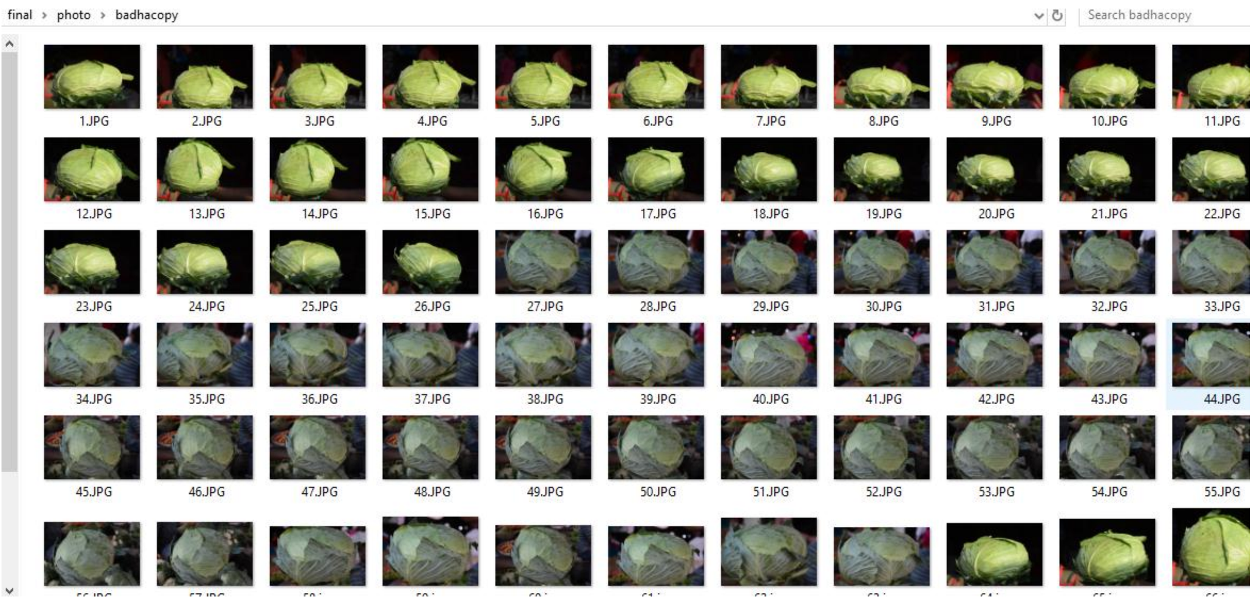

Figure 4.1: Images of Dataset Cabbage

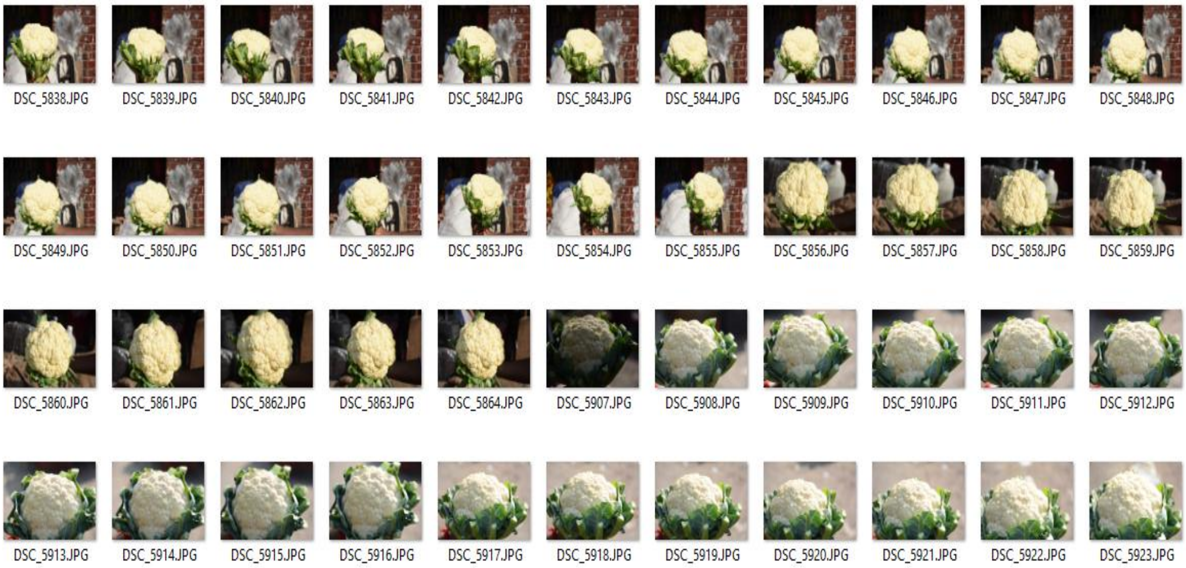

Figure 4.2: Images of Dataset Cauliflower

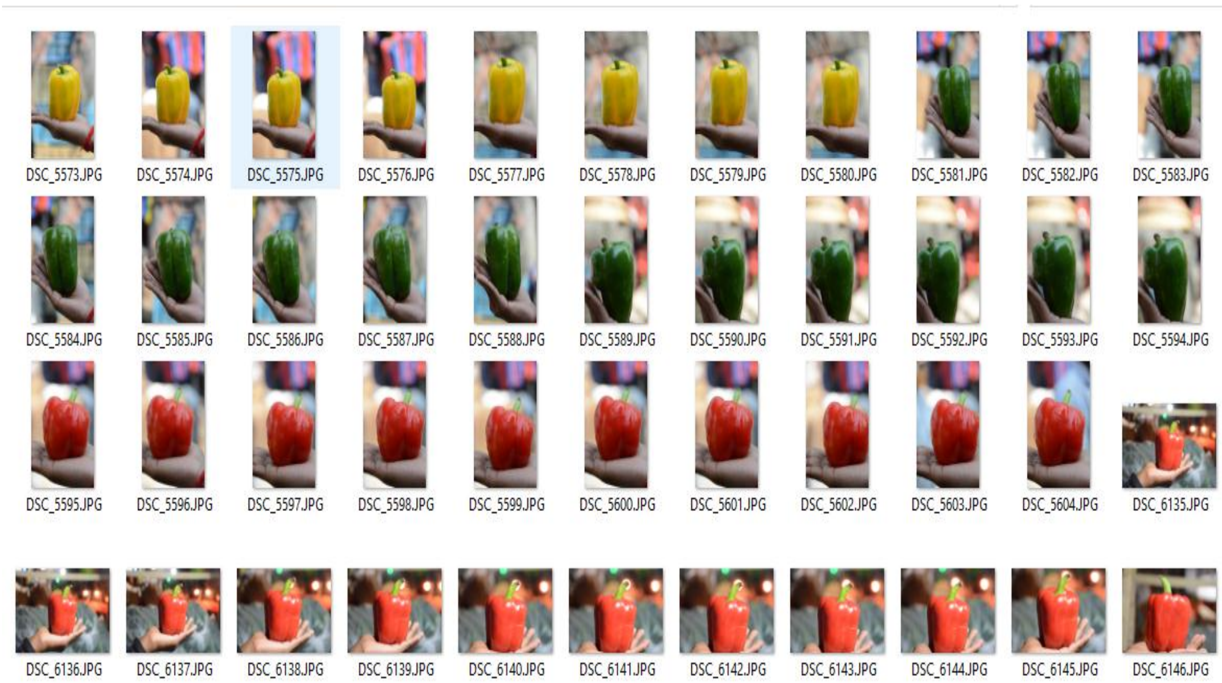

Figure 4.3: Images of Dataset Capsicum

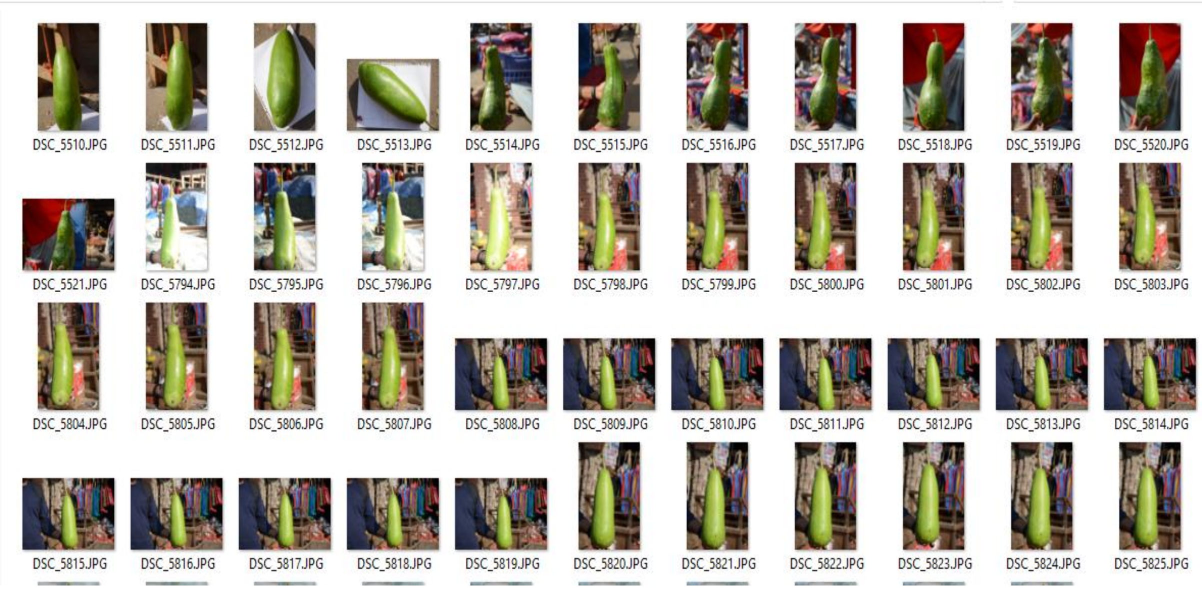

Figure 4.4: Images of Dataset Calabash

After image acquisition the pre-processing of those images were done. Then we train and labeling those datasets. After that feature extraction were done. Now here are some screenshot of the project step by step.

```
In [20]: #Label Encoding

         le = LabelEncoder()
         encoder=le.fit(labels)
         encoded_labels=encoder.transform(labels)

In [21]: print(len(set(labels)))

         13

In [22]: print(set(labels))

         {'Capsicum', 'Carrot', 'Calabash', 'Snakegourd', 'Cabbage', 'Radish', 'Pumpkin', 'Eggplant', 'Tomato', 'Turnip', 'Broccoli', 'C
         auliflower', 'Cucumber'}
```

Figure 4.5: Number of labels& labels name

```
In [27]: from sklearn.ensemble import RandomForestClassifier
         clf  = RandomForestClassifier(n_estimators=100, random_state=9)

         clf.fit(X_train, y_train)

Out[27]: RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
