International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 - 5161

Available at http://inpressco.com/category/ijcet

Review Article

Review Paper on Vegetable Identification and Detection using Image Processing

Aashna Ahluwalia[Å*] and Ruhina Karani[Å]

[Å]Computer Department, DJSCOE, Vile-Parle (W), Mumbai – 400056, India

Accepted 20 Nov 2014, Available online 30 Dec 2014, **Vol.4, No.6 (Dec 2014)**

Abstract

This paper describes an on-going project that aims to develop a vegetable detection system based on computer vision to easily identify the vegetables. It is based on image processing, which can control the classification, qualification and segmentation of images and hence recognize the vegetable. The aim of the system to be designed is a vegetable identification system, which consists of three stages: capturing an image of all the vegetables placed together, feature extraction, and vegetable recognition. Usually from the captured images multiple recognition clues such as colour, shape, size, and texture are extracted and analyzed to classify and recognize the vegetables. After the matching of the vegetables has taken place successfully, we aim to implement a system which can suggest optimal recipes based on the identified vegetables.

Keywords: *Vegetable Detection; Computer Vision; Feature Extraction.*

1. Introduction

The Web has proved to be a rich and extraordinary medium where people are constantly connecting and sharing information worldwide. One of the widely searched topics over the Web includes cooking and searching for new and innovative recipes. This search of recipes and different ingredients is of immense use especially for modern day housewives and students who are keen to experiment and create new food dishes. Object recognition is an important task in image processing and computer vision which involves determining the identity of an object being observed in an input image. Detecting multiple objects from a single frame is a tedious task, which does not always provide accurate results. This is especially in the case of vegetables, where various vegetables have similar color, shape, size and texture. Despite intense research on vegetable recognition, it remains a very challenging task, mainly due to different varieties of every vegetable.

Initially to search for recipes, one had to either type the name of the dish or type all the ingredients they want to cook with. Thus, to save time and make this process simpler, we are working on a system to suggest recipes with just one click of the image instead of tedious and repetitive typing of information.

The implementation of a vegetable detection system is only possible if these few requirements are fulfilled. Firstly, it should require minimal user effort and different users must be able to use the system without difficulty. The system should be less complex and this would assist in controlling cost factor while implementing the project. The designed system should aim to be easily available to a wide range of users, and at a minimal cost . Hence this task of recognizing vegetables and further using our results for prediction of various food recipes is the basis of the project we aim to formulate.

Review of Literature

The two most important operations performed for vegetable detection are Image Segmentation and Edge Detection.The edge is known as the discontinuity in grey level values. It is the boundary between an object and the background. The structure of edges in images is dependent on many parameters: The object's geometrical and optical properties, its illumination conditions, and image noise levels (Md.Towhid Chowdhury *et al, 2013).*

One of the papers provides a complete subjective comparison of seven different edge detection algorithms which were implemented in C++ . The experiment also was able to further list the advantages and disadvantages of the discussed algorithms. Based on the above research Cannys edge detection algorithm suits the framework of our project. Canny's algorithm has an effective way of finding errors by using probability. The next advantage is improving the signal with respect to the noise ratio and this is established by Non-maxima suppression method as it results in one pixel wide ridges as the output. It is capable of better edge detection especially in noise state with the help of thresholding method. But the major setback while working with this algorithm is time consumption because of complex computation (Mohsen Sharifi *et al, 2002).*

Another paper reports techniques like histogram matching, clustering algorithms based image segmentation

*Corresponding author: **Aashna Ahluwalia**

and relative value of parameter based segmentation to detect the rate of ripeness of fruits and vegetables. Mainly two techniques are discussed, each using coloured images of fruits and vegetables as input data .In the first type of approach we try to develop regions until a homogeneity constrain is held. This development of region can be done with neighbouring pixels or by merging and splitting regions. And in the second type of approach we detect image discontinuities, so regions are limited by the pixels. By comparing the input data image with the threshold levels the experiment concluded the maturity level of given fruits and vegetables (Hridkamol Biswas *et al, 2013).*

Finally, the last paper reviewed completes the comparative analysis of various Image Edge Detection techniques presented and demonstrates that Canny's edge detection algorithm performs better than all operators (i.e. Marr Hilreth ,Robert, Prewitt and Sobel) under almost all scenarios(Rashmi *et al, 2013).*

Based on the evaluation of the above techniques, along with the other evaluations, we have decided to setup using a simple web camera and implement the Canny's Edge Detection Algorithm along with a suitable colour based image segmentation technique , the details of which are mentioned in the following section.

2. Methodology

2.1 Hardware baseline

The following hardware requirements form the basis of our future implementation of a vegetable identification system:

- A regular webcam: A webcam is a video camera that feeds or streams its image in real time to or through a computer to computer network. The image captured by the computer, may be saved at the server, viewed or sent on to other networks via systems such as the internet, and email as an attachment. Webcams have become an integral component of home computer setups due to easy availability of broadband Internet and advancements in internet based video communication tools, Moreover, high Internet speeds enabled the use of cameras with higher resolutions and better image qualities. A webcam is generally connected by a USB cable, or built into computer hardware of tablets or laptop computers. Webcams are known for their low manufacturing cost and flexibility hence can be the lowest cost form of video telephony. The appropriate positioning of this device, along with a high resolution will guarantee a clear result for image analysis and identification of object.
- A display: The display is an integral part of our analysis. Our intention is to follow a simple approach for display choice. It should be placed away from the tray of vegetables at a calculated distance, however in real world situations the distance is only limited by the camera's point-of-view. In order to minimise constraint to environment we have assumed in our setup is that the vegetable must be placed at a sufficient distance from the display so that it is in the field of view of the camera device.

