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Remove Noise From Movies by Using Hybrid Smooth Algorithm

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ABSTRACT: Hybrid algorithms are increasingly being employed to reduce noise from videos and images. In this study, new hybrid method was used to eliminate noise from movies by first converting the movies to frames, then the frames to images which the suggested algorithm has been applied.
This study aims to create the most noise-free, closest-possible copies of the original movie images in order to produce the purest movie possible. Two traditional images noise removal algorithms were integrated into the suggested algorithm. That is to say, Median filter and the conservative smoothing filter (max &min) algorithms were implemented sequentially by utilizing Matlab software version (2016R).The outcomes of this research improve the proposed algorithm's efficacy when compared to the behavior of currently applied existing algorithms for removing noise from images. In order to evaluate our process in this study, a movie with more than 300 frames was used. Frame models were chosen, and the algorithms were then applied to the frame images. The results show that the proposed hybrid algorithm performed much better than the median and conservative smoothing algorithms in all of the selected frames while tested statically by utilizing both criteria Root Mean Square Error (RMSe) and Normalization Correlation Coefficient (NCC) values which improve the hybrid algorithm the best for removing noise from sample frames.

Keywords: Movies, Noise filters, Hybrid Algorithm, Matlab .

1. INTRODUCTION

Due to the great development taking place in the methods of using computers in various areas of life, it has become necessary to use this development in addressing many complex and related issues in our daily lives, such as issues of medicine, space, defense, communications research, image processing, and visual films. From problems such as traffic regulation[1] .Researchers have tried to find many techniques and methods to reduce noise that pollute digital images and digital video, as they have developed many effective algorithms in this field. Kalb did a research in 1991 in which he used a technique called "coring" that led to the reduction of noise for video images [2], He stated that the coring succeeded in reducing the noise. He stated that the coring function was generated by using the theoretical results and then applied and tested on a set of images .While, James Ellenberger presented in 2010 a paper "Noise Reduction in Digital Photography - Exploring the State of the Art". In it, he mentioned that a great effort has been made in recent years in developing algorithms to reduce the noise that accompanies all digital images, In order to distinguish the original image from the noise that occurred on it [3].

In 2011, Indian researcher Ranjeet Kaur Sandhu and Indian researcher Palvinder Singh Mann presented a paper entitled "Spectral Field Filter for Noise Reduction in Digital Image Used in Finite Time Applications". In it, they presented a brief summary on reducing noise from digital images and mentioned that the digital image is polluted by different types of noise during the process of transmission and image acquisition, and that noise is an unwanted signal or point that may be added or subtracted during the transmission process ad this pixel degrades the value of the unwanted image [4].

The research aims to remove or reduce noise from video files after converting them into a set of frames, which in turn represent images independent of one another, then use smoothing algorithms and apply them to these images in order to improve them, and several methods are adopted in the smoothing process in order to show the best of them And the advantages of each other from others in terms of removing distortions (noises) and clarifying some of the unclear parts of these images, thus obtaining more accurate and pure images [1], and then the process is reversed by returning the images to a set of frames and displaying these (frames) as a movie Without any distortions (noises).

2 . MATERAILS and METHODS

The first traditional filter is the Median filter. this filter is used to decreasing the noise in the image . the idea of the filter depends on the neighbors of the current pixel [5]which represents the perimeter of it with 9 pixels (3x3 window) Fig1, after arranging all the value of the 9 pixels whether ascending or descending [6], we take the middle pixel value and give it to the current pixel to be improved .