                     max_depth=None, max_features='auto', max_leaf_nodes=None,
                     min_impurity_decrease=0.0, min_impurity_split=None,
                     min_samples_leaf=1, min_samples_split=2,
                     min_weight_fraction_leaf=0.0, n_estimators=100, n_jobs=None,
                     oob_score=False, random_state=9, verbose=0, warm_start=False)
```

Figure 4.6: Using Random Forest classifier

```
Accuracy: 0.9639175257731959
F1 score: 0.9639175257731959
Recall: 0.9639175257731959
Precision: 0.9639175257731959

 clasification report:
               precision    recall  f1-score   support

    Broccoli       1.00      1.00      1.00        12
     Cabbage       1.00      1.00      1.00        22
    Calabash       1.00      0.82      0.90        11
    Capsicum       0.96      1.00      0.98        22
      Carrot       1.00      0.64      0.78        11
 Cauliflower       1.00      1.00      1.00        16
    Cucumber       1.00      1.00      1.00        13
    Eggplant       0.88      1.00      0.94        15
     Pumpkin       1.00      1.00      1.00         7
      Radish       1.00      1.00      1.00        20
  Snakegourd       1.00      1.00      1.00        10
      Tomato       0.82      0.95      0.88        19
      Turnip       1.00      1.00      1.00        16

   micro avg       0.96      0.96      0.96       194
   macro avg       0.97      0.95      0.96       194
weighted avg       0.97      0.96      0.96       194

 confussion matrix:
 [[12  0  0  0  0  0  0  0  0  0  0  0  0]
 [ 0 22  0  0  0  0  0  0  0  0  0  0  0]
 [ 0  0  9  0  0  0  0  2  0  0  0  0  0]
 [ 0  0  0 22  0  0  0  0  0  0  0  0  0]
 [ 0  0  0  0  7  0  0  0  0  0  0  4  0]
 [ 0  0  0  0  0 16  0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0 13  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0 15  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  7  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0 20  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0 10  0  0]
 [ 0  0  0  1  0  0  0  0  0  0  0 18  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0 16]]
```

Figure 4.7: Final Output of The Result

```
In [30]: len(X_train)
Out[30]: 580

In [31]: len(X_test)
Out[31]: 194
```

Figure 4.8: Number of trained data & test data

The accuracy of proposed system is 96% calculated with other features- F1 score 96%, Recall 97%, Precision 96%.

