COMPARATIVE TESTING METHOD OF EDGE DETECTION ON GERMINATED PARBOILED RICE (HANG RICE)

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ABSTRACT

This paper studies using CNN Model for edge detection. The process of edge detection is unavoidable in many image processing tasks such as retina detection, car detection, obstacle detection and other picture processing. In traditional edge detection, such as Sobel operator, Robert Operator, Canny Operator and LoG operator, the edge quality is relatively low. Therefore, the CNN Model was used to detect the edges of germinated parboiled rice (Hang rice). The results of the image are sharp, reduce noise, clear.

KEYWORDS: CNN Model, edge detection, Sobel oprator, Robert Operator, Canny Operator

1. Introduction

Detecting the edges of the image to find the contour of the object is an important part of the image processing, image analysis and Image recognition. Especially in the field of visual inspection and image separation, the image we have is different. Edge detection is the process of finding the discontinuity of image clarity. These discontinuities come from different scene characteristics, such as depth, surface orientation and material properties, and lighting patterns in scenes. [1] There are several ways to find image edges, such as Roberts, Sobel, and Canny [2-8]. The most common technique used is the first two operators. The first is called a gradient filter and the second derivative is called the Laplacien. Laplacien is very sensitive to noise interference because of the second derivative for image enhancement. Most traditional methods for detecting edge images depend on the pixels of the original image that goes to operators with gradient operators, Laplacian of Gaussian.)LOG Operator [9](and the basics of edge detection are based on gradient methods such as Roberts, Sobel, and Canny.

In traditional edge detection, image quality is relatively low with image noise. The CNN Model has been used to detect edges to obtain higher quality images reducing image noise.

2. Principle of edge detection

There are different types of edge detectors:

2.1 Sobel Edge Detectors

Sobel is a method of discrete derivatives and calculates the estimated value of the gradient of the image intensity function. The Sobel operator is a convolution image with a filter in the horizontal and vertical directions. This is composed of the gradient of two function variables the vector of two dimensions acting on each pixel. The composition is determined by the derivative. In the horizontal direction Gx and vertical Gy the value of the gradient vector in the position of the highest intensity is possible, as shown in figure 1 [8].

Gx

-1	0	1
-2	0	2
-1	0	1

Gy

-1	-2	-1
0	0	0
1	2	1

Figure 1 Sobel gradient operation 2-D masks

The general equation for the Sobel detector is [8]

$$G = \sqrt{G_x^2+G_y^2} \quad (1)$$

2.2 Robert Edge Detectors

Robert's operator is to find the edge using Robert's approximation for the derivative. Roberts will find the gradient value in the diagonal of 45 degrees and inverse. There are 2x2 filters. The general equation for the Robert detector is shown in figure 2 [8].

Gx

-1	0
0	1

Gy

0	-1
1	0

Figure 2 Roberts gradient operation 2-D masks [8]

2.3 Laplacian of Gaussian (LoG) [8]

Laplacian has 3 main steps: image filtering, image quality improvement, and edge detection. Laplacian is often used for smoothing images. Laplacian is using a Gaussian smoothing filter to reduce image noise of gray level the same way as a feeder to the operator and produce a gray image scale as an output.

2.4 Canny Edge Detector

Canny operator is the method to find the images edge using multiple methods to detect the extent of the edges of the image. The objective of Canny is to detect the edge of the image, correctly marking the edge of the picture appropriately in the possible correct position. The edge marks are as close as possible to the edges real of the image and have the lowest response. The edges of the image will be marked only once and the noise in the image will not create an artificial border. The canny method finds the edges of the image by locating the maximum area of the image gradient. Gradient is calculated using Gaussian filter derivatives. This method will give a 2-threshold value to detect the dark edges of the image and faint. It has a faint edge image in the output image.

3. CNN Model Method [10]

The CNN Method is a class of differential condition that has been known to have numerous application territories and high operational speed. The CNN model show was adjusted by utilizing hyperbolic digression (tanh x) and Von Neumann Neighborhood [10] as shown in equation 2.

