

# Decision Based Unsymmetric Trimmed Median Filter to Remove High-Density Salt and Pepper Noise

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**ABSTRACT:** Decision Based Unsymmetric Trimmed Medianilter (DBUTMF) eliminates salt and pepper noise which is included even at the higher densities and restores the image with fine details. This algorithm replaces the corrupted noise pixel value with a new pixel value by using either decision based trimmed median filter or unsymmetric trimmed median filter (UTMF). This concept is verified on a gray scale images and provided better results.

**KEYWORDS :** Unsymmetric, Salt and Pepper Noise, Trimmed, Pixel.

## I. INTRODUCTION

The quality of an image is a major factor in Image processing. Images are affected by different kinds of noise such as Impulse Noise, Gaussian Noise, Uniform noise, Raleigh noise, speckle noise and many. Impulse noise is divided into two types one is salt & pepper noise and the other one is random noise. Salt and pepper noise is occurs due to the errors in synchronization of an image while transmitting. In this work, I tried to eliminate the Impulse noise by using filters.[1]

There are many filters to reduce the salt and pepper noise such as Linear filter and non-linear filter. Linear filters are beneficial for the removal of noise density at low frequencies when compared to high noise densities. It just removes the noise in an image along with the sharp edges of an image. Therefore, Linear filter doesn't perform well at higher frequencies. There are many types of nonlinear filters introduced to reduce the noise in an image. In standard median filters(SMF)the pixel values are arranged either in an increasing order or decreasing order. If there are odd number of pixels values the middle value is replaced by the corrupted pixel. If the even number of pixel values is present then it takes the average value of the middle pixel. The disadvantage of median filter is if the noise the above 50% it remove fine details of an image. [2]

Adaptive median filter(AMF) retains the details of an image while smoothing an non impulse image also. It undergoes in two steps: It calculates the maximum value, minimum value and median of a corrupted image. In the first step it checks whether it is salt noise or pepper noise. If it is either of those then it increases the size of a window and again calculates the maximum, minimum and median values of an image. In the second stage, it verifies again whether it salt noise or pepper noise. If it is either of those it changes the damaged pixel value with median value. The drawback of this algorithm is the size of the window has to be increased and this made the image looks blur. [2]

Progressive switched median filter(PSMF) follows switching method and filtration to reduce the noise in an image. It identifies the corrupted and uncorrupted pixels. Before filtering it follows impulse noise detection algorithm to identify the corrupted and uncorrupted pixel. In the first it identifies the noise and in the second stage it reduces the noise. Due to the repeated filtration it undergoes computational complexity.[3]

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## II. PROPOSED THEORY

The proposed algorithm consists of DBUTMF and UTMF. If the noise density is below 80% then the DBUTMF filter is used if not DBTUMF is cascaded UTMF to restore the corrupted pixel.

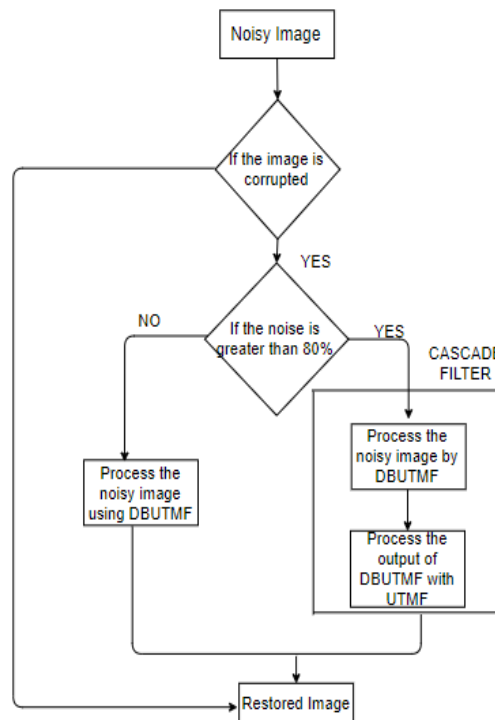


Figure 1 Flowchart for the removal of Impulse noise.

## III. ALGORITHM FOR DBUTMF

DBUTMF filter checks whether the values are from 3\*3 window and sort the values either in ascending order or descending order. The DBUTMF algorithm is as follows

Step 1: Assume the figure processed in a 2-Dimensional window of size 3\*3.

Step 2: The pixel values of size 3\*3 window is sorted in either ascending or descending order and placed in 1-Dimensional array.

Step 3 : The pixels which are not corrupted are ignored and the median of the remaining values are considered to change the corrupted pixel.

Step 4 : The pixel that is corrupted is changed with the median value and then repeat the steps from step 2 until the corrupted pixel values are replaced.

## IV. UNSYMMETRIC TRIMMED MEDIAN FILTER

Step 1: Assume the pixel is a 2- dimensional of size 3\*3.

