An Implementation Image Edge and Feature Detection Using Neural Network

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Abstract— **this paper proposed 2 methods for edge detection. In the first method Neural Network has been used for edge detection and the second method is the new method is used for edge detection based on wavelet and sobel methods. Simulation results are very promising.**

Index Terms— **Edge detection, Neural Network.**

I. Introduction

Edge and feature points are basic low level primitives for image processing. Edge and feature detection are two of the most common operations in image analysis. An edge in an image is a contour across which the brightness of the image changes abruptly. In image processing, an edge is often interpreted as one class of singularities. In a function, Singularities can be characterized easily as discontinuities where the gradient approaches Infinity. However, image data is discrete, so edges in an image often are defined as the Local maxima of the gradient. This is the definition we will use here.

Operations in image processing, This topic has attracted many researchers and many achievements have been made [1]-[8].

For Such as: Rooms et al proposed to estimate the out-of focus blur in wavelet domain by examining the sharpness of the sharpest edges [1].

Hanghang Tong et al proposed new blur detection schemes which can determine whether an image is blurred or not and to what extent an image is blurred.

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Which raises the demand for image quality assessment in terms of blur? Based on the edge type and sharpness analysis using Harr wavelet transforms [2]. X. Marichal, proposed using DCT information to qualitatively characterize blur extent [3]

Berthold K., ET AL describes the processing performed in the course of producing a line drawing from an image obtained through an image dissector camera. The edge-marking phase uses a non-linear parallel line-follower [4].

Lixia Xue et al proposed An edge detection algorithm for multispectral remote sensing image, they extended the one-dimensional cloud-space mapping model to the multi-dimensional model [5].Mike Heath et al , presented a paradigm based on xperimental psychology and statistics, in which humans rate the output of low level vision algorithms. They demonstrate the proposed experimental strategy by comparing four well-known edge detectors: Canny, Nalwa–Binford, Sarkar–Boyer, and Sobel [6], Hoover *et al* at USF have recently conducted such a comparison study based on manually constructed ground truth for range segmentation tasks [7].

Krishna Kant Chintalapudi et al showed that such localized edge detection techniques are non-trivial to design in an arbitrarily deployed sensor network. They defined the notion of an edge and develop performance metrics for evaluating localized edge detection algorithms [8].

II. EDGE DETECTION

In switched Classical edge detectors use a pre-defined group of edge patterns to match each image segments of a fixed size. 2-D discrete convolutions are used here to find the correlations between the pre-defined edge patterns and the sampled image segment.

$$(f * m)(x, y) = \sum_i \sum_j f(i, j) m(x - i, y - j)$$

(1)

Where f is the image and m is the edge pattern defined by

m(−1,-1)	m(−1, 0)	m(−1, 1)
m(0, −1)	m(0, 0)	m(0, 1)
m(1, −1)	m(1, 0)	m(1, 1)

m (i, j) = 0, if (i, j) is not in the defined grid.

These patterns are represented as filters, which are vectors (1-D) or matrices (2-D).

For fast performance, usually the dimension of these filters are 1×3 (1-D) or 3×3 (2-D).

From the point of view of functions, filters are discrete operators of directional Derivatives. Instead of finding the local maxima of the gradient, we set a threshold and consider those points with gradient above the threshold as edge points. Given the source image f(x, y), the edge image E(x, y) is given by [2]:

$$E = \sqrt{((f * s)^2 + (f * t)^2)}$$

(2)

Where s and t are two filters of different directions.

In this paper the Susan and c method is modeled by a neural network.

Although much of the previously discussed methods include at least one non-linear stage, the Susan

Approach represents a somewhat different method for edge and feature extraction, since it is almost entirely based on non-linear filtering. The basic idea of the susan method is to associate to each pixel of the image a small area of neighbor pixels with similar brightness to this center pixel [9, 11].

This method can operate in noisy image better than the other method.

Canny edge detection [10] is an important step towards mathematically solving edge detection problems. This edge detection method is optimal for step edges corrupted by white noise. Edge detection with low probability of missing true edges, and a low probability of detecting false edges. Second, the detected edges should be close to the true location of the edge.

