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Image Fusion And Denoising Technique: Survey

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ABSTRACT: This paper focuses the image fusion and impulse noise removal technique in images. During the transmission and reception in digital image processing applications, the image is corrupted from unsecured communication channel and fault in hardware. The multiple sensors sensed the image is corrupted by impulse noise due to unsecure communication. The filtered images are fused to obtain a quality image compared to individually denoised images. The process of adding two or more images into a single image is called image fusion. The various image fusion and impulse noise filter algorithm technique in this paper were survived.

KEYWORDS: Image Fusion, Noise Detector, Noise Reduction, Edge Details, Image Quality.

I. INTRODUCTION

The basic idea to behind in this paper is focus for fusion and denoising of image at good quality from impulse noise corrupted in image due to unsecured communication, electromagnetic interference and device fault. Image processing is mainly used in remote sensing, medical imaging, digital camera vision, military applications and surveillance. Image fusion is an important approach to solve this problem and produces a single image which preserves all relevant information from a set of different sensors. With the development of numerous imaging sensors, multiple images can be simultaneously pictured by various sensors. However, there are many scenarios where no one sensor can give the complete picture. There are several benefits of Multisensor image fusion: wider spatial and temporal coverage, extended range of operation, decreased uncertainty, improved reliability, and increased robustness of the system performance. Image fusion techniques are widely used as a result of storage and transmission requirement for large amount of image set. According to the distribution of noisy pixel values, impulse noise can be classified into two categories: Fixed-Valued impulse noise and Random-Valued impulse noise. The Fixed Values impulse noise is also known as "Salt and Pepper Noise" since the pixel value of a noisy pixel is either minimum or maximum value in grayscale images. The values of noisy pixels corrupted by random valued impulse noise are uniformly distributed in the range of [0, 255] for gray-scale images. Many methods recently have been proposed for the removal of Impulse noise from the image. Some of them employ the standard median filter or its modifications. However, these approaches might blur the image since both noisy and noise-free pixels are modified. To avoid the damage on noise-free pixels, an efficient switching strategy has been proposed in the related works. In general, the switching median filter (Non-linear technique) consists of two steps: 1) impulse detection and 2) noise filtering. It locates the noisy pixels with an impulse detector, and then filters them rather than the whole pixels of an image to avoid causing the damage on noise-free pixels. These filter work with low noise ratios, and are very poor when the noise ratio reaches above 40%.

In this survey, a various image fusion and denoising algorithm performs preserves the image details effectively than other older technique. The design uses two steps for impulse noise reduction and image fusion. In Multisensor sensed the image. But the sensed images are corrupted by impulse noise. The mean filtering does not affect the edges or other small structures in the image. This method is more important for the restoring of corrupted images. After the impulse noise is detected, only those pixels are processed by the filter algorithm and reconstructed the corrupted image in good manner. The restored images are combined to form the good quality image using fusion technique has been survived.

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II. RELATED WORKS

C. Pohl, *et al.* [1] categorizes these techniques into two groups: the color related techniques and the statistical/ numerical methods. The first group comprises the color composition of three image channels in the red, green, and blue (RGB) color space, as well as some more sophisticated color transformations, e.g., hue, intensity, and saturation (HIS) and hue, saturation, and value (HSV). Statistical/numerical methods include all operations that deal with the mathematical combinations of image channels, such as addition, subtraction, multiplication and division (ratio), as well as the combinations of these operations.

Qiang Wang, *et al.* [2] proposed two intuitive schemes: correlation and information deviation schemes—for evaluating the performances of image fusion techniques. The former scheme is a fast and compact version of the quantitative correlation analysis (QCA). The latter scheme is an information deviation analysis. FQCA only needs to run the information correlation calculation once for one image fusion technique. This leads to decrease of the overall calculation compared to the old QCA method, especially when the number of source images increases dramatically. The time simulations of FQCA are better than QCA technique. The different image fusion technologies are evaluated directly based on the source images and their fused images, and in this method is a convenient way of comparing to the system-level simulation, which needs more supports, such as classification technology, tracing algorithm and the methods can compare the image fusion technologies with faster speed, especially when the number of source images increases and the dimension of source images expands.

Nedeljko C, *et al.* [3] a novel metric for evaluation of image fusion algorithms, based on evaluation of similarity of regions in images to be fused with the corresponding regions in the fused image. The similarity of the corresponding regions in an input image and the fused image is measured using a wavelet-based mutual information measure. Experimental results show that the proposed metric's ranking of different image fusion methods is more consistent with the subjective quality of the fused image than the state-of-the-art image fusion metrics. The proposed image fusion metric has a number of IM and parameters (e.g., Amax equal to 3% of the total image area) which can be tuned to make the metric more suitable to a specific image fusion application.

