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Comparison Of Performance In Image Restoration By Time And Frequency Domain Techniques

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Abstract: *Image Processing is a practice of signal processing aimed at which the input is an image, for instance a photograph or video frame. Also the output of image processing might be either an image or some set of characteristics or restrictions related to the image. An image is defined as an array or a matrix, square pixel decided in rows and columns. Greatest image-processing methods involve giving the image as a two-dimensional 2-D signal and applying normal signal processing methods to it. Image processing characteristically refers to digital image processing. The arena of digital image processing mentions to processing digital images by incomes of a digital computer. It comprises many methods they are Image division, Image credit, Image Differencing and Transforming, Digital Compositing, Color Corrections and Image Restoration, etc. In this thesis, a comparison of performance of image restoration is presented to see the behavior of different filters along with diverse coding scheme. Image de-noising is the considered as part of the thesis. In de-blurring, sightless de-convolution is examined. Out of the numerous classes of sightless de-convolution methods, Non parametric approaches based on Image restraints are studied at better depth. A new procedure based on the wavelet method is developed. The algorithm brands use of spatial domain restraints of non-negativity and provision.*

Keywords: *restoration, histogram, PSNR, MSE, DWT*

I. Introduction

Image Restoration is the procedure of procurement the original image from the tainted image assumed the knowledge of the debasing factors. In DIP Digital image restoration is a ground of engineering that revision methods used to make progress of original scene from the tainted images and observations. Methods used for image restoration are concerned with towards demonstrating the degradations, typically blur and noise and smearing various filters to acquire an approximation of the unique scene. There is a diversity of reasons that might cause degradation of an image. Digital image restoration is one of the key arenas in today's DIP (Digital Image Processing) due to its extensive area of requests. Commonly happening degradations comprise blurring, gesture and sound. Blurring can be shaped when object in the image is outdoor the camera's complexity of field former during the contact, whereas gesture blur can be produced when a thing moves comparative to the camera throughout an exposure. This thesis speech the problem of image restoration when seasoning noise is substantial. It is proposed to enhance the segmentation step in the joint framework that unites classical image segmentation and image restoration. In particular, we implement robust version of a recently projected. In particular, it is implemented robust varieties of a recently projected variation framework of semi-blind image de-blurring. As can be seen from fig 1 that the basic idea of handling significant image noise is to have a strong image segmentation. Dependable on image segmentation or equivalently edge detection is the key for adaptive image de-convolution where true edges are de-blurred while noise is repressed in other region.

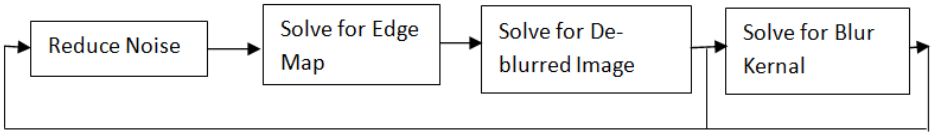


Fig1 Block Diagram of Noise Cancelation

1.1 Noise In Image:

Noise is presented in the image at the time of double acquisition or transmission. Dissimilar factors may be responsible for overview of noise in the image. The amount of pixels dishonored in the image will decide the quantification of the noise. So the primary sources of noise in the digital image are as follows:
a) The imaging sensor may be pretentious by environmental conditions throughout image acquisition.

b) Inadequate Light levels and sensor temperature may familiarize the noise in the image.
c) Intervention in the transmission channel may also crook the image.
d) If dust particles are existing on the scanner screen, they can also acquaint with noise in the image.

Our focus is to remove certain types of noise. So we classify certain kind of noise and apply different algorithms to eliminate the noise. And image noise can be classified as Impulse noise also known as Salt-and-pepper noise, Shot noise, Quantization noise, uniform noise, Amplifier noise (Gaussian noise), Film grain, on-isotropic noise, Periodic noise and Multiplicative noise (Speckle noise).

1.2 De-Noising Filters:

Filtering is a method for modifying or ornamental an image. Spatial domain process or filtering the preserved value for the current pixel is contingent on both itself and surrounding pixels. Therefore image Filtering is a neighborhood operation, in which the custody of any given pixel in the output image is unbendable by applying some algorithm to the principles of the pixels in the neighborhood of the unswerving input pixel. A pixel's environs is some set of pixels, clear by their locations comparative to that pixel. In this paper I will talk about spatial domain procedures. Front or filters will be demarcated. The universal process of complication and correlation will be obtainable via an example. Also flattening by linear filters such as box and idiosyncratic average filters will be announced.