Canny used three criteria to design his edge detector. The first requirement is reliable. In this paper neural network has been used edge detection.

Then Edge detection methods contain 3 steps:

1- the pre-defined edge patterns

2- convolution

3- thresholding

Above three methods can be model by multi layer perceptron neural network such that the pre-defined edge patterns model by weight coefficient of neural network, convolution model by multiply input matrices in weight matrix and thresholding model by bias coefficient of neural network.

We produce several edge patterns of edges for training of neural network for example the following table shows some of these edge patterns that used for training of neural network in these pattern edges shows by 1 and the non edge shows by 0.

In this paper multi layer perceptron neural network with two layers has been used for edge detection.

Figure1 shows structure of neural network that applied for edge detection

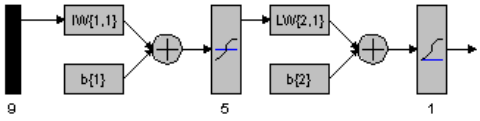

Figure1: structure of neural network

The modified levenberg marquart has been used as a learning rule. The norm of the error is .0007

In this system each pixel of image has been used as input and edges are an output of neural network.

III. SIMULATION RESULT

Each pixel of image has been used as input and edges are an output of neural network. Figure 2shows the results of canny methods and the proposed neural network approach.

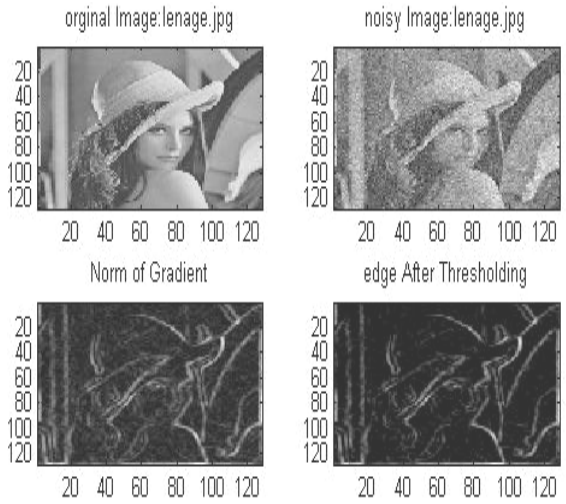

Figure 2. Edge detection using canny method

In the other method we used two orthogonal wavelet functions such as:

$$\psi_1(x,y) = -xe^{-\frac{x^2+y^2}{2}}$$

$$\psi_2(x,y) = -ye^{-\frac{x^2+y^2}{2}}$$

And we used it by Sobel operator for edge detection. Figure 3. Shows the results of Sobel methods based on Wavelet function.

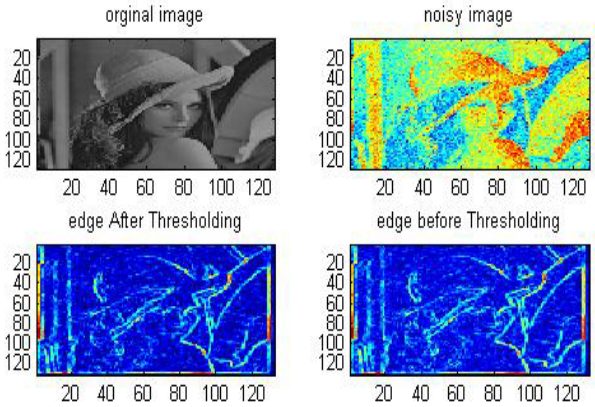

Figure 3. Edge detection using Sobel methods based on Wavelet function

Figure 4 shows the results of Neural Network methods:

Figure 4. Neural Network Results

IV. **CONCLUSION**

This paper proposed 2 methods for edge detection. In the first method Neural Network has been used for edge detection and the second method is the new method is used for edge detection based on wavelet and sobel methods. Neural Network has been used for edge detection and compares them with other methods such as canny method edge detection. The simulation results are very promising.

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