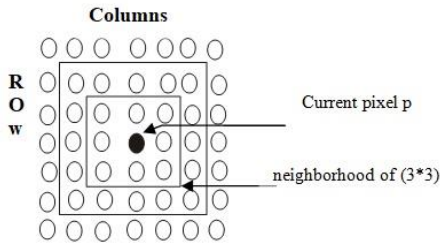

FIGURE 1: map for filter processing with image pixel

The second traditional filter is the Conservative Smoothing filter. This filter acts as the median filter in terms of dealing with the neighbors pixels , but it works on the assumption that the noise has a high spectral frequency, so it works to reduce high frequencies by a local process that makes the density of each pixel strongly homogeneous with its nearby neighbors [7]. The window with (3x3) pixels around the current pixel that will be enhanced is determined to extract the maximum value and the minimum value from among the 8 pixels (without the value of the current pixel), then if the value of the current pixel within the range, i.e. between the maximum and minimum value, then its value does not change, that is , it comes out in the resulting frame without change. But if the value of the current pixel is greater than the max value then its value is changed to the max value , and if the value of the current pixel is less the minimum value, its value is changed to the smaller value.

The proposed hybrid method is the conservative median smoothing filter. This filter also depending on his neighborhood pixels with window of (3x3) pixels around the current pixel, but by integrating the previous filters (the median and conservative smoothing filters) [1] this is by extracting the 8 neighborhoods pixels to the current pixel which is the goal of enhancement then extract the maximum and minimum values between the 8 pixels ,if the value of the current pixel is within the range then the filter dose the work of the median filter, which means that arranged all the value of the 9 pixels whether ascending or descending , then give the middle pixel value to the current pixel and if the current pixel value is greater than the max value then its value changed to the max value also if the current pixel value is less than the minimum value it will be changed to the minimum value[8], here the filter dose the work of the conservative smoothing filter.

As clarified in Fig2 , Obtaining the digital image, either through the scanner or from the Internet, and the image may contain noise resulting from the transfer process or during the imaging process for the purpose of applying the algorithm to it ,then read all its pixels, and is in the form of an array denoted by p which represent the input point to be optimized and determined p(i,j). Such as all the points adjacent to it and surrounding it are determined in the form of a (3*3) window[5], as follows:

{p(i-1,j-1),p(i-1,j),p(i-1,j+1),p(i,j-1),p(i,j+1), p(i+1,j-1),p(i+1,j),p(i+1,j+1)}.

The adjacencies are arranged for the point that the optimization is to be done, and it is among them, then determine the largest value of those neighbors and put them in the variable max, then determine the lowest value of the neighborhoods and put them in the variable min[3],[9].

