Digital Image Processing Final Report

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Abstract

This is a final report of *Digital Image Processing(G010301000)* in *Harbin Institute of Technology*. It provides a method to detect edge in an image, which gives an answer to question 3 in final examination. The methods contains three parts.

Contents

1. Question Description

In question 3 we are required to detect the edges of real apples in an image, which shows as Figure 1.

2. Methods Description

2.1. Image Enhancement

It's easy for us to process it when using `RGB` model represent images. `RGB` model, which means **R**ed, **G**reen and **B**lue components, could be processed individually. So we adjust Green component intensity first and convert it to grayscale image.

Figure 1. Orginal Image

2.1.1. Intensity Adjacent

To enhance origin image we need enhance some color and lessen others. In this image green and its similar components which represent target objects play massively important roles in edge detection, so we'd better adjust the intensity of it using color transformations: we increase its intensity by 10% to correct image to make green components distinguished.

2.1.2. Gray Processing

Grayscale image is more easy than color image in further processing. To convert a color image into grayscale one green component is chosen to split color channel and obtain grayscale image.

After gray processing it's necessary to enhance contrast. Calculate image histogram and a suitable function will take care of it.

2.2. Segmentation

2.2.1. Laplacian Detection

To detect edge we plan to partition the pixels of an image into groups that strongly correlate with objects, in this image it's real apple. We found in Figure 1 most lines are curve so some technical such as masks design for straight cannot work.

It's known that any edge is a set of connected pixels that lie on the boundary between two regions, so after image enhancement it's not very difficult for us to use some detection algorithms such as Laplacian edge detection.

2.2.2. Combiner with Image Smoothing

In detection the problems that detail are too much always arise and influence the results. To overcome this we believe image smoothing makes sense. We choose Laplacian of Gaussian filter, which uses the Gaussian for noise removal and the Laplacian for edge detection. The matrix likes this:

$$\begin{pmatrix} 0 & 0 & -1 & 0 & 0 \\ 0 & -1 & -2 & -1 & 0 \\ -1 & -2 & 16 & -2 & -1 \\ 0 & 0 & -1 & 0 & 0 \\ 0 & -1 & -2 & -1 & 0 \end{pmatrix}$$

2.3. Contrast stretching

In this step we calculate image histogram again and choose a equalization function to fix the image for better observation.

3. limitation

The effect of our method depends largely on image quality and complexity. For example the logo on real apples is difficult to recognize in final results. It needs more scientific methods such as pattern recognition and machine learning to combine with.