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Edge Detection Using Sobel Method With Median Filter

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Abstract— In this paper we show a very good approach to detect edge and corner of any image. Edges and corners are very important part of an image. Edge detection is a commonly performed operation in image processing. Many different edge detectors were used in edge detection. However, the results may not be satisfied when they are directly used in digital images which are affected by noise. Therefore, it's necessary for us to smooth the noise before detecting edges This paper proposes an improved algorithm which used the Sobel operator to detect the edges with median filter to remove the unwanted noise of an image; we also calculate the PSNR value with median filter for better performance. This paper compares and analyzes several kinds of image edge detection, including prewitt, Robert and canny with matlab tool. The experimental results on standard test images demonstrate this filter is simpler and better performing than average filter and also detect the edges accurately.

Keywords- Edge detection, Sobel operator, Median filter.

I. INTRODUCTION

Image quality improvement has been a concern throughout the field of image processing. Images are affected by various type of noise [1]. One of the most important areas of image restoration is that cleaning an image occurring by noise. The goal of reducing noise is to eliminate noisy pixels. Noise filtering can be used as replacing every noisy pixel in the image with a new value depending on the neighboring region. The filtering algorithm varies from one to another by the approximation accuracy for the noisy pixel from its surrounding pixels [8]. Image de-noising is an vital image processing task i.e. as a process itself as well as a component in other processes. There are many ways to de-noise an image or a set of data and methods exists.

In this paper a palm image is used that help in Biometric science of measuring human properties for the purpose of authentication and identification. Human's body part, also known as human's physiological characteristics are less vulnerable to change compared to human's behavioral characteristics such as signature, posture and gait. Some of the human's physiological characteristics are fingerprint, face appearance; hand geometry, iris pattern and palm print [5].

The proposed algorithm in this paper focuses on how to effectively detect the noise and efficiently restore the image. Once pixel is detected as noise in previous phase, their new value will be estimated and set in noise reduction phase. The filters are used in the process of identifying the image by locating the sharp edges which are discontinuous. These discontinuities bring changes in pixels intensities which define the boundaries of the object. Edge detection is a problem of fundamental importance in image analysis. The purpose of edge detection is to identify areas of an image where a large change in intensity occurs. Edges are basically discontinuities in the image intensity due to changes in the image structure. These discontinuities originate from different features in an image, this paper proposes a new algorithm and this algorithm improves the performance of the traditional Sobel test operators and has good edge detection with accuracy.

II. MEDIAN FILTERING

A non-linear filter changes the image intensity mean value if the spatial noise distribution in the image is not symmetrical within the window. Standard Median Filter (SMF) is one such non – linear filter. Variance of the intensities in the image is reduced by Median Filter. The novel filter processing principles are based on the daptive median filtering. Adaptive median filtering works in a rectangular kernel area S x, y and changes (increases) the size of S x, y during filtering operation, depending on certain conditions listed below. If the filter does find that the pixel at (x, y) is noise in the kernel center, the value of the pixel will be replaced by the median value in S x, y. Otherwise, the pixel gray level value will remain the same. Consider the following definition

Z min = minimum gray level value in S x, y Z max = maximum gray level value in S x, y Z med = median of gray level in S x, y Z x, y = gray level at coordinates (x, y) S max = maximum allowed size of S x, y The adaptive median filtering algorithm works in two levels, denoted level A and level B, as follows: Level A A1 = Z med – Z min A2 = Z med – Z min If, A1 > 0 AND A2 0 AND B2 < 0, output Z x,y Or else, output Z med. Every time the algorithm outputs a value, the window, S x, y is moved to the next location in the image. The algorithm then is reinitialized and applied to the pixels in the new location. AMF can achieve good results in suppressing noises of various densities. It sometimes changes its kernel maximum size in order to suit for different conditions. One way is to use different kernel mean filters to process images and determine the AMF kernel maximum size.

A major advantage of the median filter over linear filters is that the median filter can eliminate the effect of input noise values with extremely large magnitudes. (In contrast, linear filters are sensitive to this type of noise - that is, the output may be degraded severely by even by a small fraction of anomalous noise values). The output y of the median filter at the moment t is calculated as the median of the input values corresponding to the moments adjacent to t: where t is the size of the window of the median filter. Besides the one-dimensional median filter described above, there are two-dimensional filters used in image processing .Normally images are represented in discrete form as two dimensional arrays of image elements, or pixels - i.e. sets of non-negative values Bij ordered by two indexes i =1,…, Ny (rows) and j = 1,…,Ny (column). where the elements Bij are scalar values, there are methods for processing color images, where each pixel is represented by several values, e.g. by its "red", "green", "blue" values determining the color of the pixel.

III. SOBEL OPERATOR

The Sobel operator is used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator [3], computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Sobel operator is either the corresponding gradient vector or the norm of this vector. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations. On the other hand, the gradient approximation which it produces is relatively crude, in particular for high frequency variations in the image.