Step 2 If the pixel value is corrupted by the impulse noise then the corrupted pixel is trimmed and rest of the pixel median value is calculated.

Step 3 :

Case 1: In the 1-Dimensional array where the pixel value is uncorrupted the pixel is exchanged with the mean value.

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Case 2: If the pixel consists of salt and peppernoise along with neighboring pixel, pixel value that is processing is changed by the mean value. Move the window by single step and repeat the process.

## V. CASCADED FILTER

DBUTMF performs better when compared to the other filters but the disadvantage is if the pixel is above 80% it removes the fine details and the sharp edges of an image. To overcome this DBUTMF is cascaded with the Unsymmetric trimmed median filter which removes the noise even at 90% but it slightly blurs the image.

## VI. RESULTS

The proposed algorithm is verified with different ranges of noise density. Here are a few images of “football.jpg”.

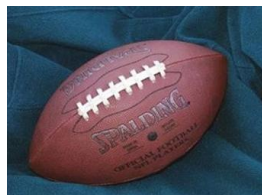


Figure 2 RGB image of football.jpg



Figure 3 RGB to GRAY conversion of football.jpg

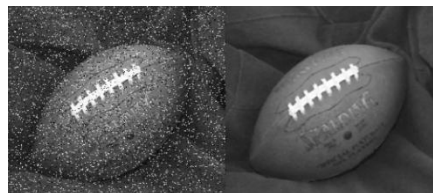


Figure 4 Analogy of Noisy and denoise imge for 10% noise density

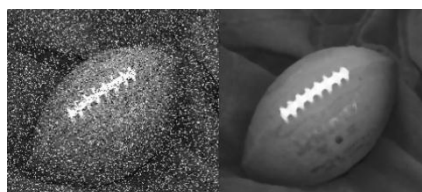


Figure 5 Analogy of Noisy and denoise imge for 20% noise density

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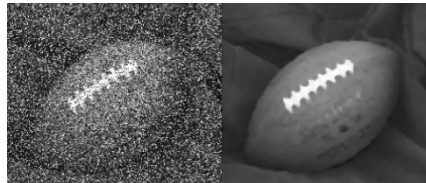


Figure 6 Analogy of Noisy and denoise imge for 30% noise density

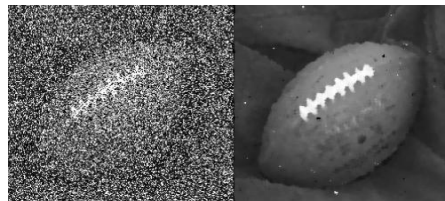


Figure 7 Analogy of Noisy and denoise imge for 40% noise density

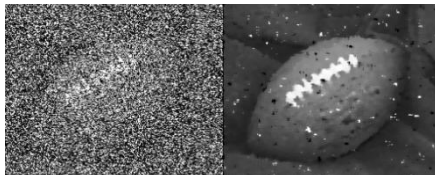


Figure 8 Analogy of Noisy and denoise imge for 50% noise density

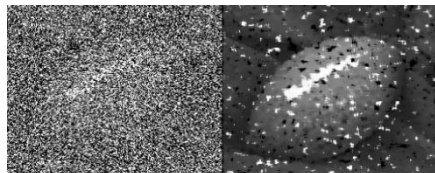


Figure 9 Analogy of Noisy and denoise imge for 60% noise density

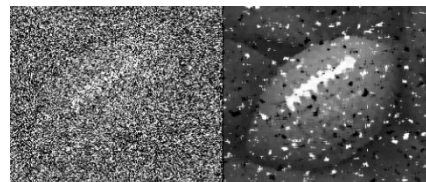


Figure 10 Analogy of Noisy and denoise imge for 70% noise density

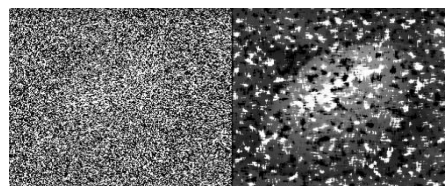


Figure 11 Analogy of Noisy and denoise imge for 80% noise density

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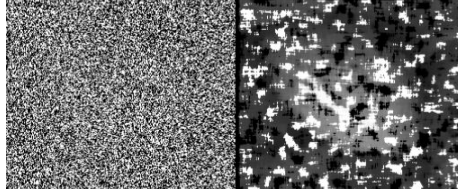


Figure 12 Analogy of Noisy and denoise image for 90% noise density



Figure 13 Conversion of GRAY Image to RGB

## VII. CONCLUSION

DBUTMF performs well when compared to the other algorithms. Even though complete information of an image at high densities such as 80% and 90% cannot be retrieved completely but the straight edges are recovered well and this algorithm provides low error rate compared to the others. The processing time of this algorithm is also very less.[1]

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