Valdimir S. Petrovic, *et al.* [4] In this proposed method of Multiresolution signal-level image fusion is presented for accurately transferring visual information from any number of input image signals, into a single fused image without loss of information or the introduction of distortion. This new gradient fusion significantly reduces the amount of distortion artifacts and the loss of contrast information usually observed in fused images obtained from conventional multiresolution fusion schemes. This is because fusion in the gradient map domain significantly improves the reliability of the feature selection and information fusion processes. Fusion performance is evaluated through informal visual inspection and subjective psychometric preference tests, as well as objective fusion performance measurements. Results clearly demonstrate the superiority of this new approach when compared to conventional fusion systems.

Sheng Zheng, *et al.* [5] proposed a new image fusion method using the support value transform, which uses the support value to represent the salient features of image. This is based on the fact that, in support vector machines (SVMs), the data with larger support values have a physical meaning in the sense that they reveal relative more importance of the data points for contributing to the SVM model. The mapped least squares SVM (mapped LS-SVM) are used to efficiently compute the support values of image. The support value analysis is developed by using a series of multiscale support value filters, which are obtained by filling zeros in the basic support value filter deduced from the mapped LS-SVM to match the resolution of the desired level. Compared the proposed approach is effective and is superior to the conventional image fusion methods in terms of the pertained quantitative fusion evaluation indexes, such as quality of visual information ($Q^{AB/F}$), the mutual information. The proposed SVT-based method provides a little higher evaluation index values than the conventional image fusion methods including the LAP, UAW, and DWT methods although it has a little lower computation efficiency since it is an undecimated multiscale transform.

Moeness G. Amin, *et al.* [6] proposed a fuzzy logic fusion method is applied to the outputs of the first fusion stage. The performance of the proposed approach is evaluated on through-the-wall radar images obtained using different polarizations. Experimental results show that the proposed approach enhances image quality by producing outputs with high target intensity values and low clutter. In this proposed a two-stage fuzzy fusion (TSFF) approach that combines multiple images without the increased complexity. The images are generated using back projection without applying any high-resolution technique. The proposed approach is also used to enhance the fusion results of

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existing methods. In the first stage, the input images are combined using a pair of image fusion methods, such as additive and multiplicative, or wavelets and PCA. In the second stage, the fuzzy logic method is used to fuse the outputs of the first stage. Through this two-stage fusion, an enhanced composite image with high target intensities and lower clutter levels is produced.

J.Harikiran, *et al.* [7] introduces the concept of image fusion of filtered noisy images for impulse noise reduction. Five different filtering algorithms are used individually for filtering the image captured from the sensor output. The filtered images are fused to obtain a high quality image compared to individually denoised images. This restoration of image data is very likely to find potential applications in a number of different areas.

J.Harikiran, *et al.* [8] proposed the Image Fusion based on local area variance is used to combine the de-noised images from two different filtering algorithms, Vector Median Filter (VMF) and Spatial Median Filter (SMF). The performance of the Image Fusion is evaluated by using a new non-reference image quality assessment; Gradient based Image Quality Index (GIQI) is proposed, by adding the local gradient information to the UIQI metric, to estimate how well the important information in the source images is represented by the fused image. Experimental results show that GIQI is better in non-reference image fusion performance assessment than universal image quality index (UIQI).

Dharmaiah.Devarapalli, *et al.* [9] introduces an image fusion technique for impulse noise reduction, where the fused image will combine the uncorrupted pixels of the filtered noisy images obtained from different sensors. The image captured by different sensors undergoes iterative filtering algorithm, search for the noise-free pixels within a small neighborhood. The filtered images are fused in to a single image using a fusion algorithm by using the quality assessment of spatial domain. The experimental results show the proposed algorithm can perform significantly better in terms of noise suppression and detail preservation in images.

P.V.Lakshmi, *et al.* [10] proposed the Genetic Algorithm is an effective way of quickly finding a reasonable solution to a complex problem. GA's are being used in different optimization and pattern recognition problems such as Function Optimization, System Identification and Control, Image Processing, Robotics, Facial Recognition, Parameter Optimization of Controllers. The filtered images are fused using GA to obtain a high quality image compared to individually de-noised images. In order to better appraise the noise cancellation behavior of our fusion technique, edge detection is performed using canny filter for the fused image. Experimental results show that the proposed method yields very satisfactory results.

Gurudev B. Sawarkar, *et al.* [11] introduces a new hybrid image the concept of image fusion of filtered noisy images for impulse noise reduction and enhancement approach driven by both global and local processes on luminance and chrominance components of the image. This approach based on the parameter-controlled virtual histogram distribution method, can enhance simultaneously the overall contrast and the sharpness of an image. The approach also increases the visibility of specified portions or aspects of the image whilst better maintaining image color. The experimental results have shown the superiority of the proposed approach.

