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DEFENSIVE IMAGE PROCESSING PIPELINES AGAINST CONFIGURATION MEMORY ERRORS IN SRAM

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Abstract
In digital image forensics, it is generally accepted that intentional manipulations of the image content are most critical and hence numerous forensic methods focus on the detection of such 'malicious' post-processing. However, it is also beneficial to know as much as possible about the general processing history of an image, including content-preserving operations, since they can affect the reliability of forensic methods in various ways. In this paper, we present a simple yet effective technique to detect median filtering in digital images—a widely used denoising and smoothing operator. As a great variety of forensic methods relies on some kind of a linearity assumption, a detection of non-linear median filtering is of particular interest. The effectiveness of our method is backed with experimental evidence on a large image database.

Keywords: Image processing, median filter, SRAM-based FPGA, SEU, configuration memory, soft error.

1. 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

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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.

2. RELATED STUDY:

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)

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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.

4. METHODOLOGY

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 Gx and Gy are two images which at each point contain the horizontal and vertical derivative approximations, the computations are as follows. Even though such image processing primitives typically do not harm the authentic value of an image, they are of interest in a forensic examination of an image since they can affect forensic methods in various ways. First, the actual state of an image prior to manipulation may influence the set of tools we are using to analyze the image or our interpretation of the evidence derived from these tools. This is related to the field of steganalysis, where, for instance, the choice of a suitable spatial-domain detector should be made conditional to the cover properties.8 Second, certain post-processing steps may interfere with or diminish subtle traces of previous manipulations and thus decrease the reliability of forensic methods. In the course of this paper, we shall focus on the median filter, a well-known denoising and smoothing operator.9 In the line with what was mentioned above, we believe that a detection of median filtered images is of particular interest since a great variety of image forensic techniques rely on some kind of linearity assumption. Because median filtering is a highly non-linear operation, it is likely to affect the reliability of these methods. A typical example is the detection of resampling,10 which employs a local linear predictor of pixel intensities and was shown to be vulnerable to median filtering.11 The rest of this paper is organized as follows: Starting from a short review of basic properties of the median filter in Sect. 2, we will center on the so-called streaking artifacts in Sect. 3 and show how this characteristic can actually be used to detect median filtering in bitmap images. Since forensic methods are generally desired to be robust against lossy post-compression, Sect. 4 will focus on detection of median filtering after JPEG compression. Both sections are underpinned by detailed experimental results from a large database of images. Finally, Sect. 5 concludes the paper.

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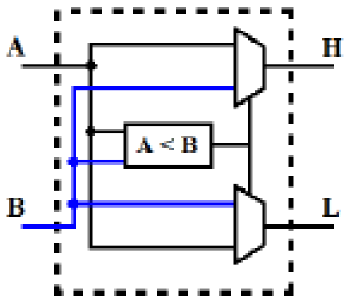

Fig.3.1. Proposed system.

5. SIMULATION RESULTS

Higher correlation gives rise to better edge preservation. In addition, this algorithm named fast and efficient impulse noise removal (FEINR) uses simple fixed length window of size 3 x 3, and hence, it requires significantly lower processing time compared with other algorithms. whether the value of a current pixel lies between the maximum and minimum values that occur inside the selected window. The impulse noise pixels can take the maximum value 255 and minimum values 0. If the value of the pixel processed is within the range, then it is an uncorrupted pixel and left unchanged. If the value does not lie within this range, then it is a noisy pixel and is replaced by the median value of the window.

Fig.5.1. Simulation model

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.

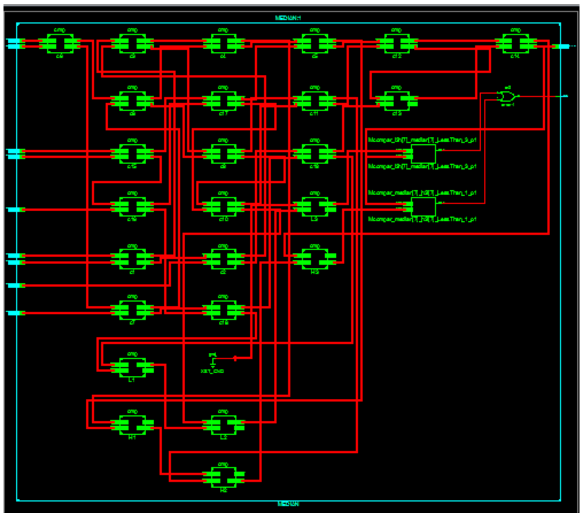

Fig.5.2. RTL model.

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Fig.5.3. Simulation results.

CONCLUSION

This paper is an extension of our preceding paintings presented in [10] approximately a fault-tolerant implementation of the median clean out. Our proposed approach exams if the median output value is inner a dynamic variety created whenever with the last non-median outputs. The proposed approach has been in contrast in phrases of aid usage and mistakes detection charge with DMR and RPR schemes. The design has been implemented in a Xilinx SRAM-based totally FPGA and numerous fault-injection campaigns have been executed. Image-level experimental results show that, adding 35% of FPGA sources to the precise design, 91% of the corrupted images may be detected. This lower overhead way that a decrease amount of faux excellent detections are executed, a lot much less reprogramming time is wasted and, consequently, the time that the median filter out isn't operational due to the reconfiguration is minimized. Pixel-degree outcomes show that photographs with homogeneous pixel-price areas are much less liable to be corrupted at the same time as processed by using the usage of a configuration reminiscence broken median clean out. More homogeneous pixel-price areas endorse extra median filter out inputs with same values, so the possibility that a median clean out malfunction alters the median fee is reduced. The test photos have additionally been analyzed to prove that they cowl awesome enter scenarios. These experiments have discovered that the RPR method is relying at the input images, on the same time as the detection rate of our proposed technique isn't suffering from the input pics. In end, although our technique can not encounter as many corrupted pixels because the DMR scheme, it detects enough to prevent ninety one% of the corrupted photos from being erroneously processed by means of manner of the subsequent image processing module. Moreover, the closing 9% of undetected pix gift a lower MSE cost than the DMR, which means that the picture damage propagation to successive picture processing operations is minimized.

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