4.3 Performance analysis

Here we used Random Forest classifier algorithm to detect vegetables name. We also used HU moments, Color Histogram and Haralick Textures for extracting features of the datasets.

Finally, the predicted vegetable name is printed in the screen. Here is our confusion matrix below that we found in our result.

```
confussion matrix:
[[12  0  0  0  0  0  0  0  0  0  0  0  0]
 [ 0 22  0  0  0  0  0  0  0  0  0  0  0]
 [ 0  0  9  0  0  0  0  2  0  0  0  0  0]
 [ 0  0  0 22  0  0  0  0  0  0  0  0  0]
 [ 0  0  0  0  7  0  0  0  0  0  0  4  0]
 [ 0  0  0  0  0 16  0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0 13  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0 15  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  7  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0 20  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0 10  0  0]
 [ 0  0  0  1  0  0  0  0  0  0  0 18  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0 16]]
```

Figure 4.9: Confusion matrix

And we found the final result below.

```
clasification report:
              precision    recall  f1-score   support

    Broccoli       1.00      1.00      1.00        12
     Cabbage       1.00      1.00      1.00        22
    Calabash       1.00      0.82      0.90        11
    Capsicum       0.96      1.00      0.98        22
      Carrot       1.00      0.64      0.78        11
 Cauliflower       1.00      1.00      1.00        16
    Cucumber       1.00      1.00      1.00        13
    Eggplant       0.88      1.00      0.94        15
     Pumpkin       1.00      1.00      1.00         7
      Radish       1.00      1.00      1.00        20
  Snakegourd       1.00      1.00      1.00        10
      Tomato       0.82      0.95      0.88        19
      Turnip       1.00      1.00      1.00        16

   micro avg       0.96      0.96      0.96       194
   macro avg       0.97      0.95      0.96       194
weighted avg       0.97      0.96      0.96       194
```

Figure 4.10: Classification Report

4.4 Summary

Every year our country imports many vegetables from different countries especially from India. Day by day people of our country getting busy in their workplace. So, they can’t go to market and buy vegetables for their family. Even now a days they have no idea about local vegetables. They can’t tell most of the name of the vegetables. By using our method, they can easily know the name of the local vegetables. It will also helpful for the children to know about local vegetables.Also, this image processing technique help other developer to develop application over vegetable detection or disease detection of the vegetables. Our proposed method also help new developer to develop more application like this.

CHAPTER 5

CONCLUSIONS ANDFUTURE RESEARCH

5.1 Conclusions

In this work local vegetables are recognized through image processing techniques which can be used in different kind of applications to detect any vegetable or fruit which can open a door for helping people and children. The whole process is done with a 97% of accuracy using collected vegetables images in different angle. Though there are some problems while working for collecting image data of various vegetables. We try to overcome all the problem and develop the vegetable detection system. Using this techniques various fruit or vegetable can be detected and classified with a computer vision system.

5.2 Implication of further study

To make our life easier, gradually we are getting very much dependent on modern technologies where in our country, agriculture sector is far behind from using these technologies which can be a matter of affluence in a remarkable rate.The proposed system shows a new way to involve with the machine learning method which is able to detect the vegetables name. This approach can be implemented into any kind of mobile based application or web-based application to reach the people of our country. People sends the captured image from the local market and get the output on their hand in a second showing which vegetables that was. And this is our future plan to make an application which people can easily use to recognize local vegetables and fruits also.

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APPENDICES

Appendix A: Research Reflection

The purpose of this Appendix is to provide an introduction to Research refection. The group research project was a challenging and enjoyable experience typical of the course as a whole. We have had little exposer to group work at university. So, it was a nice change to be part of an effective and dynamic team.

The experience of our work taught us many things. In the beginning we were very much confused about our work. We change plan in many times. We go to village market for collecting data which was much enjoyable. We enjoyed a lot talking to the vegetable seller and local people. We think this research result help local people.

Appendix B: Related Issues

Collecting images from this kind of urban area like Dhaka was very difficult. We had to go to villages and markets for collecting data. We had to talk with the vegetable seller to understand them why we take pictures of those vegetables. Some seller didn’t give us permission to take pictures. So, we had to convince them.

We had to learn so many new algorithms and techniques to implement our ideas and research work to be effective. Variation of the image backgrounds and quality of the images were challenging to modify and reduce the changes in results hereby.

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