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Translation of Image Edge Detection Based on Python

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Abstract. Matlab software is often used in image processing, with the development of science and technology, a lot of data to be efficient and real-time processing is valued. Python as a new interpretation scripting language, the program is simple, easy to understand, and maintain real-time processing. Using python in image processing, can well keep the requirements of the designer, because of the open and free program, reduce the difficulty of programming, and enhance the interest of programmers. In this paper, through the comparison between canny operators, Sobel operator, lapla operator in image processing, the simulation results verify that the canny operator has good detection effect. The simulation results show the advantages of python, is suitable for the use in image processing.

1. Introduction

In the 21st century, car ownership increased dramatically. In order to reduce the occurrence of traffic accidents, we need to use high-tech to complete, but the image processing in which plays a vital role [1]. Image processing requires a lot of matrix operations, the use of computer equipment need to use programming language to carry out, such as C language or VHDL and so on. These language code is long and running fast, however, there are high threshold, learning process is relatively slow and other shortcomings for student. In the display of learning, we need a language that can improve the efficiency of learning and reduce the difficulty of development of the language [2].

Python is an interpreter, object-oriented, dynamic advanced programming language, with simple, easy to read and scalable features. It has become one of the most popular programming language. Many scientific research institutions and well-known universities have begun to use Python as a programming language [3]. The Python language provides many free, open source packages, such as the Video Capture library, the PIL library, and the pytesser Library in image processing, which leave an initial impression on researchers. The Scikit Learn projection has become a simple and efficient data mining and data analysis tool by virtue of generality and open source, built on the basis of Numpy, Scipy and Matplotlib [4]. Numpy is equivalent to Matlab, which provides solutions to matrices, linear algebra, Fourier transforms, etc., and also contains FORTRAN code sets, C++ code sets [3]. Two free function packages, Scipy and Matplotlib, provide numerical and graphical capabilities for Python respectively. Although Python is flexible and widely used, edge detection is seldom used in image processing [5]. This paper mainly uses Open CV to complete the simulation [6].



2. Edge Detection Principle

Edge detection is important in the image preprocessing, and the purpose is to detect the image in the brightness of the object edge. The edge direction of the image is different, the amplitude of the change is also different, the horizontal pixel value changes very slowly, and in the vertical direction of the transformation is more intense, so the first or second order differential operator on the image of the object edge detection.

Edge is the most obvious change of gray level on the image. Edge detection uses this feature to locate the edge pixels of each pixel of the image by differential or two order differentiation. According to the gray values of adjacent areas, the edge types can be divided into three steps: ladder shape, pulse shape and roof shape. For the ladder shape, the image edge points correspond to the peak values of the first order differential image and the zero crossing of the two order differential image; For pulse like and roof like edges, the edge points correspond to the zero crossing of first derivative and the peak of the two derivative.

3. Algorithm

3.1. Canny Operator

Canny operator edge detection is a multi-level differential edge detection algorithm, which is a good tradeoff between image filtering and edge detection.

The Canny operator edge detection operator satisfies the following three criteria:

- (1) Signal to noise ratio criterion
- (2) Location accuracy criteria
- (3) Single edge response criterion

Canny is the best operator for detecting step edges. The design process is as follows:

- (1) First, the Gauss filter is used to smooth the image
- (2) Differential operators are used to calculate the magnitude and direction of the gradient
- (3) Non maximum suppression of the gradient amplitude
- (4) Double threshold algorithm is used to detect and connect edges

3.2. Sobel operator

Sobel edge detection algorithm is based on first order differential edge extraction algorithm. The gradient is a measure of the function, and an image can be seen as the image gray continuous function of the sampling point array. Therefore, the significant changes of image gray values can be detected by the gradient discrete approximation function.

The Sobel differential operator is an omnidirectional differential operator under odd number size templates:

$$G_x = [f(i+1, j-1) + 2f(i+1, j) + f(i+1, j+1)] - [f(i-1, j-1) + 2f(i-1, j) + f(i-1, j+1)] \quad (1)$$

$$G_y = [f(i-1, j+1) + 2f(i, j+1) + f(i+1, j+1)] - [f(i-1, j-1) + 2f(i, j-1) + f(i+1, j-1)] \quad (2)$$

The Sobel operator introduces weighted local averaging factor, so it can smooth the noise in the image; Since it is separated by two rows or two rows of pixels, the part of the false edge is removed and the actual edge is smoothed. Therefore, the elements on both sides of the edge are enhanced, and the edge is widened, at least two pixels.

3.3. Laplacian operator

Laplace is a two order operator edge detection method. Its principle is that: the formation of slow gray edge through differential operators form a unimodal function, the peak position corresponding to the edge points; differential of unimodal function, differential is at the peak value of 0, the peak phase and

the corresponding symbols on both sides, the extreme points of the original two the zero order differential, by detecting the zero crossing point can be extracted from the image edge.

In the practical application, in order to eliminate the influence of noise, firstly, the Gauss function is used to filter the image, and then the two derivative of the filtered image is calculated, so $\nabla^2[G(x,y)*f(x,y)]$. Among them, $f(x, y)$ is the image, $G(x, y)$ is the Gauss function, The nature of order by convolution and differential exchange: $\nabla^2[G(x,y)*f(x,y)] = \nabla^2G(x,y)*f(x,y)$, $\nabla^2G(x,y)$ is Laplace Gauss operator.

4. Simulation Result

Canny operator simulation



Figure 1. Artwork master



Figure 2. Inspection chart

Sobel operator simulation



Figure 3. x direction

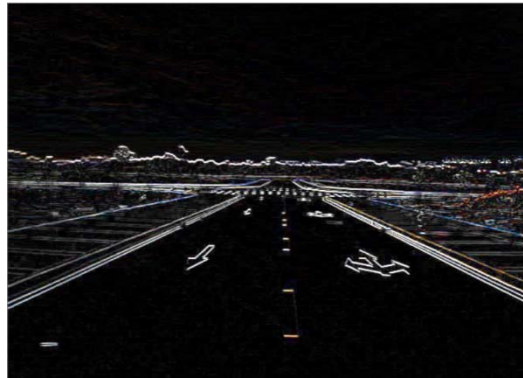


Figure 4. y direction



Figure 5. Sobel inspection chart

Laplacian operator simulation



Figure 6. Inspection chart

5. Conclusion

Seen from the application of Python in image edge detection processing can: Python language programming is simple, easy to understand and verify the Canny operator edge detection has good detection effect is good, very good for us to learn Python language.

Python language and its function library is free, open source is more likely to cause us to learn the language of the python, especially opencv, can c++, call the opencv MATLAB to complete image processing. Because in the c++ programming language is too long, the efficiency is slow in MATLAB, so in the python programming language is short efficiency, faster, with both advantages of Python language and its function library for use in image processing, to promote the research process.

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