



Removal of High Density Salt & Pepper Noise Using Modified Decision Based Un-Symmetric Trimmed Median Filter

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ABSTRACT: In the Transmission of images over channels, Images are corrupted by salt and pepper noise, due to faulty communications. Salt and Pepper noise is also referred to as Impulse noise. The objective of filtering is to remove the impulses so that the noise free image is fully recovered with minimum signal distortion. The best-known and most widely used non-linear digital filters, based on order statistics are median filters. Median filters are known for their capability to remove impulse noise without damaging the edges. Median filters are known for their capability to remove impulse noise as well as preserve the edges. The effective removal of impulse often leads to images with blurred and distorted features. At high noise densities, their performance is poor. A new algorithm to remove high-density salt and pepper noise using modified Decision Based UN Symmetric Trimmed Median Filter (DBUTM) is proposed.

I. INTRODUCTION

The objective of filtering is to remove the impulses so that the noise free image is fully recovered with minimum signal distortion. The best-known and most widely used non-linear digital filters, based on order statistics are median filters. Median filters are known for their capability to remove impulse noise as well as preserve the edges. The effective removal of impulse often leads to images with blurred and distorted features. Ideally, the filtering should be applied only to corrupted pixels while leaving uncorrupted pixels intact. Applying median filter unconditionally across the entire image as practiced in the conventional schemes would inevitably alter the intensities and remove the signal details of uncorrupted pixels. Therefore, a noise-detection process to discriminate between uncorrupted pixels and the corrupted pixels prior to applying nonlinear filtering is highly desirable. Adaptive Median is a “decision-based” or “switching” filter that first identifies possible noisy pixels and then replaces them using the median filter or its variants, while leaving all other pixels unchanged. The adaptive structure of this filter ensures that most of the impulse noises are detected even at a high noise level provided that the window size is large enough. The existing non-linear filter like Standard Median Filter (SMF), Adaptive Median Filter (AMF), Decision Based Algorithm (DBA) and Robust Estimation Algorithm (REA) shows better results at low and medium noise densities. At high noise densities, their performance is poor. A new algorithm to remove high-density salt and pepper noise using modified shear sorting method and Decision Based Unsymmetric Trimmed Median Filter (DBUTM) is proposed.

In image processing it is usually necessary to perform high degree of noise reduction in an image before performing higher-level processing steps, such as edge detection. The median filter is a non-linear digital filtering technique, often used to remove noise from images or other signals. The idea is to examine a sample of the input and decide if it is representative of the signal. This is performed using a window consisting of an odd number of samples. The values in the window are sorted into numerical order; the median value, the sample in the center of the window, is selected as the output. The oldest sample is discarded, a new sample acquired and the calculation repeats.

In image processing, to smooth a data set is to create an approximating function that attempts to capture important patterns in the data, while leaving out noise or other fine-scale structures/rapid phenomena. Many different algorithms are used in smoothing. One of the most common algorithms is the "moving average", often used to try to capture important trends in repeated statistical surveys. In image processing and computer vision, smoothing ideas are used in scale-space representations. Smoothing is a process by which data points are averaged with their neighbours in a series, such as a time series, or image. This usually has the effect of blurring the sharp edges in the smoothed data. Smoothing is sometimes referred to as filtering, because smoothing has the effect of suppressing high frequency signal and enhancing low frequency signal.

The inexpensiveness and simplicity of point and shoot cameras, combined with the speed at which budding photographers can send their photos over the Internet to be viewed by the world, makes digital photography a popular



hobby. With each snap of a digital photograph, a signal is transmitted from a photon sensor to a memory chip embedded inside a camera. Transmission technology is prone to a degree of error and noise is added to each photograph. Significant work has been done in both hardware and software to improve the signal-to-noise ratio in digital photography. In software, a smoothing filter is used to remove noise from an image. Each pixel is represented by three scalar values representing the red, green, and blue chromatic intensities. At each pixel studied, a smoothing filter takes into account the surrounding pixels to derive a more accurate version of this pixel. By taking neighbouring pixels into consideration, extreme “noisy” pixels can be replaced. However, outlier pixels may represent uncorrupted fine details, which may be lost due to the smoothing process. This project examines four common smoothing algorithms and introduces a new smoothing algorithm. These algorithms can be applied to one-dimensional as well as two-dimensional signals.