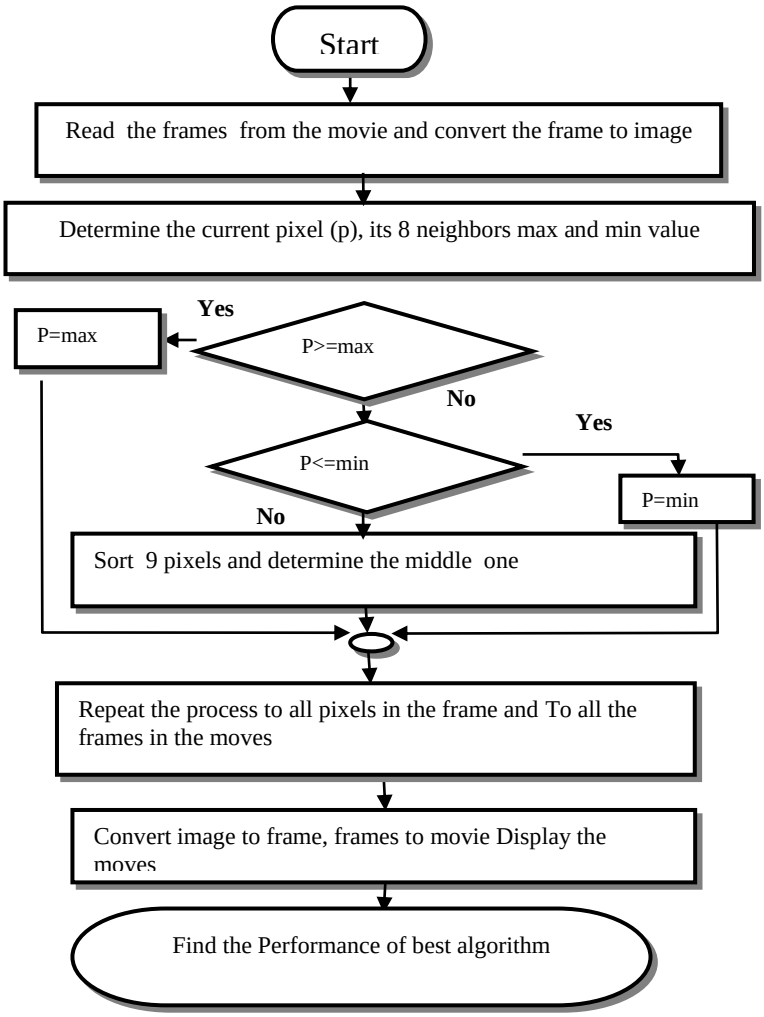

FIGURE 2: Flow chart for proposed algorithm

3. RESULTS and DISCUSSION

As a practical application, a video movie was converted into a set of frames to be displayed as follows as shown in Fig3.

FIGURE 3: Input data set of frames converted from movie as separated images

Thus, The three algorithms were applied to this movie when the window size of the neighborhoods of the point to be optimized was (3 * 3), as the number of points for the neighborhoods is 9 points, including the same point, and the

scales are calculated on this basis. Measurements are made on the images using different amounts of noise, the noise type was Salt & pepper with the amount of noise (0.05) and (0.1) as shown in the results display figure that show the images that contain noise Then display it after applying each algorithm to it with the aim of filtering it from noise, as clarified in Fig4.

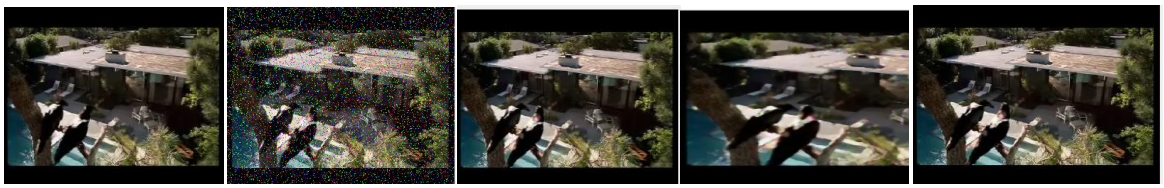

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FIGURE 4: Out results for the proposed algorithms

Whereas, the out results illustrated the implementation for the proposed algorithms in this study that explain the implementation which is illustrated on one of the input frames .That is to say,
a : the original image of the movie before containing the noise
b : the image of the movie after containing the salt & pepper noise, 0.1
c : Applying the Conservative smoothing (Max & Min) algorithm to image and 3*3window
d : Applying the Median algorithm to image and 3*3window
e : Applying the Hybrid smoothing algorithm to image and 3*3window.

4 . PERFORMCE CRETERIA

Measuring higher enhance Image (frame) quality can be guaranteed when less noise detect after the process to the noisy image and gets an image as a result closer to the original image[10]. Here we used one of the most popular quality measurements available for noise removal [11]. the measurement is Root Mean Square error (RMSe). The RMSe obtained by subtract the pairs images , original image and the result image after processing by the equation (1). After the process finished will calculate RMSe_the less value indicate that the result image is closer to the original image which means that the filter is good in remove noise from the image.

$$RMSe = \sqrt{\frac{1}{m*n}\sum_{c=0}^{n-1}\left[I'(r,c)-I(r,c)\right]^2} \qquad (1)$$

Where , is I refre to the orginal image , I' indicate to out result image
To explain the RMSe results we display a specific frames of a video movie, the movie consist of 513 frames . Number of frames have been selected to display and measure the RMSe Metric as described below in table (1).