Mathematically, the operator uses two 3×3 kernels which are convolved with the original image to calculate approximations of the derivatives - one for horizontal changes, and one for vertical. If we define **A** as the source image, and $\mathbf{G}_x$ and $\mathbf{G}_y$ are two images which at each point contain the horizontal and vertical derivative approximations, the computations are as follows:

$$Gx = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix} * A \text{ and } Gy = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & +2 & +1 \end{bmatrix} * A$$

Where * here denotes the 2-dimensional convolution operation.

IV. TYPES OF NOISE

1 Amplifier noise (Gaussian noise) The standard model of amplifier noise is additive, Gaussian, independent at each pixel and independent of the signal intensity. In color cameras where more amplification is used in the blue color channel than in the green or red channel, there can be more noise in the blue channel. Amplifier noise is a major part of the "read noise" of an image sensor, that is, of the constant noise level in dark areas of the image [10].

2 Salt-and-pepper noise An image containing salt-and-pepper noise will have dark pixels in bright regions and bright pixels in dark regions [11].This type of noise can be caused by dead pixels, analogto-digital converter errors, bit errors in transmission, etc.This can be eliminated in large part by using dark frame subtraction and by interpolating around dark/bright pixels.

3 Poisson noise Poisson noise or shot noise is a type of electronic noise that occurs when the finite number of particles that carry energy, such as electrons in an electronic circuit or photons in an optical device, is small enough to give rise to detectable statistical fluctuations in a measurement [12].

4 Speckle noise Speckle noise is a granular noise that inherently exists in and degrades the quality of the active radar and synthetic aperture radar (SAR) images [12].

V. PROPOSED ALGORITHM

The base of the algorithm is to determine the accurate edge detection of palm by using the sobel operator with averaging filter. For generating the accuracy we use the pixel values of background, object, and edge pixel is the basic requirement and by using this concept we can equal the pixel value of background and object pixel value and for this an grey scale image is used and find the threshold value using histogram. In this paper by using the Sobel operator and median filtering, it can effectively remove the salt and pepper noise from the image. The reason is that average filtering has a fine result when filtering out jump signal. The stochastic signal of salt and pepper noise is caused by the mutation of continuous signal, so by combining these methods then they can better extract the edges of the image with salt and pepper noise signal. There are many edge detection algorithms but we use sobel algorithm due to its simplicity but it is sensitive towards noise and due to it an inaccurate edges are not detected properly and in order to overcome these noise problem, we combining the filter,sobel operator and convert the image into binary image using histogram.

1. Firstly take the RGB image of palm after that use of Median filter for smoothing the image with add the salt and paper noise.
2. Secondly use the filter image of palm applies the segmentation histogram for change the image into **RGB TO BINARY.**

3. Third step is to set the value of threshold to**126**.
4. In fourth step we found the binary image of palm after applying the threshold.
5. After that we apply the Sobel edge detection algorithm for every pixel of the image, to make convolution with the template, and get the gradient of the point.
6. At last we compare the other edge detection algorithms with the proposed new algorithm.

VI. RESULTS

This paper will use a palm hand image with salt-pepper noise as the original image in Fig: 1. First, use the traditional edge detection operators (include Sobel operator, Prewitt operator, Laplacian operator and Canny operator) to do edge detection of noise in images Fig 2, 4, 5, 6.Then, proposing the Median filter to overcome the noise problem, the operator can effectively remove the noise and make good image edge detection.