In [12], Tao Chen, Kai-Kuang Ma and Li-Hui Chen (1999) proposed a Tri-State Median Filter for Image Denoising. A novel nonlinear filter, called tri-state median (TSM) filter, is proposed for preserving image details while effectively suppressing impulse noise. The simulation result of the proposed filter consistently outperforms other median filters by balancing the tradeoff between noise reduction and detail preservation. To achieve better results, a camera calibration procedure may be placed before our system. For different values of noise density, optimum threshold range for yielding smallest MSE values and good visual quality can be obtained through similar simulation experiments.

In [13], Zhou wang and David zhang (1999) proposed a new median based filter, i.e., Progressive switching median (PSM) filter to restore images corrupted by salt & pepper noise. This algorithm was developed by two main concepts 1) switching scheme based image filters 2) progressive methods –impulse detection and noise filtering procedures are progressively through several iterations. The Simulation results demonstrate that the proposed algorithm is better than traditional median-based filters and is particularly effective for the cases where the images are very highly corrupted ratios ranging from 5% to 70% and MSE also better than other median based methods, especially when noise ratios are high. It can remove almost all of the noise pixels while preserve image details very well.

In [14], Tao Chen and Hong Ren Wu (2001) proposed a novel adaptive median filter that employs the switching scheme based on the impulse detection mechanism. i.e., Adaptive Impulse Detection Using Center-Weighted Median (ACWM) Filters. The Extensive simulations that the proposed filter consistently works well in suppressing

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both types of impulses (fixed & random valued impulse) with different noise ratios. While still possessing a simple computational structure.

In [15], Tao Chen and Hong Ren Wu (2001) proposed a generalized framework of median based switching schemes, called multi-state median (MSM) filter. By using simple thresholding logic, the output of the MSM filter is adaptively switched among those of a group of center weighted median (CWM) filters that have different center weights. This proposed MSM filter is equivalent to an adaptive CWM filter with a space varying center weight which is dependent on local signal statistics. The proposed extensive simulations MSM filter produces better performance than the other median based filters, being consistently effective in noise suppression and detail preservation for various images corrupted at different noise ratios.

In [16], Crnojevic, Senk and Trpovski (2004) proposed a robust estimator of the variance, MAD (median of the absolute deviation from the median), is modified and used to efficiently separate noisy pixels from the image details and therefore has no sensitivity to image contents. The proposed algorithm complexity is equivalent to that of the median filter and the pixel-wise MAD concept is straight forward, low in complexity, and achieves high filtering performance.

In [17], Raymond H. Chan, Chen Hu and Mila Nikolova (2004) proposed a consists of two-stage iterative method for removing random-valued impulse noise. In the first phase, we use the adaptive center-weighted median filter (ACWM) to identify pixels which are likely to be corrupted by noise (noise candidates). In the second phase, these noise candidates are restored using a detail-preserving regularization method which allows edges and noise-free pixels to be preserved. These two phases are applied alternatively. This Simulation results indicate that the proposed method is significantly better than those using just nonlinear filters or regularization only. Like other medium-type filters, ACWMF can be done very fast. The application of DPVM is the most time-consuming part as it requires the minimization of the functional in robust statistics with applications to early vision .For example, for 30% noise, our method takes 30 times more CPU time than ACWMF. The timing can be improved by better implementations of minimization routines for solving the robust statistics with applications to early vision.

In [18], Hancheng Yu, Li Zhao and Haixian Wang (2008) proposed an efficient algorithm method uses a statistic of Rank-ordered relative differences to identify pixels which are likely to be corrupted by impulse noise. Its consists of two methods 1.RORD impulse detector into many existing filtering techniques, allowing them to detect and properly handle impulse-like pixels in a noisy image. 2. A simple weighted mean filter (SWMF) by using the RORD detector and the reference image to suppress impulse noise, while preserving image details. The time required for our denoising process is less compared with ACWM-EPR, ROAD-TRIF, and ROLD-EPR. Although our algorithm is applied iteratively also much faster, especially when the noise level is high., the simple weighted mean filter offers good filtering performance while its implementation complexity is lower than other filters.

III. RESULT AND DISCUSSION

The various image fusion and denoising filter algorithm of impulse noise reduction for image in this survey were studied. So, in this survey, Median Filter has restored the image with blurring the image details. ACWM Filter has restored the good image only at low noise ratio and poor in high noisy ratio. AMF Filter has restored the good image only at high noise ratio and poor in low noisy ratio compare to ACWM Filter in suppressing both types of impulses (fixed & random valued impulse) with different noise ratios.

IV. CONCLUSION

From the above discussion, conclude the image fusion and impulse noise reduction technique is more valuable in tradition in digital image processing applications and we presented a survey of image fusion and impulse noise reduction algorithm for restoration of corrupted images from unsecured transmission and reception, even though they have several drawbacks for restoration of corrupted image processing and enhancement technique. So, a new image fusion and impulse denoising algorithm is proposing in my future work.

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