The CNN Method clearly created the ideal edge delineate that are one-pixel wide and unbroken. The false caution rate of clamor fluctuation likelihood ($P_F(\sigma^2)$) for which an edge locator can be without much of a stretch pronounce an edge pixel, given that there is no

edge. The CNN parameters can be balanced and demonstrated to fathom Halfway differential conditions and most extreme probability issues for edge discovery.

The CNN parameters can be balanced and displayed to fathom fractional differential conditions and greatest probability issues for edge discovery. The state conditions of our CNN show an arrangement of privately associated normal differential conditions which can be considered as a spatially discretized portrayal of a given Incomplete differential condition (PDE) where the capacities must be picked fittingly. The CNN condition has the accompanying condition.

$$\tanh x = \frac{\sinh x}{\cosh x}, \tanh x = \frac{(e^{x}-e^{x})\div 2}{(e^{x}-e^{x})\div 2}, \tanh x = \frac{e^{x}-e^{-x}}{2} x \frac{2}{e^{x}+e^{-x}},$$

$$\tanh x = \frac{e^{x}-e^{-x}}{e^{x}+e^{-x}} \quad (2)$$

Inf(tanh x) = -1, sup(tanh x)=+1 implies full controllability and continuity of the model

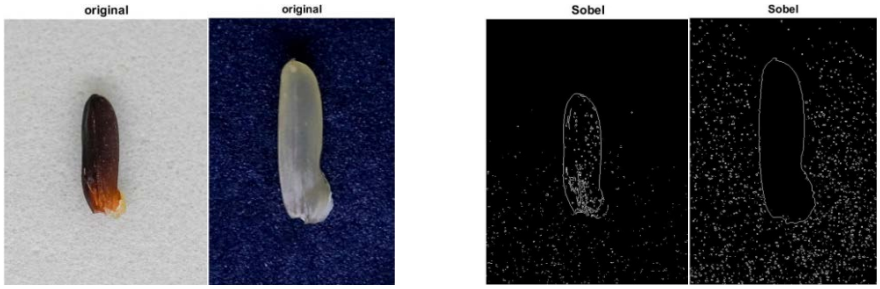
4. Experiments

This paper is one way doing all the ways in image processing including five methods of Sobel, Robert, LoG, canny and CNN algorithms. To compare the different ways in edge detectors, the one which works better under different conditions should be investigated.

Experiments were carried out over 400 X 640 sizes of standard test images. Edge detection methods like Roberts's operators, Sobel operator, LoG operator, Canny operator and CNN operators have been implemented on standard test image.

4.1 Comparison

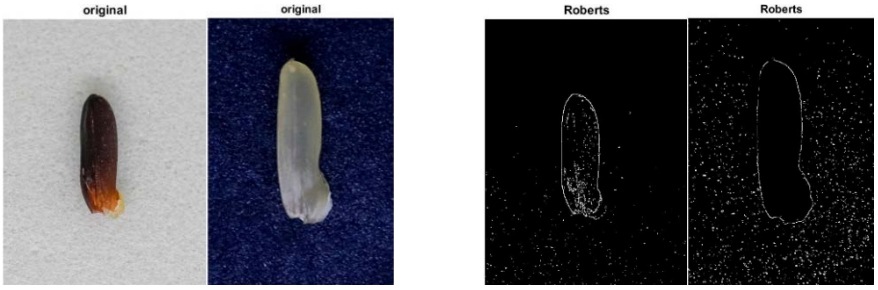
4.1.1 The result of Sobel method:



a) Original image b) Sobel method, threshold=0.05

Figure 3 a) Original Image b) Edge Detection in Sobel Method

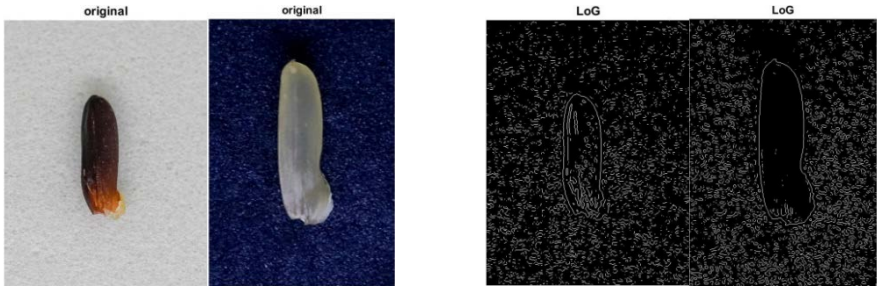
4.1.2 The result of Roberts method:



