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Efficient Denoising For Removing Fixed And Random Valued Impulse Noise In Images-A Survey

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ABSTRACT

In Digital image processing application separation of Salt and Pepper noise from images plays a vital role. Hence the extraction of image is processed by standard filters. The efficiency of these filters is very low and it cannot identify the Image details and noises at higher noise level. In depth research is carried out in this area to detach the noise in immensely degraded images. This paper gives vast survey on different filtering methods for improving image quality.

Keywords: Image Denoising, Median Filter, salt and pepper noise, Decision tree Based Median filter.

1. INTRODUCTION

Most challenging problem in image pre-processing is Image Denoising. Noises are added in digital images during image capturing and transfer. The different types of noises occurred in images are Gaussian noise, impulse noise, Shot noise, Quantization noise and anisotropic noise. Fixed valued noise plays significant role in quality of images comparatively than other noises. This noise can be removed by applying various types of filters such as Mean Filter, Median Filter and modified versions of standard filters. Apart from these filters, Un-Symmetric Trimmed-Mean Filtering and its improved versions are used to extract the image features in effectively. In recent years, exhaustive research is carried out in developing the techniques for enhance the quality of images. However, the foremost challenges in designing a filter for removing a salt and pepper noise lies in distinguishing the image features as appear as

a salt and pepper from the actual salt and pepper noise. In this paper, the complete literature review is carried out on various filtering techniques for preserving the features of image. The contents of the paper are as follows, section 2 discuss about literature survey of various filtering techniques, section 3 conclusion of the work.

2. SURVEY ON FILTERS FOR REMOVING SALT AND PEPPER NOISE

M.Jayamanmadharao et al (2013) presented a hybrid approach for enhancement of Image quality. Noisiness of the pixels was verified by their intensity values. Threshold was generated by statistical parameter values instead of setting or assigning a threshold for sliding windows. Initially, weighted mean and standard deviation values were calculated and the noisy pixel was determined (when the difference between center pixels and the weighted mean greater than the threshold value). The proposed technique obtained better performances than other available techniques [1].

Karthik et al (2014) proposed a Modified Cascaded Filter for reduce the noise in images. It consists of Decision-Based Median Filtering (DMF) and Un-Symmetric Trimmed-Mean Filtering (UTMF).In standard median filter the defective pixels were replaced by the median value of the surrounding pixels in selected window. In DMF the perfect pixels ware retained and faulty pixels were changed by the median value of nearby pixel. The cascaded connection of DMF and UTMF were used to decrease noise level in images and it results better than previously developed filters [2].

Sajan P. Philip et al (2013) suggested a new algorithm for eliminate the noises and preserve the details in digital images. Decision tree was developed by the following levels: Isolation, Fringe and Similarity Module (SM). In this method the noisy image was given to the decision-tree impulse detector; if the pixel was corrupted by the noise then it was given to the edge preserving filter otherwise directly given as a output image. The Decision Tree Based Algorithm is provided a low computational complexity and less hardware cost [3].

Rutuja N. Kulkarni and P.C. Bhaskar (2014) submitted a Filter for conserving the information of images. This method was constructed by noise detection and noise filtering. The current processing pixel was replaced either by mean or median values depends on the pixel values in the selected window. Decision Based Median Filter provides high PSNR than the existing filters [4].

G. V. Manoj Gowtham and R. Sathish Kumar (2014) introduced a median filter to improve the features of images. Insertion of 0's in row and column of 0 and 256 by method of padding array. This algorithm was designed by noisy candidate detection followed by design process. The performance of design process was adding noise to the image, processing of image and read the output image. This algorithm has been simulated by Modelsim using vhdl. The impulse noise is fully removed by proposed median filter [5] .

Manju Chouhan and C.D Khare (2013) developed a median filter for taking away of unwanted information in images. This algorithm used 4X4 images and processed the window as a 3X3 matrix. The four median values were calculated simultaneously and the time consumption was reduced. This algorithm was

implemented in FPGA using VHDL. Based on experimental results the Median Filter with parallelism achieved better image enhancement factor [6].

Sukhwinder Singh and Neelam Rup Prakash (2014) explained a Modified Adaptive Median Filter for enhance the image features. Rank Order Absolute Difference (ROAD) defines how the intensity of processing pixel is differing from their most neighbouring pixel. The ROAD values were calculated for particular window. Noisy element was determined by comparing the ROAD value and threshold value. Once it determined then the window was considered as a noisy and a filter is applied for noisy window or otherwise the windows were retained. From their simulation results, the Modified Adaptive Median Filter is achieved better PSNR value and image enhancement factor [7].

P. LATHA et al (2014) advanced an Adaptive Algorithm for improving the visual quality of videos. It was well suited for noisy atmosphere. The Adaptive Threshold Algorithm has divided into two parts such as noise detection and adaptive filter. The steps involved in these methods were as follows: noisy video file was converted into noisy frames, noise counter was initialized, the local mean of processed and unprocessed pixels were computed and the threshold value was determined by the edge parameter value and noise corner value. If the processing pixel value was greater than the threshold then it was called a noise free pixel or otherwise noisy pixel. It was changed by mean values of the processing window. The Adaptive Threshold Algorithm yields a better and fast filtering of noise at high densities than the standard and modified version of the Median filter [8].