II. Related Work

Gonzalez,R.C., and Woods, R.E. In their paper "Digital Image processing ", [1] offered a halftone image restoration by means of Least Mean Square algorithm with naive Bayes classifier. The authors have advanced a least mean-square filter for cultivating the robustness of the removed features, and employed the simple Bayes classifier to verify all the removed features for classification.

Chen G.Y,Bui T.D,Krzyzak A.[2] in "Image denoising with neighbour dependency and customized wavelet and threshold" projected an image compression method by means of Multilevel Image restoration Coding used for image classification. Feature vectors are taken out with four levels of Image restoration coding to categorize the several categories of images for presentation comparison in six different colour spaces.

Raman Maini, et al [3] in "A Comprehensive Review of Image Enhancement Techniques," suggested a variable image restoration coding through optimal quad-tree segmentation to compress still images. The misrepresentation of the reconstructed image is minimal. Bit plane decrease scheme is practical to achieve lower bit rates.

Jeba Akewak," Digital image processing and image restoration", [4] recommended a least mean square error technique for Image restoration Coding. The compression ratio is enhanced by coding only half of the bits in the IMAGE ENHANCEMENT bit plane of every block; the other half will be inserted at the receiver. The future interpolative algorithms minimize the errors caused by the two level quantizer.

MYAN-xin SHI, CHENG Yong-mei1 et al [5] in "Adaptive Filter for Color Impulsive Removal Based on the HSI Color Space" labelled an image restoration scheme based on instant preserving image restoration coding. To decrease the bit rate of the traditional restoration arrangement, the block search order coding method is employed to exploit the resemblance among neighbouring image blocks. In adding to that, smooth blocks (blocks having same strength values) and complex blocks (blocks having diverse intensity values) are treated using different methods.

Sangita S L, et al [6] in "A brief review on image restoration in image processing" established an adaptive IMAGE ENHANCEMENT algorithm known as ESPO, Equal Sign Position Optimization for optimal pixel classification. Combination of the ESPO algorithm into conservative Absolute Moment Image restoration Coding attains minimum Mean Square Error.

S. Oudaya Coumal, P. Rajesh, and S. Sadanandam, Image restoration filters and image quality assessment using reduced reference metrics, Sri Manakula Vinayagar Engineering College, India.S. Oudaya Coumal, A et al, [9] in "Image restoration filters and image quality assessment using reduced reference metrics" anticipated an IMAGE ENHANCEMENT method which uses a difference enhancement technique.Xudong Jiang, Senior Member, IEEE, Iterative Truncated Arithmetic Mean Filter and Its Properties.Xudong Jiang et al, [10] in "Iterative Truncated Arithmetic Mean Filter and Its Properties" obtainable an Image restoration Coding for real-time image coding at reasonable bit-rate, with low calculation and storage demands.

Weiwen Lv, Peng Wang, Bing An, Qiangxiang Wang, Yiping Wu, A spatial filtering algorithm in low frequency wavelet domain for X-ray inspection image denoising, Institution of Materials Science and Engineering, Wuhan, ChinaWeiwen Lv et al, [11] in "A spatial filtering algorithm in low frequency wavelet domain for X-ray inspection image denoising, Institution of Materials Science and Engineering" suggested a colour image image restoration coding for compression in which the truncated errors are condensed to achieve better quality for the colour images.

Ramana Rao, et al, [12] anticipated a new BTC algorithm using look-up tables. This algorithm manufactured images with better independent quality.

Huang, C. S. et al, [13] offered a Hybrid IMAGE ENHANCEMENT in which a universal codebook using Hamming codes with a differential pulse code modulation (DPCM).The idea of the paper emerged from reference [l4] by **Jyoti Rani and Suberjeet Kaur** (2014) IN "Image Restoration Using Various Methods and Performance Using Various Parameters". In this the Restoration Techniques for image is used for the data communication purpose and the encoding of data is done using quasi group technique.

