A Review on Removal of Salt and Pepper Noise
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Abstract— Since last 20 years the Noise Removal techniques have drawn a lot of interest of the researchers, there are types of Noise Removal technique. The process of removing noise from the original image is still a demanding problem for researchers. One of the main tasks of image processing is to distinguish between noise and actual contents so that the un-wanted noise from the image signal can be removed. The distortion of an image by noise is very common that gets introduced during its acquisition processing, compression, transmission, and reproduction. Various terms related to Noise Removal are explored in this paper.

Key words: Image, Impulse Noise, Median filter, Noise density

General Terms: Image Processing, Noise Removal

I. INTRODUCTION

Image noise is random variation of brightness or colour information in images. It can be produced by the sensor and circuitry of a scanner or digital camera. Image that are transmitted over the channel are corrupted by noise. Image noise is an undesirable by-product of image capture that adds spurious and extraneous information. Noise is an unwanted signal so we required removing in image for better resolution and brightness. The most possible type of noise is impulse noise which can also be called as salt & pepper noise. Useful algorithm is DBA[4]. Impulse noise in image is present due to bit errors in transmission during the signal acquisition stage. Salt and pepper noise can corrupt the images where corrupted pixel takes either maximum or minimum grey level. Filters are used to remove the noise from noisy images. For this, various filtering techniques were proposed to remove the impulse noise. So the next challenging task is for reducing noise from whole image and it is becoming a research topic.

II. IMAGE DENOISING TECHNIQUE

There are two basic approaches to image denoising[5], transform domain filtering[3] methods and spatial filtering methods.

A. Transform Domain Filtering:

Image transforms are extensively used in image processing and image analysis. Transforms change the representation of a signal by projecting it onto a set of basis functions. The transforms do not change the information content present in the signal. Most of the image transforms like Fourier transform, Discrete Cosine transform, Wavelet transform, etc. Transforms play a significant role in various image processing applications such as image analysis, image enhancement, image filtering and image compression.

B. Spatial Domain Filtering:

The term spatial domain refers to the image plane itself, and approaches in this category are based on direct manipulation of pixels in an image.

The various types of spatial filters that can be used in image denoising are as follows:

1) Linear Filter

Linear filters tend to blur sharp edges, destroy lines and other fine details of image.

a) Mean Filter:

Mean filter is nothing just a simple sliding window spatial filter that replaces the centre value of the window with the average values of its all neighbouring pixels values including itself.

b) Weiner Filter:

Wiener filtering is a mean square technique. It is the most important and useful technique for removing blur in images.

2) Non Linear Filter

With the non-linear filter, noise is removed without any attempts to explicitly identify it.

a) Median Filter:

Median filter follows the moving window principle and uses 3×3, 5×5 or 7×7 window. The median of window is calculated and the center pixel value of the window is replaced with that value. It works best for salt and pepper noise. One main advantage of median filter is that it ignores those pixel values that are anomalous and also does not create artificial values.

The limitation of median filter is that the process of sorting the entire pixel set can be tedious if the image size is huge and may not be cost effective.

III. MEDIAN FILTER TECHNIQUES

Median filtering is a nonlinear method used to remove noise from images. It is widely used as it is very effective at removing noise while preserving edges. It is particularly effective at removing ‘salt and pepper’ type noise. The median is calculated by first sorting all the pixel values from the window into numerical order, and then replacing the pixel being considered with the median pixel value.

Given a set of random variables \( X = (X_1, X_2, \ldots, X_N) \), the order statistics \( X(1) \leq X(2) \leq \ldots \leq X(N) \) are random variables, defined by sorting the values of Xi in an increasing order. The median value is then given as

\[
\text{median}(x) = \begin{cases} 
X_{(k+1)}, & \text{for } N = 2k + 1; \\
\frac{1}{2} (X_{(k)} + X_{(k+1)}), & \text{for } N = 2k;
\end{cases}
\]

Where \( m = 2k + 1 \) is the median rank.
## IV. CONCLUSION

This paper explores the comparison of various image denoising algorithms like median filter, adaptive median filter, decision based algorithm, decision based median filter, modified decision based unsymmetrical trimmed median filter that could be useful to the researchers. Their disadvantages and PSNR researcher can get best options for their interest of study in denoising algorithm for median filter.

## REFERENCES


