Removal of various Noises in Images and Videos Using FPGA

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Abstract
Here we are presenting various algorithms for high-density salt and pepper noise removal in images and in videos too. During transmission of images over channel, images can behampered or corrupted by salt and pepper noise, impulse noise. We have to remove these noises then only faithful reception/recovery can be guaranteed. In such type of noise, where 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 all the available methods, proposed algorithm is one of the reliable method to remove the salt and pepper noise without damaging the edge details. Field Programmable Gate Array (FPGA) is used to remove noise along with proper security.

IndexTerms- Asymmetric Trimmed Median Filter, Median Filter, Salt and pepper noise, FPGA

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.

EXISTING SYSTEMS

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.

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. Butwindow size has to be increased at high noise densities which may lead to blurring the image.

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].

PROPOSED ENHANCED 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.

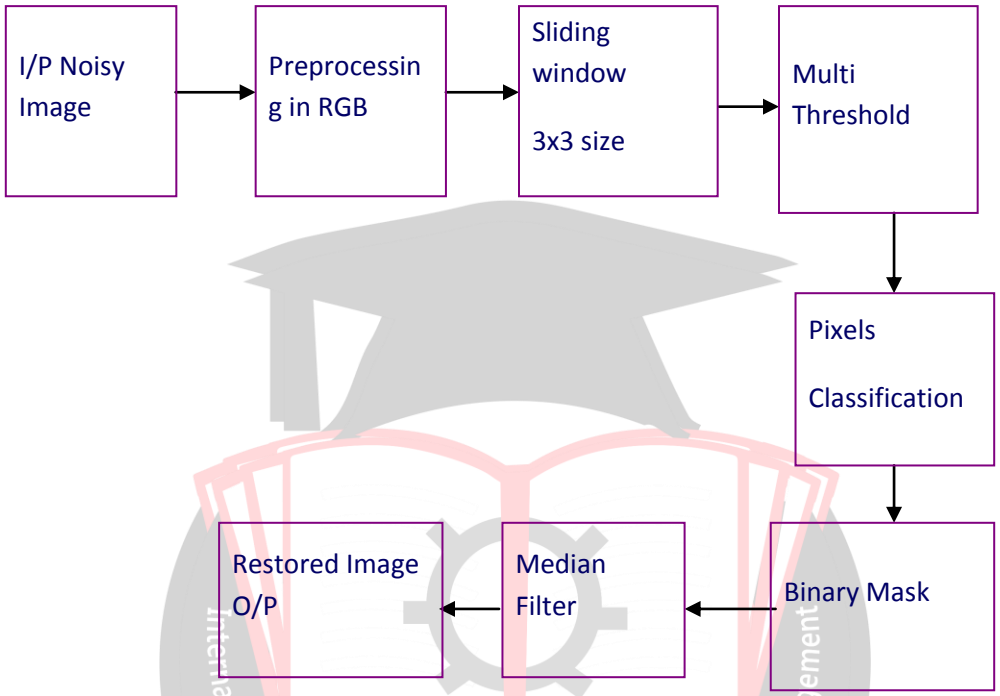

Fig. 1 Block Diagram of proposed method

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.

MODIFICATIONS

Steganography is the art of invisible communication byconcealing information inside other information. The term Steganography is derived from the Greek and literally means"covered writing" . A steganography system consists ofthree elements: cover-object (which hides the secret message),the secret message and the stego-object (which is the cover object with message embedded inside it. Steganography is one of the mostpowerful techniques to conceal the existence of hidden secret data insidea cover object. Images are the most popular cover objects forsteganography, and thus the importance of image steganography.Embedding secret information inside images requires intensivecomputations, and therefore, designing steganography in hardware speeds up steganography. This work presents a hardware design of Least Significant Bit (LSB) steganography technique.The LSB is the lowest significant bit in the byte value of the image pixel. The LSB based image steganography embeds the secret in the least significant bits of pixel values of the cover image.

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 centerpixel.
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.