Table 1-. Values of RMSe for noise with(3*3) window

Image(frame)	Conservative smoothing filter		Median filter		Hybrid filter	
Noise value	0.05	0.1	0.05	0.1	0.05	0.1
frame 1	6.228	6.231	5.074	5.157	4.811	4.941
frame 2	7.139	7.246	5.088	5.143	4.942	5.021
frame 3	7.312	7.322	4.990	5.501	4.844	5.380
frame 4	6.590	6.601	4.426	4.126	4.662	4.716
frame 5	8.913	9.035	7.492	7.593	6.669	6.729

To show the quality of the algorithms used to remove noise, another measure unit were illustrated (NCC) Normalization Correlation Coefficient [12].The simple correlation coefficient is a measure of the degree of correlation or commitment between the two independent variables. It is used in several estimates, including a- Point estimation b- Period estimation [13]. And that the value of the correlation coefficient ranges from -1 to +1, meaning that $-1 \leq r \leq +1$, [14] . In our application, the correlation coefficient scale was used to compare the points of the two images produced after optimization and the original, and to note the extent of the correlation between them as mentioned in equation(2)[10], the results of Ncc as shown in table (2) .

$$NCC = \frac{\sum x, y^{P(x,y)P'(x,y)}}{\sum x, y^{P^2(x,y)}} \quad (2)$$

Table 2-. NCC values for noise with (3*3) window

Image(frame)	Conservative smoothing filter		Median filter		Hybrid filter	
Noise value	0.05	0.1	0.05	0.1	0.05	0.1
frame 1	0.873	0.871	0.890	0.889	0.972	0.971
frame 2	0.995	0.990	0.992	0.986	0.997	0.993
frame 3	0.804	0.798	0.832	0.829	0.856	0.847
frame 4	0.865	0.853	0.890	0.858	0.868	0.879
frame 5	0.915	0.908	0.954	0.948	0.975	0.962

The variation noise resources make the image enhancement process very challenge and so on to the movies. Since images are very important in our lives, it has become necessary to find good filters to remove noises. By following the practical results in the scale tables, we look at the amount of RMSe in table (1) , the best value for the RMSe metric should be closer to the value zero considering that the RMSe equation is to subtract an result image from original image and indicate the difference between them , the more the difference is small, i.e. close to zero, that is , there is no difference in the image obtained after removing the noise, meaning that the filter was good , so in table (1), the type of noise Salt & pepper with amount (0.05) and (0.1) , We find that the best results for the value of the RMS were for the Hybrid algorithm in 4 frames (frame 1,2,3,5) and 1 frame to median algorithm (frame 4), while the lowest values were for the Conservative smoothing filter ,figure (4) . This demonstrated that the Hybrid algorithm is better at dealing with Salt & pepper noise, we also found that the results value for the hybrid filter and median filter are so closer which is normal because the nature of the work of the hybrid filter comes from the work of median filter , we also did not see any strange values in the results value of all filters (we mean that there is no significant change in the resulting image, but only a change in the edges within the image), because no external values were inserted into the image frame, but the work of all filters is within the same image values.

The same ratios were also observed for the correlation coefficient(Ncc) in table (2), in this metric the value is better as close as possible to the value one, so the best values those of the Hybrid filter results in 4 frames (1,2,3,5) and 1 frame for median filter.

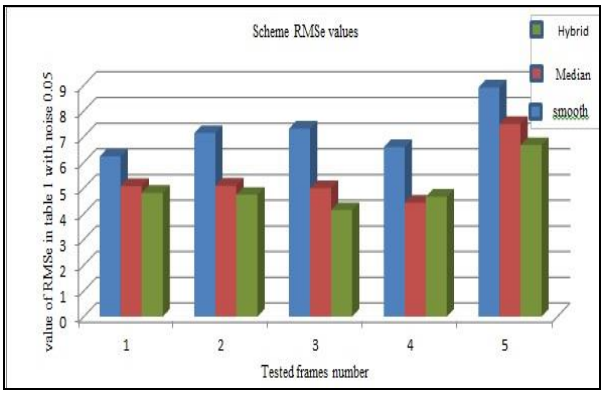

FIGURE 5: Evaluating graph for the RMSe values

5 . CONCLUSION AND FUTURE WORK

The purpose of this study is to obtain the performance of hybrid algorithm to eliminate the noise from video frames and images .In addition to, the efficiency of enhancement filtering methods which in turn has an active role to gain an accurate result through combined two traditional filters to produce hybrid filter . Furthermore, the statistics measurement improve that the calculations for the sample frames more clear and better than traditional filters.

