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Different Approaches for the Removal of Different Valued Salt and Pepper Noise in Images Using Spartan 3 FPGA with Security

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ABSTRACT

In this paper we propose efficient algorithm for high-density salt and pepper noise removal in images and videos. In the transmission of images over channels, due to faulty communications images are corrupted by salt and pepper noise. We will deal with the images corrupted by salt-and-pepper noise in which the noisy pixels can take only the maximum or minimum values. Several nonlinear filters have been proposed for restoration of images contaminated by salt and pepper noise. Among this proposed algorithm is reliable method to remove the salt and pepper noise without damaging the edge details. Field Programmable Gate Array is used to remove noise. In this paper we are achieving some modification of information hiding with the secret bits of information to replace the random noise, using the lowest plane embedding secret information to avoid noise and attacks, making use of redundancy to enhance the sound embedded in the way nature to be addressed. The results showed that the modification has a very good hidden invisibility, good security and robustness for a lot of hidden attacks.

Keywords— Unsymmetric Trimmed Median Filter, Median Filter, Salt and pepper noise, Stenography, LSB (Least significant bits)

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I. INTRODUCTION

Video frames are often corrupted by impulse noise. In general, the impulse noise in images is present due to bit errors in transmission or introduced during the signal acquisition stage. Impulse noise is classify mainly in two types, which is salt and pepper noise and random valued noise. There are many nonlinear filters have been proposed for restoration of images contaminated by salt and pepper noise. In these methods standard median filter has been established as reliable method to remove the salt and pepper noise without damaging the edge details. The drawback of standard Median Filter (MF) is that the filter is effective only at low noise densities [1]. If noise level is over 50% the edge details of the original image will not be preserved by standard median filter [8]. At high noise densities, trimmed median value cannot be obtained if the selected window contains all 0's or 255's or both. At very high noise density at 80% to 90% this algorithm does not give better results. Steganography has been in the news recently as it was members of the al-Qaeda terrorists were communicating by embedding Arabic messages inside digital files, such as JPEGs and MP3s, and distributed over the internet [9]. Steganography is the art of concealing the presence of information within an innocuous container. It is now possible to hide any sort of digital media inside any other type of digital media [11]. For example, it is possible to hide a text message, encrypted or plain text, inside of a digital picture or sound file.

II. EXISTING SYSTEMS FOR REMOVAL OF HIGH DENSITY SALT & PEPPER NOISE IN IMAGES & VIDEOS

A. Standard Median Filter (MF):

Standard median filter has been established as reliable method to remove the salt and pepper noise without damaging the edge details. It sets a limit on the number of good pixel used in determine median and mean value and substitute to impulse pixel with the summation of its mean value and median value which is divide by 2. After that it passes through Gaussian filter. This method can remove salt and pepper noise with a noise level as high as 90%. However, drawback of standard Median Filter (MF) is that the filter is effective only at low noise densities [1]. When the noise level is over 50% the edge details of the original image will not be preserved by standard median filter.

B. Adaptive Median Filter (AMF):

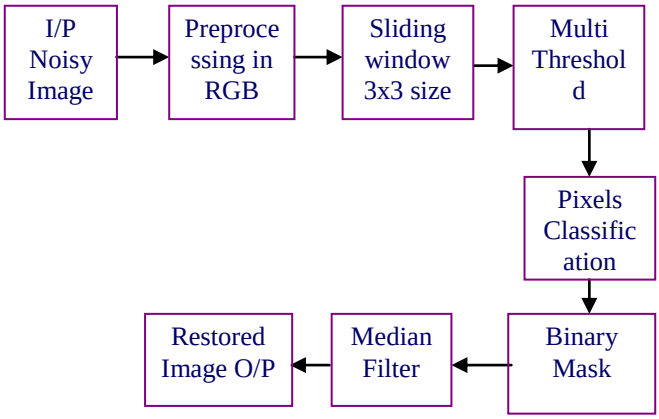
Based on two types of image models corrupted by impulse noise, two new algorithms for adaptive median filters are proposed. It has variable window size for removal of impulses while preserving sharpness. 1st is ranked-order based adaptive median filter (RAMF). The 2nd one is called as impulse size based adaptive median filter (SAMF) when the noise level is over 50% the edge details of the original image will not be preserved by standard median filter. This filter (AMF) [2] performs well at low noise densities. But window size has to be increased at high noise densities which may lead to blurring the image.