2.2 Software baseline

Canny Edge Detection Algorithm

The Canny edge detection algorithm is known to many as the optimal edge detector. Canny intended to discover an algorithm that would satisfy the following constraints: good detection – the algorithm should mark as many real edges in the image as possible, good localization – edges marked should be as close as possible to the edge in the real image and minimal response – a given edge in the image should only be marked once and image noise should not create false edges, as far as possible. Canny used the calculus of variations to fulfill these requirements. The optimal function in Canny's detector is described by the sum of four exponential terms, and the first derivative of a Gaussian can be approximated by it. The first and most obvious advantage of using this algorithm is the low error rate. The importance of edges occurring in images should not be missed and that there will be no responses to non-edges. The next criteria are the edge points should be well localized. It means that the distance between the edge pixels as found by the detector and the actual edge is to be at a minimum. Lastly, it has improved signal to noise ratio and hence better detection especially in noise conditions. But the complex computations involved make the implementation extremely time consuming (Rashmi *et al, 2013).*

3. Parameters of Vegetable Classification

Recognition parameters such as color and texture are extracted and analysed to classify and recognize the vegetables detected after the image detection and segmentation has taken place.

3.1 Classification based on colour

For human beings, one of the most important descriptors of the world around us is color. The human visual system is particularly attuned to two things, color and edge. We know that the human visual system is not particularly good at recognizing subtle changes in grey values, and color is perceived as being made up of varying amounts of red, green and blue. That is, human vision is particularly sensitive to these colors. Any single method cannot solve any recognition problem completely hence various classification techniques. Sometimes image processing technology uses color to simplify a monochrome problem by improving contrast or separation or removing noise, blur etc. To avoid the illumination effects we must convert the image to HSV model. The histogram of captured image is calculated in order to compare it with stored histograms of learnt images. Next, specific class properties are defined according to feature and a different class of database is created. Then the system starts comparison with the input images to test and see which class it fits, till best match is found (Md.Towhid Chowdhury *et al, 2013).*

3.2 Texture based Classification

An image texture is a set of metrics calculated in image processing designed to for perceived texture of image

quantification. Image Texture provides information about the spacing of color or intensities within selected region of a picture. This attribute can be used to classify images in computer graphics, using two ways, Structured Approach and Statistical Approach. Texture Segmentation is the use of image texture to divide regions into segments. There are mainly two approaches of segmentation based on image texture, region based and boundary based. Segmenting the image based on texture is not a perfect technique but can be used along with color parameters for enhanced results. Future trials are being made to group or cluster pixels based on texture properties together (Md.Towhid Chowdhury *et al, 2013).*

3.3 Camera Parameters

These parameters include resolution, position and lighting conditions of the camera device currently in use. The camera resolution must be chosen effectively to detect correctly and within minimum cost. The next important parameter is the camera position: The camera must be placed at an appropriate distance from the vegetable and positioned at a suitable angle to obtain a clear field of view. The distance of the camera from the vegetable position is very crucial for eye detection. Easier and more accurate detection can be obtained by reducing the distance. The aim is to create a model which is minimally affected by these factors.

4. Discussion

We intend to develop a vegetable vision system that uses a webcam device and colored images. A special purpose imaging setup with controlled lighting allows very precise segmentation of the desired item from the background. Recognition clues such as texture and color are extracted from segmented images. Being a complex process,image processing, system may not achieve 100% correct recognition, keeping this in mind, from the outset, user interface will be designed accordingly. Presently, texture and color are best developed features, and the ones that contribute most to reliable recognition. Color provides valuable information in estimating the maturity and examining the freshness of vegetables. Using color alone, quite respectable classification results are achieved. Results can be further improved by adding texture, in the range of 15 -20%. Features such as shape and size can augment the feature set to improve classification results.

Conclusion and Future Works

Image processing and analysis cannot guarantee an accurate result. But by adhering to precautions, an optimal result in detection of vegetables is achievable. Every vegetable is uniquely distinct and needs to be classified based on the colour and texture. The optimality of the output will also depend on the image quality and angle of the photograph taken.

In future, we plan on implementing a vegetable detection system based on computer vision using the above researches so that we can make this system easily available and at a minimum cost to its users.

Acknowledgements

We have great pleasure in presenting this review paper on "Vegetable Identification and Detection using Image Processing". We take this opportunity to thank all those who have contributed in successful completion of this report.

We wish to express sincere thanks and deep sense of gratitude to respected mentor Asst. Prof. Ruhina Karani**,** in Computer Engineering department of D.J. Sanghvi College of Engineering, for her support with all of her kindness. We are also thankful to our parents for their continuous encouragement to pursue higher studies and our friends for the help and support they provided.

References

Md.Towhid Chowdhury**,** Md.Shariful Alam, Muhammad Asiful Hasan,Md.Imran Khan (2013) **,**Vegetables detection from the glossary shop for the blind,.*IOSR Journal of Electrical and Electronics Engineering* (*IOSR-JEEE)*

Hridkamol Biswas,Faisal Hossain (2013) ,Automatic Vegetable Recognition , *http:/ /ijesi.org/papers/ Vol%202(4)/Version-3/F243741.pdf*

Mohsen Sharifi, Mahmoud Fathy, Maryam Tayefeh Mahmoudi (2002),A Classified and Comparative Study of Edge Detection Algorithms, *Information Technology: Coding and Computing, Department of Computer Engineering,Iran University of Science and Technology,Narmak, Tehran-16844, IRAN*.

Rashmi ,Mukesh Kumar, Rohini Saxena,(2013),Algorithm and technique on various edge detection: A Survey, *An International Journal (SIPIJ) Vol.4, No.3*.