a) Original image b) Robert method, threshold=0.05

Figure 4 a) Original Image b) Edge Detection in Roberts Method

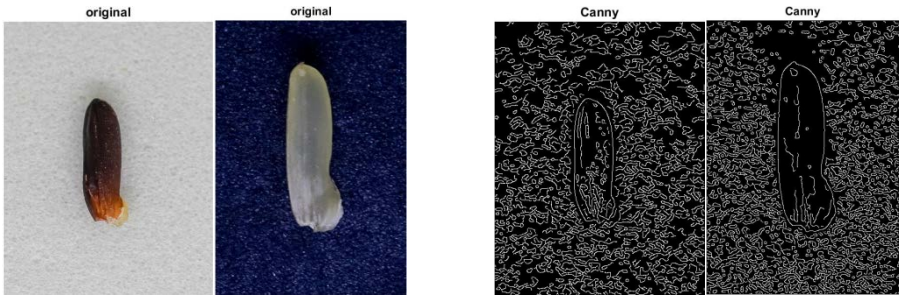
4.1.3 The result of LoG method:



a) Original image b) LoG method, threshold=0.05, sigma=2.5

Figure 5 a) Original Image b) Edge Detection in LoG method

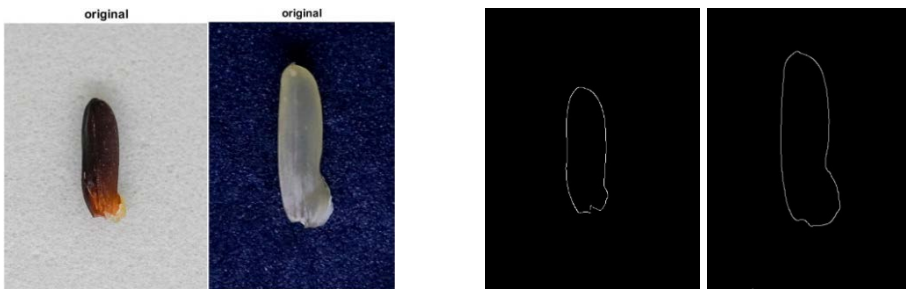
4.1.4 The result of Canny method:



a) Original image b) Canny method, threshold=0.05, sigma=2.5

Figure 6 a) Original Image b) Edge Detection in Canny method

4.1.5 The result of CNN method:



a) Original image b) CNN method

Figure 7 a) Original Image b) Edge Detection in CNN method

The results show that CNN gives better results than other methods such as Roberts, Sobel and Canny on LOG method. The CNN model showed good detection effect on the outline and also in the middle of the Hang Rice image while other methods showed weak and discontinuous edge. It also includes false edges and reduced image noise

Table 1 Computational time in seconds

No.	Method	Image Original 1	Image Original 2
1	Sobel	0.5214	0.5318
2	Robert	0.6151	0.5915
3	LoG	0.8838	0.6178
4	Canny	0.6735	1.9855
5	CNN	0.5325	1.3840

Table 2 Comparative table on different edge detection methods

No.	Method	Disadvantage	Advantage
1	Sobel	- Sensitive to noise - Cross operator gives response to some edge	- operator is simplicity - Detection of edge
2	Robert	- Sensitive to noise	- Simple edge detector - quick to compute 2D gradient
3	LoG	- takes time, - many reduces details	- Detection of edge - reduces noise
4	Canny	- Complex to compute - Flase zero crossing	- Good Edge Detection - Minima response to noise
5	CNN	- Complex to compute	- good noise reduction - terms of the computational time required, usability - false alarm rate

5. Conclusions

In this paper, various edge detection methods are analysed. The methods are applied with the algorithms. However, the most common edge detection technique are Gradient-based and Laplacian edge detection. Gradient-based method such as Sobel, Roberts filters have a major disadvantage of being sensitive to noise. The CNN produces the best edge

map market. The best edge detection method should detect error, and provide solution for processing image and reduce image noise. With the CNN method, this example can be used to detect image clarity for future use.

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