C. Decision Based Algorithm (DBA):

A two step algorithm is implemented in which the first step ensure detection of corrupted pixels in the degraded image and the second step replaces the degraded image with either the median of uncorrupted pixels in the selected window and if the selected window contains noisy pixels only than trimmed global mean filter is used. Decision Based Algorithm (DBA) is proposed [5]; to overcome the drawbacks of above filter At high noise density the median value will be noisy which is 0 or 255. In such case, replacement is done by neighbouring pixel. This repeated replacement produces streaking effect [6].

III. PROPOSED SYSTEM

Adaptive Median is a "decision-based" filter that first identifies possible noisy pixels and then replaces them using the median filter or its variables, while all remaining pixels are kept unchanged. This filter is good for detecting noise even at a high noise level. For designing system, the basic idea of the proposed scheme is illustrated in Fig. 1.



"Fig.1: Block Diagram of proposed method"

In this paper we are going to use input noisy image which is affected by salt and pepper noise. Those input pixels are under gone into pre-processing in which we are going to convert the image RGB bands in to gray image and then creating a text file which is containing pixel values of the noisy image. Now, by considering 3*3 mask, in which the center pixel value is going to observe and then compare using some threshold value. Depending upon the threshold value we will classify the image pixels. Then by using median filter that of size 3*3 mask is going to apply on the image. The pixels which are affected by noise are replaced by the median value of the neighbour pixel values. To eliminate the noise, this process is applied for all the noisy affected pixels. The noise free image we can get at the output end. For modification with steganography the message can be camouflaged in text message. First we will investigate least significant bit insertion, where you literally put the information in the least significant bits of an image. We will now go over an example that involves inserting an A into 3 pixels of a 24 bit image. Here is the original raster data:

(00101101 00011100 11011100) (10100110 11000100 00001100) (11010010 10101101 01100011)

The binary value of A is 11001000 and encoding A into the last bits of this 3 pixel sequence will change the above sequence to:

(00101101 00011101 11011100) (10100110 11000101 00001100) (11010010 10101100 01100011). Notice that only the underlined bits had to be changed in order to create the A. On the average only have of the bits would have to be changed in an LSB (Least Significant Bit) encoding scheme.

IV. ALGORITHM

The proposed algorithm processes the corrupted images by first detecting the impulse noise. The processing pixel is checked for its noise presence. That is, noise free pixel is left unchanged if the processing pixel lies between maximum and minimum gray level values. If the processing pixel takes the maximum or minimum gray level then the pixel is noisy and it is processed by this algorithm.

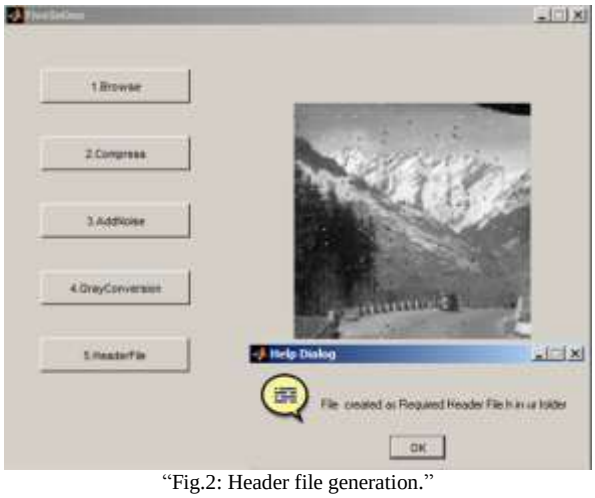
1. Read an image.
2. Resize image.
3. Convert to gray scale
4. Copy this image into new one.
5. Filter the border of image.
6. Take pixel as center pixel and form 3x3 window.
7. Load all values of 3x3 window into array except center pixel.
8. Sort in ascending manner all arrays.
9. If pixel value is 0 or 255 then only perform.

10. Calculate median by adding n/2 value and its next value if even value.
11. Calculate median by adding n/2 value if odd value.
12. Replace median value with center pixel value.
13. Display new pixel valued image.
14. Put information in the least significant bits of an image.
15. Recover information using FPGA hardware.