EXPERIMENTAL ANALYSIS AND RESULTS

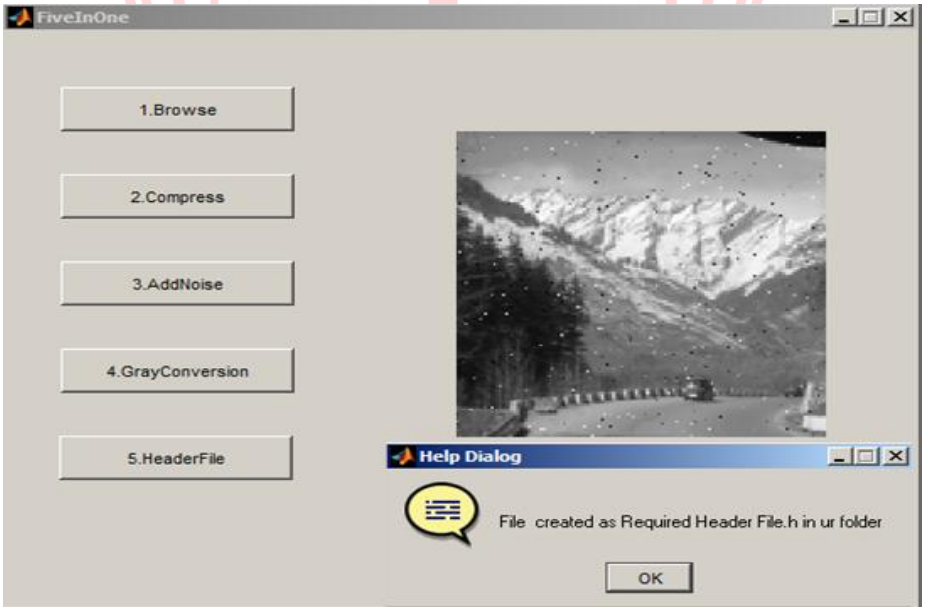

Fig. 2 Header files generation

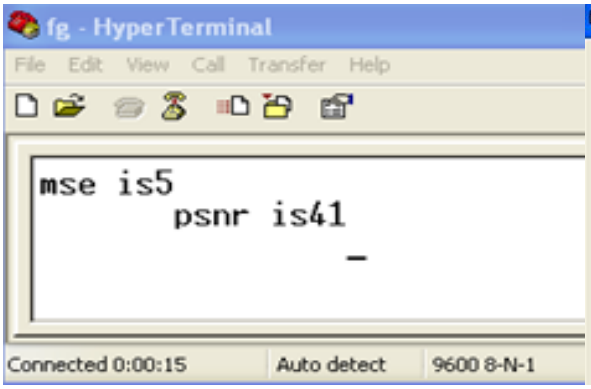

Fig. 3 MSE and PSNR Calculation

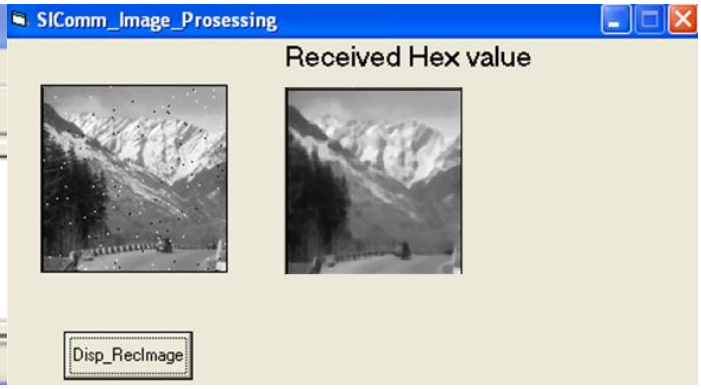

Fig. 4 Removal of noise from an image using FPGA

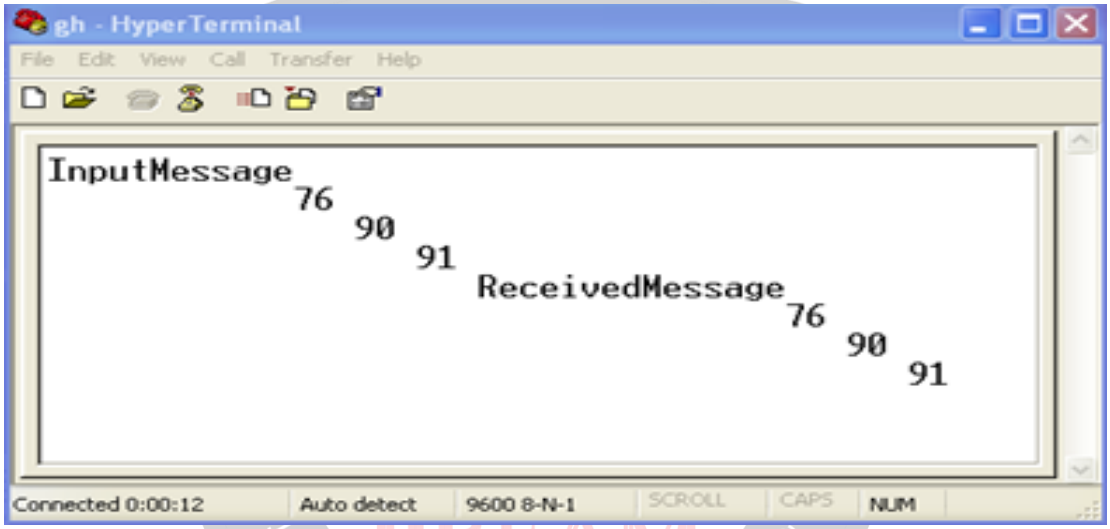

Fig. 5 Secured message transmission result

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.

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