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Image Denoising using Non Local Algorithm

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Abstract: The technology to denoise an affected Image commonly known as Image Denoising technique (IDT) is the most useful and impactful technique used for improvisation of graphics and its assets. Further added with Non-local mean method which is one of the peak performing method. It actually modifies each and every pixel by the mean pixels including nearby neighborhoods. The Non-Local Mean Method actually tests on different types of noised images and it has extremely useful results. The output represents that it decreases the noise and improve its Clarity and performance.

Keywords: Gaussian Noise, Image Denoising, Non-Local Means

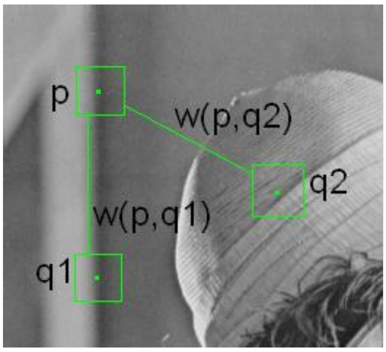
I. INTRODUCTION

Denoising of an image has a basic problem in the field of image processing. This paper gives different techniques for removal of noise and gives us to compose which method will supply the credible estimate of real image given a version which is degraded[3]. Denoising of an image [11] is one of the most important topics for research and development in the field of processing an image digitally. It is important because it assure the effectiveness of other image improvisation algorithms in the same field like registration and segmentation of an image. In the digital image processing noise removal is a common process in order to suppress various types of noises such as Salt & Pepper noise, Gaussian noise, Speckle noise that might have impaired an image during transmission & acquisition[9].Removing of noise or reduction of noise can be done by filtering on an image[5].In image processing, the denoising has been a crucial and old trouble for many dicker [8]. Buades, Coll and Morel discovered non-local means algorithm [1]. They defined that this algorithm has a very fine denoising than others. It actually used a set of predetermined filters and reduced the influence of areas to denoise a pixel. But the weight is computed from the high dimensional space. The NLM (Non-local Means) method swaps every pixel by the weighted mean pixels with nearby neighborhoods. The weighting function is determined by the similarity between neighborhoods.

But one of the major problems is to find the weighting function. In this research, it gives a new and unique weighting function and getting an improved NLM. This research, perform experiments to compare the weighting function against the original function, and it proves that the improved non-local algorithm outperforms the original non-local means method.

II. NONLOCAL MEANS ALGORITHM

In this, full review of non-local means method is written. In the NLM algorithm, the method first computes the similarity between the window centered on a pixel the noisy image and the window centered on other pixels in the same noisy image. This method uses the similarity to find the function of weighting.



The above fig. set a demonstration of self-similarity in an image. P and q1

Pixels have similarities in neighborhoods, but pixels p and q2 don't have similar Neighborhoods. That's why, ql pixels will have a more stronger effect on the Denoised value of p than q2.

Each p pixel of the non-local means denoised image is calculated by the formula:

$$NL(V)(p) = \sum_{q \in V} w(p,q)V(q) \quad (1)$$

Where V = noisy image and weights w (p,q) fulfil the conditions :

$$0 \le w(p,q) \le 1 \text{ and } \sum_q w(p,q) = 1$$

Each and every pixel is a weighted mean of all the pixels in the image. The weights are depends on the similarity between the neighborhoods of pixels p and q. for e.g.in fig.1 above the weight w(p,q1) is much greater than w(p,q2) because pixel p and pixel q1 have same neighborhoods and pixel p and pixel q2 do not. If p is the

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total noise density then salt and pepper noise of density is p/2.[8] for computing the similarity, a neighborhood must be explained. Let N_i is the square neighborhood centering with pixel i and with a user-defined radius Rsim.
. It can be caused by pixels which are not living, analog-to-digital converter errors, and bit errors in transmission [9]. To find the similarity within two neighborhoods use the weighted sum of squares difference between the two neighborhood sort by a formula:

$$d(p,q) = \|V(N_p) - V(N_q)\|_{2,F}^2$$

F = neighborhood filter which is applied to the (difference of the neighborhoods)^2. The weights can computed by the formula:

$$w(p,q) = \frac{1}{Z(p)} e^{\frac{-d(p,q)}{h}}$$

Z(p) is the normalizing constant defined as

$$Z(p) = \sum_q e^{\frac{-d(p,q)}{h}}$$

h = weight-decay control parameter
As already described about F that it is the neighborhood filter with Rsim.
The weights of F are computed by formula:

$$\frac{1}{Rsim} \sum_{i=m}^{Rsim} 1/(2*i+1)^2$$

Where m = weight's distance from the centre of the filter. The filter provide more weight to pixels which are near the centre of the neighborhood and not as much weight to pixels that are near the neighborhood's edge. The centre weight of F and the pixels with one's distance has the equal weight. In spite of the unique shape of the filter, the filter F's weight do sum up to one.

