

Image Processing in Food Processing and Agriculture

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SUMMARY

The recent advances in sensors quality and processing power give us with outstanding tools for designing more difficult image processing. Images are a very important source of data and information in the agriculture sector. The use of image processing techniques has excellent applications for the analysis of agricultural operations. Fruit and vegetable classification is one of the major applications that can be used in supermarkets to automatically identify the kinds of fruits or vegetables purchased by customers and to determine the appropriate price for the produce. In this article, we review the present applications of image processing in food processing and agriculture.

INTRODUCTION

Image processing has been verified to be an effective tool for analysis in various fields and applications. From the farmers' point of view, in the agriculture sector, the characteristics like a canopy, yield, and quality of the product were the main measures for plants. Many times expert advice may not be inexpensive, and most of the time the presence of experts and their services may consume time. Image processing lengthwise with the accessibility of communication networks can variation the situation of getting expert advice well within the time since image processing was an effective tool for analysis of parameters. This article aims to focus on the analysis of the application of image processing in the agriculture field and food processing such as chemical analysis of food products, imaging techniques, plant disease detection, weed detection, and fruit grading. The application of image processing can improve decision-making for vegetation measurement, irrigation, food product analysis, fruit sorting, etc.

The external look of fruits is an important marketing and sale importance. Consumers tend to acquaint required internal quality with external aspects. Computer vision has been successfully dragged in tasks such as variety and shape classification, fault detection, and quality grading.

Precision agriculture was the latest and most innovative technology which tends to integrate advanced techniques to increase farm output and also enhance the farm inputs in a profitable and environmentally sensible manner. Plant growth, Irrigation stress, Fertilizers, pesticides, and quality of yield were the main factors of concern in agriculture. Maximum times the expertise was essential to evaluate the difficulties and which may be time consuming and costlier issue in evolving countries. Image processing was one of the technologies which can be applied to evaluate the parameters related to agronomy. Applications of image processing in agriculture can be broadly classified into two categories: the first depends upon the imaging techniques and the second one is based on applications.

What is image processing?

An image is an array, or a matrix, of square pixels (picture elements) prepared in columns and rows. The former is the color feature while features extracted from the latter are known as size or shape features. Pixels are simple parts of images. Two kinds of data are contained in each pixel, i.e. brightness value and positions in the coordinates that are assigned to the images. This system plays a major role in the food quality evaluation by keeping accuracy and consistency whereas eliminating the subjectivity of manual inspections. They give flexibility in use and can be reasonable alternatives for human visual decision-making methods.

Preprocessing:

Preprocessing is the stage preceding the extraction of characteristics, which aims at improving the acquired image and highlighting the features or regions of interest, thus removing distortions and noise while not adding further information to its content.

Image Processing Workflow:

Image Acquisition:

It is an initial step for image processing, Image Acquisition is nothing but retrieving an image by a source like a Camera, sensors, etc. This captured image is used as input for the further process.

Segmentation:

Segmentation is nothing but the process of dividing the input image into the subgroups, from the first step the captured image is divided into subgroups and this subgroup helps to reduce the complexity of the image. The segmentation process can be based on the similarity of the color of each pixel and its neighboring pixels

Feature extraction:

This is the process of reducing the number of input variables when developing a productive model. It helps to reduce computation costs and improve the performance of the model.

The extraction of parameters enables the association between regions of the image and objects in the scene (Gonzalez RC., 2009). After these stages, the image should be ready for the extraction of important characteristics.

Edge Detection:

It is a part of image segmentation, Edge detection is a technique of finding boundaries of an object in the given image, and it makes changes in image brightness.

Identification of Objects:

Object identification is a computer vision technique used to identify the object in the given image. An identified object from an image is called output.

The final stage of processing aims to recognize and interpret the images, seeking to make sense of the set of objects of the image, with the goal of improving human visualization and the automatic perception of data in a computer. The detailed procedure for analysis of image processing is shown in Fig 1.