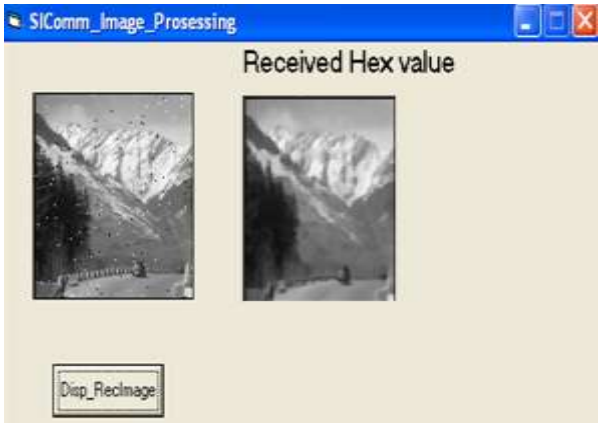
V. RESULTS

The developed algorithms are tested using 512*512, 8-bits/pixel. The performance of the proposed algorithm is tested for various levels of noise corruption and compared with standard filters namely standard median filter (SMF), decision based algorithm (DBA) and adaptive median filter (AMF). Each time the test image is corrupted by salt and pepper noise of different density ranging from and after selecting 3x3 pixels sorting is the most important operation used to find the median of a window. There are various sorting algorithms such as bubble sort, binary sort, quick sort, merge sort etc. In the proposed algorithm, shear sorting technique is used since it is based on parallel architecture. Next work for this concept with more precision is going on. Programmable digital logic chips like FPGAs are used. We can program them to do almost any digital function. Xilinx software is used for Impulse c coding. The header file is created by using matlab software and passed to impulse c coding to remove noise in Xilinx. On VB, GUI and on Hyper terminal the output we are going to observe. We are going to check Mean square error and PSNR values with different sorting algorithms. For steganography modification the secrete data is stored in same folder of matlabs current directory to embed in image. Data is embed using LSB stenography in FPGA processor Spartan 3 XCS300 with Xilinx 10.1 version. Fig.5 shows image pixel creation then image transfer and received and input message which is delivered and received.

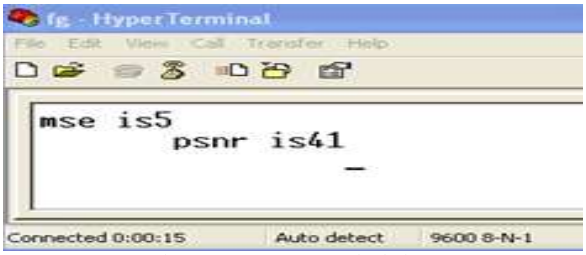
VI. EXPERIMENTAL ANALYSIS



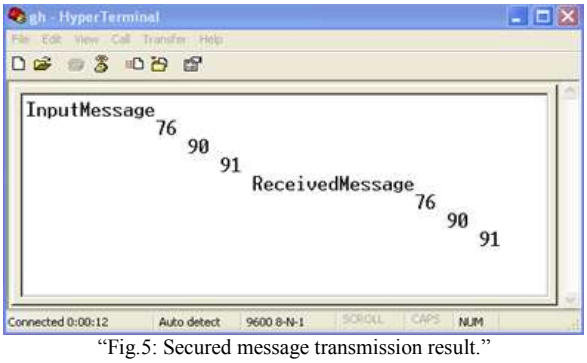
"Fig.2: Header file generation."



"Fig.3: Removal of noise from an image using FPGA."



"Fig.4: MSE & PSNR calculation."



"Fig.5: Secured message transmission result."

TABLE I
Peak Signal to Noise Ratio(db) of different techniques for image with different noise

Noise Level	Median technique	Adaptive Median	Decision Based	Proposed Method
1.0	44	48	48	60
0.5	46	50	50	63
0.1	47	52	52	67

TABLE III
Mean Square Error values of different techniques for image with different noise densities.

Noise Level	Median technique	Adaptive Median	Decision Based	Proposed Method
1.0	6	6	6	3
0.5	4	4	4	2
0.1	3	3	3	1

VII. CONCLUSION

In this paper we proposed FPGA implementation for removal of impulse noise from an image. The FPGA chip implementation of de-noising technique and edge preserved de-noising with median filtering and then sorting technique gives better performance in terms quantitative evaluation and visual quality. Compared to other techniques percentage of impulse noise with lowest hardware cost and lowest complexity will reduced. As shown in table value of PSNR & MSE is better in proposed algorithm. Here we modified system with a data hiding and extraction procedure. It is possible for information hiding with the secret bits of information to replace the random noise, using the lowest plane embedding secret information.

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