II. DECISION BASED UNSYMMETRIC TRIMMED MEDIAN FILTER (DBUTM)

In DBUTM, the corrupted pixels are identified and processed. The DBUTM algorithm checks whether the left and right extreme values of the sorted array obtained from the 3x3 window are impulse values. The corrupted processing pixel is replaced by a median value of the pixels in the 3 X 3 window after trimming impulse values. The corrupted pixel is replaced by the median of the resulting array.

III.SHEAR SORTING ALGORITHM

Sorting is the most important operation used to find the median of a window. There are various sorting algorithms such as binary sort, bubble sort, merge sort, quick sort etc. In the proposed algorithm, shear sorting technique is used since it is based on parallel architecture. In practice the parallel architectures help to reduce the number of logic cells required for its implementation. The illustration of shear sorting is shown in Figure.3.1-3.4. In the odd phases (1,3,5) even rows are sorted in descending order and rows are sorted out in ascending order. In the even phases columns are sorted out independently in ascending order.

IV.MODIFIED SHEAR SORTING ALGORITHM

In order to improve the computational efficiency shear sorting algorithm is modified as follows:

- i) All the three rows of the window are arranged in ascending order.
- ii) Then all the columns are arranged in ascending order.
- iii) The right diagonal of the window is now arranged in ascending order.

In this case, the first element of window is the minimum value, last element of the window is the maximum value and middle element of window is the median value. After the third stage of sorting itself the median value is obtained even though all the elements are not arranged in ascending order. The illustration of sorting algorithm is shown in the table containing the comparison of the various sorting techniques.

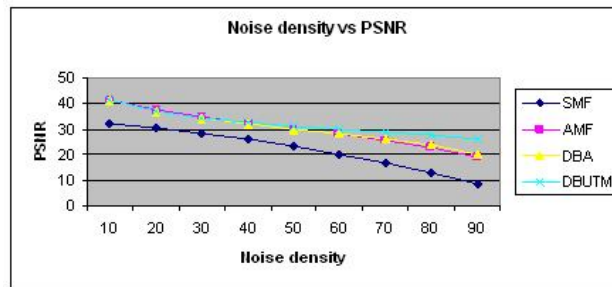
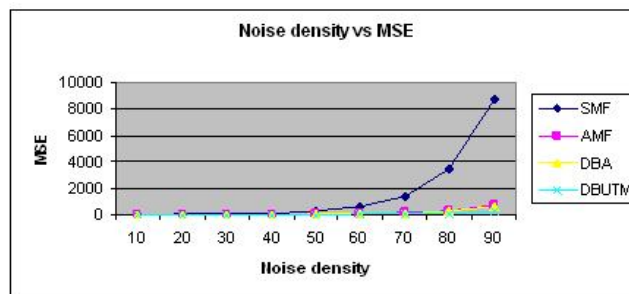
V.DECISION BASED UNSYMMETRIC TRIMMED MEDIAN FILTER (DBUTM)

Decision Based Algorithm (DBA) is a recently proposed algorithm to remove salt and pepper noise. In DBA each pixel is processed for de noising using a 3 X 3 window. During processing if a pixel is ‘0’ or ‘255’ then it is processed else it is left unchanged. In DBA the corrupted pixel is replaced by the median of the window. At higher noise densities the median itself will be noisy, and, the processing pixel will be replaced by the neighborhood processed pixel. This repeated replacement of neighborhood pixels produces streaking effect. In DBUTM, the corrupted pixels are identified and processed.

The DBUTM algorithm checks whether the left and right extreme values of the sorted array obtained from the 3x3 window are impulse values. The corrupted processing pixel is replaced by a median value of the trimming impulse values. The corrupted pixel is replaced by the median of the resulting array.

VI. FILTER PERFORMANCE

Graph for Noise density Vs PSNR

**Graph for Noise density Vs MSE**

VII.CONCLUSION AND FUTURE SCOPE

An efficient non-linear algorithm to remove high-density salt and pepper noise is proposed. The modified sheer sorting architecture reduces the computational time required for finding the median. This increases the efficiency of the system. The algorithm removes noise even at higher noise densities and preserves the edges and fine details. The performance of the algorithm is better when compared to the other architecture of this type. The developed algorithms are tested using 512X512, 8- bits/pixel images.

The performance of the proposed algorithm is tested for various levels of noise corruption and compared with standard filters namely standard median filter (SMF), adaptive median filter (AMF) and decision based algorithm (DBA). Each time the test image is corrupted by salt and pepper noise of different density ranging from 10 to 90 with an increment of 10 and it will be applied to various filters.

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