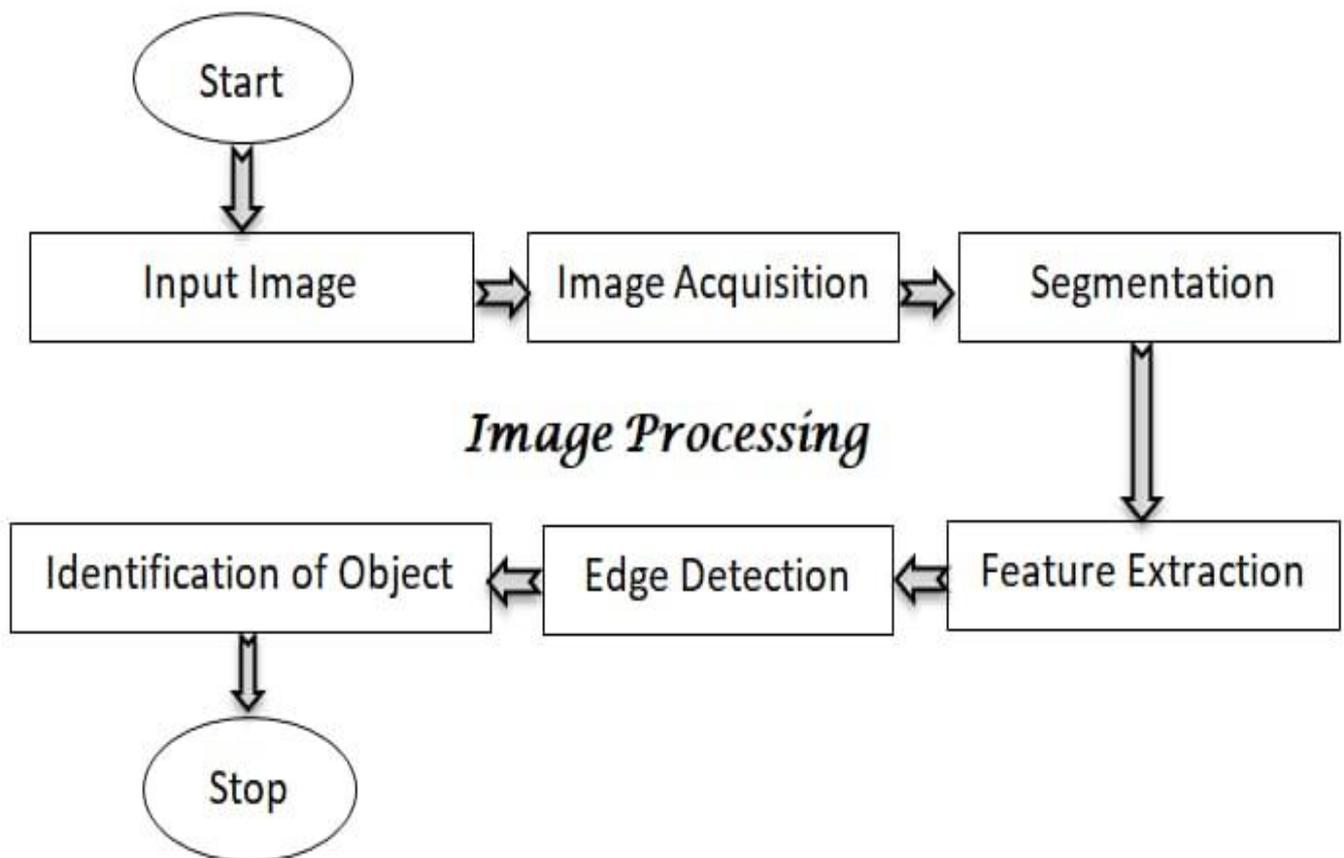


Figure 1: Flowchart of Image Processing

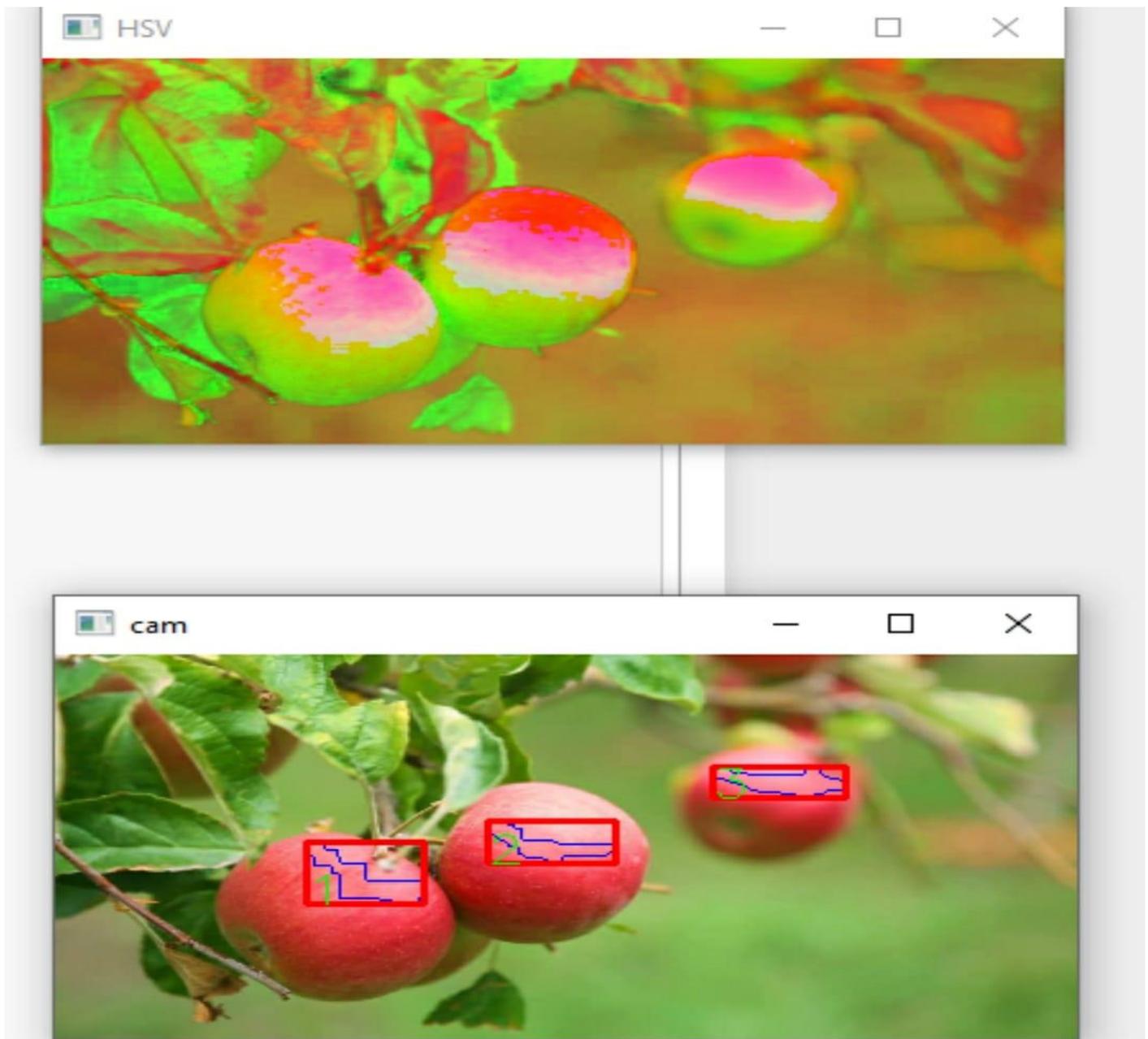


Figure 2: Image processing of Fruits

Applications based on image processing techniques in food processing and agriculture

1. Application in weed detection

Weeds were the plants growing in the incorrect place on the farm which enters with the crop for water, light, nutrients, and space. Because of this reduction in yield and effective use of machinery is occurred. Weed resistor was mainly from an agriculture point of view; so many researchers developed various methods based on image processing. Weed detection methods used algorithms based on edge detection, and color detection.

2. Application in fruit/food grading

Image processing in agriculture and food industries has been useful in the areas of grading, sorting of fresh products, and also the detection of defects such as dark spots, cracks, and bruises on fresh fruits and seeds, etc. Image processing concepts are related to grading bakery products, fruits, vegetables, and grains.

3. Application in the food industry

Image processing methods are used in the food industry for sorting and for quality inspection. The appearance of bakery products is an important quality attribute, which together with the product flavor significantly influences the purchase potential of the product by consumers.

CONCLUSION

The image processing method was proved as an effective machine vision system for agriculture. Weed classification which disturbs the yield can be correctly categorized with the image processing algorithms. The accuracy of classification varies from 85% to 96% depending on the algorithms and limitations of image acquisition. Thus, with such great precise classification farmers can relate herbicides to incorrect forms. This method supports saving the environment as well as the overall cost. In the case of fruit grading systems, the classification accuracy can be obtained up to 96% with correct imaging techniques and algorithms. Thus we can conclude that image processing was a non-invasive and active tool that can be applied to the agriculture domain with great accuracy for the analysis of agronomic parameters.

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