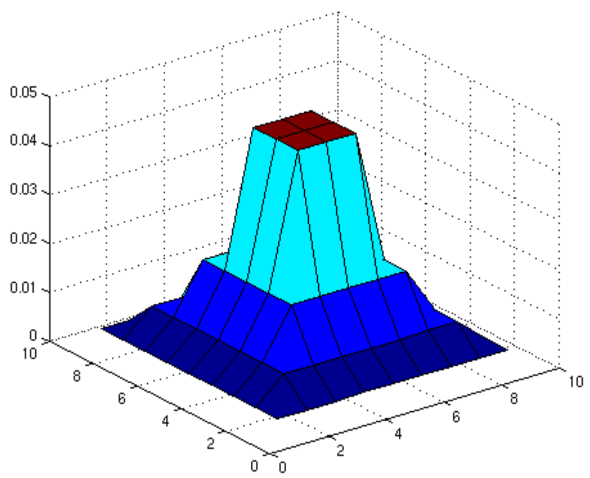

Figure 2: Shape of F(filter) with Rsim = 4.

Equation (1) from above have a special case when q = p because the weight w(p,p) can be much greater than the weights from each and every other pixel in the image.
To prevent pixel p from over-weighing itself let we consider that w (p,p) equal to the other pixels having maximum weight. Mathematically,

$$w(p,p) = max\{w(p,q) \mid p \neq q\}$$

Non-local Means Parameters:
Non-local denoising algorithm [12] is compared to original non-local means algorithm. Now we talk in-depth about algorithm which is non-local for removing noise from digital image was given.

NLM has three parameters
1. h, is the weight-decay control parameter that controls where the weights lies on the decaying exponential curve. If h is too low, enough noise will not be removed. If h is too high, the blurry image is produced. When an image with white noise with a standard deviation of sigma□ h should be set between 10sigma and 15sigma.

Rsim which is the neighbourhoods' radius used to find the two pixels similarity. If Rsim has very large value of radius, no neighbourhoods will be found which is similar or common, but if it is too short, too many similar or common neighbourhoods will get common values for Rsim and they are 2 and 3 to give size of neighbourhoods are 7x7 and 9x9.

3. Rwin, is a search window's radius. In a window, it will decreased to a weighted average of all pixels. The window is centred at the current pixel that need to be calculated. Rwin's constant value are 7 and 9 to give size of windows are 15x15 and 19x19 and the algorithm will accept a weighted average of 15^2 pixels rather than for a NxN image of a weighted average of N^2 pixels.

III. CONCLUSION

Gaussian filtering is not performed good on all the cases. The method noise for the Gaussian filter has detail and contained extensive structure from the image. The Wiener filter performance is equivalently better than the Gaussian filter. As images were still have noise in the form of blurry image but by this method more noise was being removed and similar like Gaussian Filter it also has detail and structure from image.

The SUSAN filter performance is at the top than the above two. When the image has less noise The SUSAN filter is used to perform good. Although, in spite of the good results the method noise still contained some image's structure. The NLM (Non-Local mean) method performance is eventually very good and accurate and has good job of preserving edges than other methods. On periodic textures like the striped pants from the Barb test case, it is best. In case of Camera and Walter where there

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was no noise, the denoised image looked clear and without any disruption. For NLM method, the noise method contained little structure from the image specially when we are talking about all test cases. The NLM algorithm removed noise and preserved its details.

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REFERENCES

[1] Buades, A., Coll, B. and Morel, J.M. (2011) Non-Local Means Denoising.
[2] Bayram, I. and Kamasak, M.E. (2012) Directional Total Variation. IEEE Signal Processing Letters, 12, 781-784.
[3] Kanika Gupta, S.K. Gupta, "Image Denoising Techniques – A Review paper", International Journal of Innovative Technology and Exploring Engineering (IJITEE), March 2014, Vol.2, Issue-4.
[4] Bai Jian and Feng Xiangchu, "Image Denoising and Decomposition Using Non-convex Functional",Chinese Journal of Electronics, Vol.21, No.1, Jan. 2012.
[5] Chrtylda Angelin Hannah. J, Natheldha Mary Navina. Sis, "A Survey on Image Denoising", International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622, Vol. 3, Issue 1, January- February 2013.
[6] P. Coupé, J. V. Manjón, M. Robles and D. L. Collins, "Adaptive multiresolution non-local means filter for three-dimensional magnetic resonance image denoising", IET Image Processing, vol. 6, no. 5, (2012)
[7] Wu Y., Tracey B. and Noonan J.P., "James-Stein Type Center Pixel Weights for Non-Local Means Image Denoising", arXiv:1211.1656v1 [cs.CV] 7 Nov 2012
[8] Jena B., Patel P., Majhi B., Tripathy C.R., "Image Denoising Techniques For Salt And Pepper Noise., A Comparative Study", International Journal Of Research In Computer Applications And Robotics, ISSN2320-7345, Vol.1 Issue.8, November 2013
[9] Kaur J., Kaur R., "Digital Image De-Noising Filters A Comprehensive Study", International Journal Of Research In Computer Applications And Robotics, ISSN 2320-7345, Vol.2 Issue.4, April 2014
[10] Liu, Y.L., Wang, J. and Chen, X. (2008) A Robust and Fast Non-Local Means Algorithm for Image Denoising. Journal of Computer Science and Technology.
[11] Dauwe, B. Goossens, H.Q. Luong and W. Philips, " A Fast Non-Local Image Denoising Algorithm.
[12] Lebrun M., Leclaire A., "An Implementation and Detailed Analysis of the K-SVD Image Denoising Algorithm", Image Processing On Line, 2 (2012).