Infrared Target Edge DetectionIn In Sea Sky Backgrand

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Abstract—**Edge detection and extraction is very important in image processing and recognition whose algorithm directly affect the performance of the entire detection system. The ability of image denoising and the accuracy of edge detection are both required high, especially in the complex natural environment at sea. Most of image edge examination algorithms before have limitations and disadvantages of their own, so there is still room for improvement in this area. I 'd like to put forward a sea-sky-line detection algorithm and give simulation examples based on image filtering processing and gray image corrosion in the complex background of natural environment at sea, aiming at acquiring preferable ability of denoising and target extraction on the premise of ensuring the detection accuracy.**

Keywords-edge detection;grayscale;edge join;integrated filtering

I. INTRODUCTION

Image edges contain abundant intrinsic information (such as direction, step property, shape, etc.), and they are important attributes of image feature extraction in image recognition. The edge features tend to vary gently along the edge, while the pixels in the direction perpendicular to the edge change drastically. So, in this sense, the algorithm that extracts edges is the mathematical operator that detects the edge pixels that conform to the edge characteristics. Many methods of edge detection have their own characteristics, but there are also limitations and shortcomings. Therefore, the edge detection of images needs further improvement and development.

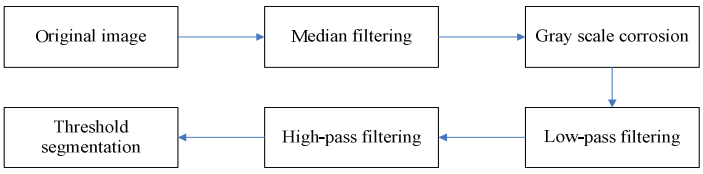
The commonly used edge detection operators include Roberts operator, Sobel operator, Prewitt operator, Log operator and Canny operator. Each operator in edge detection is based on different algorithms, so each operator in the inhibition with sensitivity to noise and on the edge of the sensitivity and precision are different[1-5], At present, the majority of scholars on the image denoising has done a lot of research, Preety D et al studied Image denoising by supervised adaptive fusion of decomposed images restored using wave atom, curvelet and wavelet transform[6], Leipo Yan et al . studied a noisy chaotic neural network approach to image denoising[7], G. Motta, et al studied the iDUDE framework for grayscale image denoising[8], Leipo Yan et alstudied image denoising using noisy chaotic neural networks[9], Wei Zhu ea al studied image denoising using mean curvature of image surface[10], L. P. Wang et al image denoising using stochastic chaotic simulated annealing[11],but no one operator can fit for noise suppression and edge detection accuracy.

In this paper, a method of edge detection using high precision edge detection operator is proposed, which can guarantee the detection of target edges under high noise and complex background. Through the comprehensive filtering and gray scale corrosion of the original image, the target edge detection can be achieved in the complex background with high noise.

II. ALGORITHM PRINCIPLE

A. Integrated image sharpening filtering and gradient processing

Because the real image often disturbed by the noise during acquisition and transmission, so before the edge detection, the first response to the image denoising and sharpening processing, so the original image can achieve edge detection requirements, but also can improve the detection accuracy of target edge, its basic steps are as follows:



The basic idea is gray corrosion as well as median and low pass to the original image, to eliminate a lot of the noise to the original image sharpening, sharpening and edge of the object, the edge detection is more accurate; followed by a high pass filter and threshold segmentation to separate the target from the background, and the gray image into two the value of image, phase separation and improve the target boundary background, preparing for edge detection.

1) Implementation of contour extraction method for corrosion algorithm

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In mathematical morphology, corrosion has the function of eliminating boundary points of an object. The structure element takes 3 x 3 black spot blocks, and the corrosion will reduce the boundary of the object along the periphery by one pixel. Then, edge detection is actually equivalent to using 3 x 3 blocks of 9 point structure elements to etch the original image, and then subtract the etched image from the original image. If the object itself is less than the structure elements in the image after corrosion in the object will disappear completely; if part of objects only less than structural elements (such as small, is connected) after corrosion object connectivity at the faults in the west, is divided into two parts. Gray scale corrosion is helpful to eliminate the salt and pepper noise in the environment. Meanwhile, the edge of the image is partially ablated so as to eliminate the isolated noise points and to reduce the noise margin.

The other X is the image, and the B is the structuring element. BZ represents the result of the translation of the structural element B Z and B^S stands for a symmetric set of structure elements about the origin. Its mathematical expression is as follows[12]:

$$B^S = \{-b; b \in B\} \quad (1)$$

Operational definition of corrosion:

$$X \Theta B^S = \{Z; BZ \ X\} \quad (2)$$

Mathematical morphology to extract the boundary operator as follows:

$$ED(X) = X - (X \Theta E) \quad (3)$$

E :3 x 3 structural elements; $ED(X)$:The boundaries of the image X。The edge width of the object detected by this method is only one pixel, so it has higher positioning accuracy. At the same time, the two valued image has a complete contour, so the edges detected by the contour extraction have continuity.

2) Implementation of ideal low pass filter

Most likely to think of the attenuation of high frequency component method is a called "high frequency components of the cut-off frequency of all" position "cut", the image spectrum in all higher than the cut-off frequency of the frequency components is set to 0, below the cutoff frequency component is set to remain unchanged, we call the ideal low pass filter. If the width of the image is M and the height is N , the ideal low-pass filter can be formally described as

The frequency domain origin of the filter is at the center of the spectrum image, and the filter element values in the circular area with the cutoff frequency as the radius are all 1, and the values of the idea filter elements of the sock are all 0. The ideal low-pass filter can remove image noise to a certain extent, but the blurring effect of edge and detail is also obvious.

Similarly, the implementation of the ideal highpass filter is, on the contrary, no longer specifically described

B. Edge detection and target location

After the treatment, the original image has the condition of edge detection, edge detection and target alone may exist many problems, this algorithm also further processing in edge detection, target edge connected with the target positioning function. Its specific process is as follows:

1) Edge detection operator

In the edge detection, we usually have the following operators, respectively, using 'Sobel' operator, 'Prewitt' operator, 'Roberts' operator,' Gauss Laplasse ',' log 'operator and' canny 'operator. The results of each operator are also different.

•The edge accuracy

The Roberts operator and the log operator have higher positioning accuracy.

The Roberts operator is simple and intuitive, and the log operator uses the zero crossing property of the two derivative to detect the edges. But the log operator can only obtain the edge location information, and can not obtain the edge direction and so on.

•The edges from different directions

For the sensitivity of the edge direction, the Sobel operator and the Prewitt operator have better results in detecting the oblique step edge

The Roberts operator detects the horizontal and vertical edges with better results. Log operator does not have edge direction detection.

The Sobel operator can provide the most accurate estimation of the edge direction.

•The ability to denoise

Although the location accuracy of Roberts operator and LOG operator is higher, noise removal is of great influence.

The Sobel operator is the local average method and direction of differential phase combination. Since the Roberts operator only processes the image directly and does not process the image, it will cause the Roberts operator to be sensitive to the image noise. The Sobel operator can be seen as the local mean method to smooth the image, and then the direction difference operation, there is a certain denoising effect. It calculates the partial derivatives of X and Y on the 3 x 3neighborhood of the image (x, y)[13] .

The pixels (x, y) gradient value $G[f(x, y)] = \sqrt{G_X^2 + G_Y^2}$,in the formula

$$\begin{aligned} G_x = &[f(x-1, y+1) + f(x, y+1) + f(x+1, y+1)] \\ &-[f(x-1, y-1) + f(x, y-1) + f(x+1, y-1)] \end{aligned} \quad (4)$$