III. Proposed Method

In this proposed work to establish the de-nosing procedure of salt and pepper noise of several images by numerous methods. Numerous de-noising algorithms have been future to recuperate a noise tainted image. However, most of them cannot well convalesce a heavy noise tainted image with noise fatness above 80 or 90%. So in this work, a new approach is proposed to professionally eliminate background noise by perceiving and adjusting noisy pixels in an image. And if the middle pixel of a local window is trafficked as noisy, this center pixel is take the place of by a weighted median worth on an optimal way, enabling impulse noise to be disconnected. Equally, the center pixel is reserved unaffected when it is confidential to noise-free, soft the quality of re-established image being well upheld. Investigational consequences show that the future scheme cannot only jobwise suppress high-density character noise, but also can well arrangement the full information of an image.

Proposed Algorithm

1. Defining a window of 3x3
   x = padarray(x,[3 3],'replicate');
2. Change it to double precision
   x = double(x);
3. For a particular window scanning of all the intensities
   for i=4:1:xlen-3
   for j=4:1:ylen-3
4. Check for lowest value
   if N(i,j) == 0
   s = 1;
5. Check for highest value
   while sum(g(:)<1) && s<smax
   s = s+1;
6. Updating the intensity value within window
7. Wavelet transform of the output of input filter
   for i=4:1:xlen-3
   for j=4:1:ylen-3
8. Inverse Wavelet transform
9. Apply the same procedure again
10. Get the new matrix and change it to uint8
    y = uint8(y(4:xlen-3,4:ylen-3));

To get the better result I have applied CLAHE FILTER, HE filter (histogram equalization), Average filter, Wiener filter, and median filter respectively to achieve a better result. After applying median filter, I have applied my proposed algorithm to remove salt and paper noise form the corner of the image which was not removed by the earlier filter. By doing this the MSE of the image is reduced and the PSNR value is increased this method is also referenced to time and frequency domain technique.

IV. Result And Analysis

The spatial domain filters have so many applications in numerous fields. These filters help in eliminating the various types of noises from the tainted or degraded images. The filters have numerous efficient noise removing competences. Each filter implements different operation on different kind of noise efficiently. After getting an input image we apply salt and pepper noise and the remove it with various methods to show the comparison and apply the proposed method to give a better result than the others.

Test Image

V. Results

Noisy Input image

HE FILTER

AVG FILTER

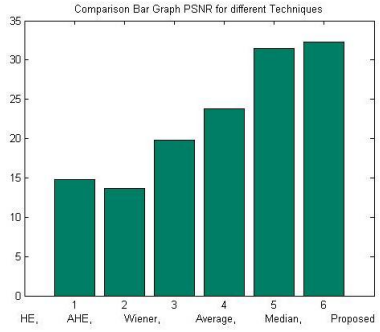
CLAHE

WIENER FILTER

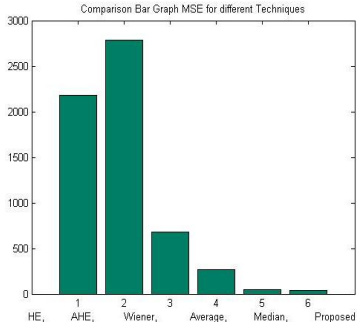
MEDIAN FILTER

PROPOSED FILTER

Histograms of the Output Results



PSNR Comparison of different technique



MSE Comparison of different technique

FILTER	CLAHE	HE	AVERAGE	WIENER	MEDIAN	PROPOSED
MSE	2786.4733	2177.7295	268.45426	81.2327	45.87453	8.8279
PSNR	13.6803	14.7508	23.8421	19.7978	31.5151	32.2394

VI. Conclusion

It is clear that for input image proposed method is giving the best result among all other image restoration technique used previously. It's been observed that there is an approximate improvement of 60% in PSNR and huge reduction in MSE of 90%.Also the same kind of observation is presented in the result section. For all the test image there is a great improvement in PSNR and MSE is analyzed with proposed image restoration method. In the future development in can be combining with fuzzy histogram equalization to further improve the performance. All observation and experiment is done. It's been observed that there is a test image used to present the proposed work in this paper. Criteria for choosing the test images are that they cover all types of image used in real world example.

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