Figure: 1 Palm image with salt & pepper noise

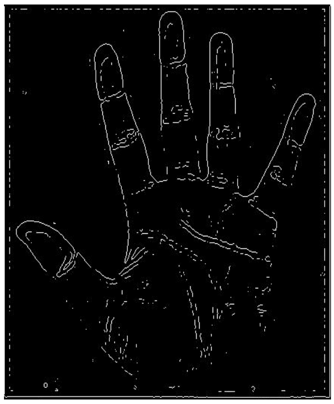

Figure: 2 Sobel edge detection

Figure: 3 canny edge detection

Figure:4 Prewitt edge detection

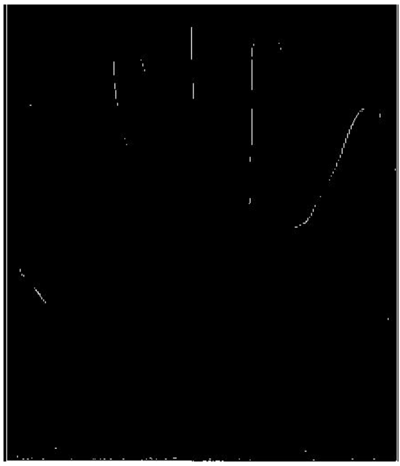

Figure: 5 Robert edge detection

Figure: 6 Log edge detection

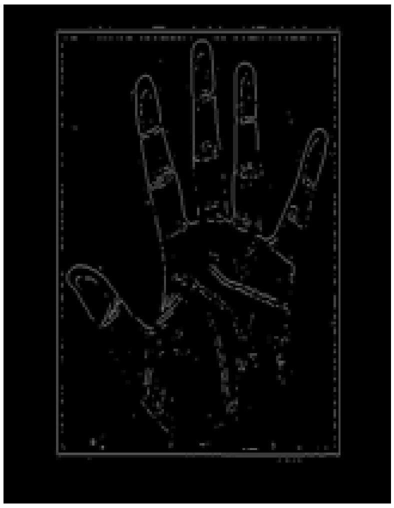

Figure:7 sobel with Average filter

As can be seen from the figures, the image by adding salt and pepper noise, the traditional detection operator for image edge detection, noise points will be all detected, and the details become very fuzzy edges, even the classical Canny operator testing effects are far from satisfaction Fig.3 This is due to the traditional edge detection operator mostly are different in the gray value of the field, the edge of adjacent pixels of a first derivative magnitude of extreme significant will changes apparently, so it can detect the image edges, while the image-doped mixed with abundant noise signal, salt pepper noise and grayscale images have poor signal generator, it can also be easily detected, which lead to the classic operator detection results very poor. In order to overcome this shortcoming, this paper combines some commonly used denoising methods with these classical operators, the median filter denoising, as Figure.7 and Figure 8 shows the method based on median filter with a combination of Sobel operator and canny operator but the result is still poor and edges are not detected accurately even with canny operator, ,we can compare the experimental results with other classical operator, and the result is same like canny and sobel, and but the Sobel operator combination of Mean methods and other traditional methods eliminates the noise and smooth the image but edges and not detected properly with any method. In this paper, an edge detect operator combining mean filter and Sobel operator is given, it is shown in figure 7 but the advantage of using

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the median filtering is that it can eliminate the peak pulse and high frequency noise signal, but also can inhibit the step and ramp mutation, at the same time the mutation does not cause phase, while the salt-pepper noise is just be caused by the signal step of hopping. But finally we use a Global thresholding technique called Otsu for Segmentation purpose and for that histogram thresholding is used. And a threshold value of 126 is calculated through Otsu global thresholding So finally Otsu methods effect is very good, and this denoising method and a segmented image is used for edge detection that Combined with the Sobel, canny and Roberts operator, and through the comparison Fig.8 and Fig.9 and, Fig.10, And we can find that the result with the sobel operator is very good as compared with the other edge detection methods and hence our aim to improved the sobel operator is proved

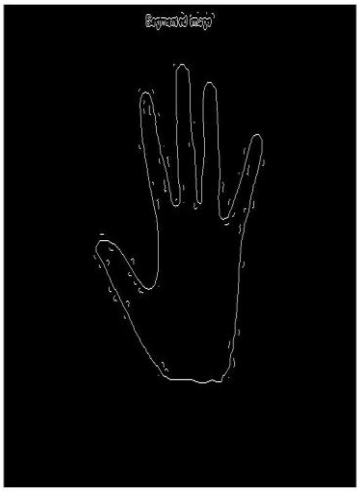

Figure: 8 canny with Median filter

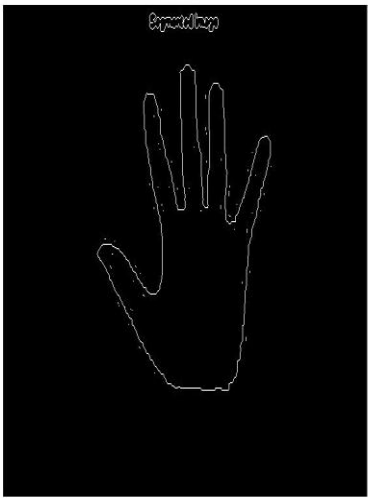

Figure :9 Robert with median filter

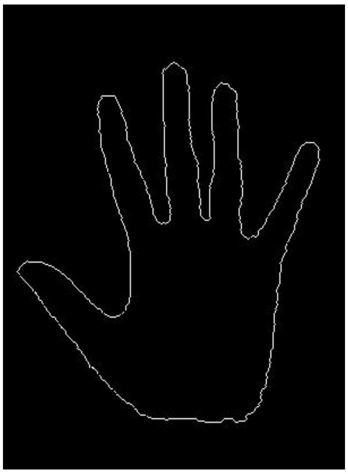

Figure: 10 Sobel using Otsu with Median filter

VII. CONCLUSION & FUTURE ENHANCEMENT

This paper combines Sobel operator and median filter that makes accurate edge detection for an image. This new algorithm can effectively detect the edge accurately and properly eliminate the peak-pulse and high frequency noise signal, and keep down the salt and pepper noise Various edge detection algorithms and design methods have been described and discussed in this paper. The major research directions that can be followed and improvements to be made in the future edge detection techniques are categorized in the following categories:

1) Image noise reduction.
2) Precise edge detections with a minimum error detection possibility.
3) Accurate edge localization that can detect edges within a single pixel.Future Work Different-filtering techniques can be introduced to reduce the noise. The integration of multiple algorithms for image segmentation in addition to Sobel-edge detection and binary image segmentation can be considered.

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