According to that , for the future work , authors will implement a comparative study for different hybrid enhancement methods by using big data .

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CONFLICTS OF INTEREST

None

REFERENCES

[1] P. Prashant and R. Sawant, "An Image Processing based Techniques for Noise Remove in Noisy Image during Engineering and Medical Applications," vol. 4, no. 11, pp. 561–564, 2017.
[2] A. J. Kalb, "Noise Reduction in Video Images Using Coring on QMF Pyramids," 1991.
[3] C. Miao, "Research on denoising processing of computer video electromagnetic leakage reduction image based on fuzzy degree," *Eurasip J. Image Video Process.*, vol. 2019, no. 1, 2019, doi: 10.1186/s13640-018-0405-4.
[4] Abhishek R and Srinivas N, "An Advanced Technique for Removal Of Salt & Pepper Noise In Images," *Int. J. Eng. Comput. Sci.*, vol. 2, no. 2, pp. 2319–7242, 2013.
[5] A. E. Ilesanmi and T. O. Ilesanmi, "Methods for image denoising using convolutional neural network: a review," *Complex Intell. Syst.*, vol. 7, no. 5, pp. 2179–2198, 2021, doi: 10.1007/s40747-021-00428-4.
[6] H. H. Ali, "Development Of Traditional Algorithms and Make a Hybrid Algorithm to Denoising The Color Images", Al-Rafidain Journal of Computer Sciences and Mathematics, vol. 1, pp. 35–47, 2012.
[7] K. Huang and H. Zhu, "Image Noise Removal Method Based on Improved Nonlocal Mean Algorithm," *Complexity*, vol. 2021, 2021, doi: 10.1155/2021/5578788.
[8] Y. Zhou, H. Cao, and T. Guo, "A Hybrid Algorithm for Noise Suppression of MEMS Accelerometer Based on the Improved VMD and TFPF," *Micromachines*, vol. 13, no. 6, 2022, doi: 10.3390/mi13060891.
[9] A. M. Hambal, Z. Pei, and F. Libent Ishabailu, "Image Noise Reduction and Filtering Techniques," *Int. J. Sci. Res.*, vol. 6, no. 3, pp. 2319–7064, 2015, doi: 10.21275/25031706.
[10] P. Sun, C. Wang, M. Li, and L. Liu, "Partial Differential Equations-Based Iterative Denoising Algorithm for Movie Images," *Adv. Math. Phys.*, vol. 2021, 2021, doi: 10.1155/2021/8176746.
[11] S. Rahman, M. M. Rahman, M. Abdullah-Al-Wadud, G. D. Al-Quaderi, and M. Shoyaib, "An adaptive gamma correction for image enhancement," *EURASIP J. Image Video Process.*, vol. 2016, no. 1, p. 35, 2016, doi: 10.1186/s13640-016-0138-1.
[12] S. Garg, R. Vijay, and S. Urooj, "Statistical approach to compare image denoising techniques in medical MR images," *Procedia Comput. Sci.*, vol. 152, no. January, pp. 367–374, 2019, doi: 10.1016/j.procs.2019.05.004.
[13] A. A. M. Suberi, W. N. W. Zakaria, A. Nazari, R. Tomari, N. F. N. Fuad, and M. N. H. Mohd, "Comparative performance of filtering methods for reducing noise in ischemic posterior fossa CT images," *Procedia Comput. Sci.*, vol. 157, no. 2018, pp. 55–63, 2019, doi: 10.1016/j.procs.2019.08.141.
[14] A. Nazir, M. S. Younis, and M. K. Shahzad, "MFNR: Multi-Frame Method for Complete Speckle Noise Removal in Ultrasound images Using KDE," *Preprints*, vol. 14, no. 8, pp. 6–11, 2020, doi: 10.20944/preprints202006.0090.v1.