Okuwobi Idowu Paul and Yonghua Lu (2014) developed wavelet thresholding techniques for image denoising. Wiener filter has removed all the noises in the smooth region but the performances of the edges were very poor. In this method wavelet with wiener filter had preserved more information than the thresholding with wiener filter. Based on their simulated results Wiener filter with wavelet transform provides better performance than the wiener filter with thresholding and Fourier transform. [9].

A.Anilet Bala et al (2014) introduced a new method called image denoising method by curvelet transform and wiener filter. The curvelet transform has consists of four different transforms namely, 2D wavelet transform, 2D fast transform, random transform and ridgelet transform. At First apply a noisy image into a Wiener filter. Next the filtered image was given to the curvelet transform and finally the denoised output was produced. From their results, this algorithm is better than the existing transform techniques and also it is better for YCbCr than the RGB color model [10].

Suman Shrestha and Suman Shrestha (2014) offered a new Adaptive system for image denoising. It was developed by slightly alter the contents of decision based median filter (DMF) and adaptive median filter (AMF). DMF produced the better visual clarity at low noise density levels than the conventional techniques. At extreme noise density levels, the proposed filter gives better image enhancement factor [11].

Gobu.C K and Priya.R (2014) proposed architecture for enhance the features and reduce the faultiness of images. Impulse noise was classified into salt and pepper noise and random valued noise. The random valued noise was removed by the Decision Tree Based Algorithm. Instead of full images odd and even line buffer were

used. So, computational complexity was very less. Thus the Algorithm is implemented in FPGA and proved better performance with less cost [12].

Priya Kapoor and Samandeep Singh (2014) offered an Improved Modified Decision Based Filter to remove extremely dense impulse noise in images. Decision Based filter was replaced the noisy pixel and retained the noise free pixel. Improved Decision Based Switching Median Filter was used global mean for highly faulted images. From their experimental result shows that the proposed filter is produced a good visual quality than the existing filters (standard median filter, switched median filter) [13].

S.Surendhar et al (2014) developed a denoising architecture for extract the details from noises with low power. Here, cloud noise filtering algorithm was promoted to reduce the noise levels while improving the image quality. Cloud based filtering method can obtained better visual quality by parameters used in performance measure. This can be implemented by hardware and it provides low power, less complexity and low hardware cost [14].

S. Athi Narayanan et al (2013) advised an Iteration based Filters for restoring the images. It retains the value of defective pixels in present iteration and processed this by on next. If the noise pixels neighborhood window was totally affected by noise then the neighborhood window size was incremented when defective pixel was found the surrounding value. The same image can be processed by different window size and noise densities and it yields extensive results at the noise density is more [15].

Vivek Chandra et al (2013) proposed an Adaptive and Unsymmetric Trimmed Median Filter for removal of high density salt and pepper noise from the images. This algorithm was keeping features of gray and colour images. This filter changed the defective pixel by a value of mean or a median of all other non-defective pixels in the selected window. The proposed filter is compared in terms of PSNR and IEF with previously introduced filters with different percentage levels of noise. It yields higher Image Enhancement Factor (IEF) and PSNR for images which are affected by more percentage of noises [16].

Abhishek R and Srinivas N (2013) recommended a new Weighted Median Filter (WMF) was best for improving image features and removing noises in images. This filter is to find faulty pixels and then replaced by its variants, where perfect pixels are left as it is. The existing non linear filters were produced better results in low noise level only. So, overcome this disadvantage by proposed Filter. Multiple thresholds were used instead of single threshold for improving the PSNR values. From the comparison table the proposed filter is obtained high PSNR and low MSE values [17].

V. Pranava Jyothy and K. Padmavathi (2013) introduced a filtering algorithm to suppress the noises which are introduced in the channel and also save the detailed information of gray scale and colour videos. The vital role of this algorithm was converted the faulty videos into faultless frames. This efficient algorithm is verified by applying noises in varied levels and compared with already developed filters. The performance of this algorithm is evaluated and it gives best visual quality at the noise levels are low or high [18].

Thresa Paulraj (2013) proposed a Directionality based Filter for eliminate the defective pixels while preserving non defective pixels. The proposed algorithm uses 12 directional nearest neighbour pixel from 7X7 windows and it was compared against the DWM. The proposed filter can be maintained the image quality with less executable time [19].

3. CONCLUSION

This paper provides an extensive literature survey on the different median filters used for reduce the imperfection of elements. The following key conclusions from the survey are.

1. Even though the special filters produced the best performance they resulted in degradation of image resolution.
2. Gaussian filter does not preserve the fine details.
3. The arithmetic mean filter smoothens the local variation in images. This filter cannot remove all the noises from the images and also the image is too blurred.
4. The Weiner filter removes noise better than the Gaussian filter but the image is still blurry.
5. Median filter is synthesized by Xilinx software is computationally more complex.
6. The limitation of median filter is their computational cost. Calculating Median value for every processing window requires 8 clock cycles.
7. The power consumption is more because of the clock cycles (frequency) P=CV^2F.

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