Detection of Red Ripe Tomatoes on Plants using Image Processing Techniques

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Abstract

- Tomatoes are well-known grown fruit in farming and cultivation of tomatoes has greatly increased in past few years. It is necessary to develop an algorithm to differentiate red ripe tomatoes because of tomato fruit does not ripe simultaneously.
- This poster presents a method based on image processing techniques to recognize ripen tomato from others. According to the experimental results, proposed methodology shows encouraging accuracy (87%) for detecting the red ripen tomato.

Introduction

- Tomatoes are world wide popular fruit and cultivate mainly in green houses. Nowadays, high labour cost is needed to increase the size of the greenhouse and it's extremely time consuming process.
- Based on the Figure 1, colour is a most important and effective feature to identify the tomato quality.

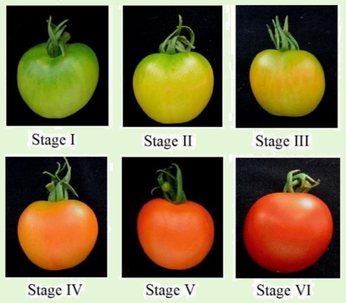

Figure 1: Different stages of tomato ripening

- Several features such as RGB model [1] and colour based algorithm [2] are used to recognize the fruits in the state-of-the-art methods.
- The main goal of this poster is to develop an algorithm to differentiate the red ripen tomatoes from the others.

Methodology

- The diagrammatic representation of the proposed methodology is given in Figure 2. It describes the steps that were involved in this research.

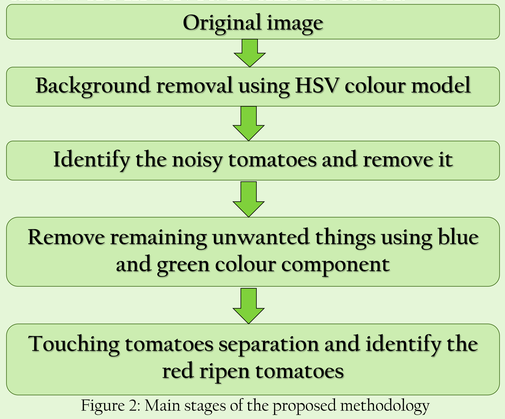

Figure 2: Main stages of the proposed methodology

- Ripen tomato can be determined by its colour and the colour of a ripen tomato region is defined as at least 95 percentage red colour value of the whole image.
- First of all, the proposed algorithm blurred the original image using Gaussian blur. So, neighbouring pixels become a little more uniform in colour, so it will ease brighter and darker spots on the image and keep holes out of the mask. Then, HSV colour model is applied to segment similar colour objects using H components of the HSV colour space.
- Then, common morphology operators are applied with a structuring element in order to remove the noises. In order to find out the red region parts only in the image, bitwise operation is carried out between the resultant image and original image.
- Finally, blue and green components are subtracted from the resultant image in order to remove background noises.
- It is a very challenging task to separate touching tomatoes and recognize red tomatoes from non-red ones. Next step of this proposed methodology is separating touching tomatoes and then identify red tomatoes from the non-red ones.
- Watershed algorithm is used to segment and Euclidean Distance Transform is computed. Here, closest foreground pixels are computed and distance map is generated. After identifying the contours, largest contour represent boundary of a given object in the image. Finally, put a circle surrounding the object for a given the contour of the object. To extract the individual objects, bitwise operation is applied.
- Also, Figure 3 describes the main steps of this proposed methodology.

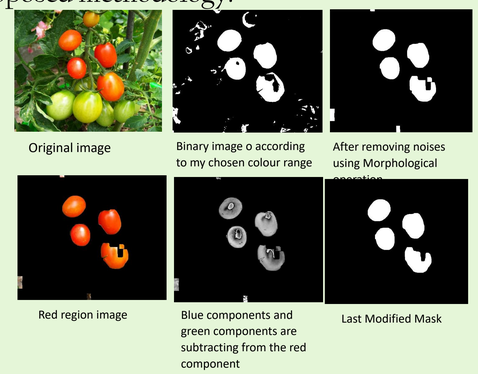

Figure3: Diagrammatic representation of proposed methodology

Dataset

- In this experiment, 100 images are collected from different sources and each images are captured by camera with 16 mega pixel on natural light condition. Single tomatoes, ripe tomatoes, non-ripe tomatoes and touching tomatoes are included in this collected dataset.
- For each image, total number of ripen tomatoes, non-ripen tomatoes and touching tomatoes are recorded in this dataset.
- Figure 4 shows some sample images from this dataset.

Figure 4: Some sample images from the collected dataset

Experimental Design and Testing Results

- Proposed methodology is applied to detect the ripen tomato and then circles are placed on the region of interest. Finally, count the total number of circles in the image and checked with dataset information.
- Based on our testing results, 87 images are correctly classified out of 100 images.
- The Figure5 shows some sample output images from this experimental design.
- **According to the experimental results, proposed methodology shows encouraging accuracy (87%) for red ripen tomato detection.**

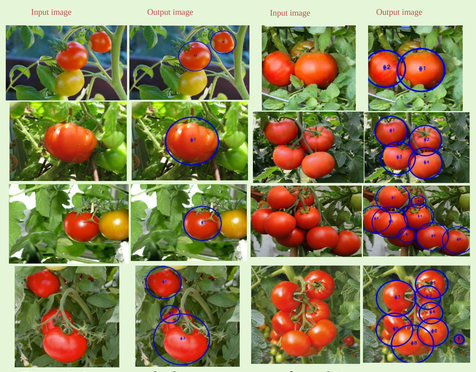

Figure 5: Some sample detection outputs for red ripen tomatoes

Conclusion

- In this poster, a method for detecting red ripen tomato is described.
- Our future work is mainly focused on to develop an algorithm to check whether the picked tomato is good or damage.

References

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