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Image Noise Handling Mechanism: An Analysis of Image Filtering Mechanisms

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Abstract: With the emergence of technology, information is represented in image form rather than textual form. The image capturing mechanisms may cause noise within the image. The noise causes distortion and leads to production of misleading information. In order to tackle the issue noise handling mechanism are required to be incorporated within existing image handling mechanism. Filtering is one of the strategies associated with noise handling. Noise handling mechanisms are analysed in the current context and optimised strategy can be detected for parameter enhancement in future.
Keywords: Image capturing, noise handling mechanism, filtering

I. INTRODUCTION

Humans have capabilities to integrate, incorporate, all his visual information. It is very difficult to gather such capabilities via machine to compile visual information such as images, graphics etc. so that it is very important to visualize that techniques of transmission processing and storage.
[1], [2]Digital Image acquisition is the first step towards designing and digital image system using different wavelength sensors. These sensors records two dimensions images of three dimension visual world. The two dimension images captured are quantized to get digital images. In case noisy images are received they are degraded by different mechanisms. Image may be blurred due to improper focused cameras. These case defocused cameras will be used with blurring mechanism. Very important on way came into existence to focus outdoor images to procured the foggy environment in winter to capture an image in a foggy day will be in blurred form. The steps considered in image processing are listed as under

A. Image Acquisition

[2]Digital cameras are used to capture visual information by an imaging sensor in the form of images, videos. Sometimes we get noisy signals which may result in blurred images. The degradation may be due to fog or mist in the atmosphere and this type of gradation is known as atmospheric degradation.

B. Discretization/Digitization Quantization Compression

[3]Convert image data into discrete form and compress for efficient storage or transmission. The image in this representation is converted from analog to digital form. Digital information presents better clarity as compared to analog images.

C. Image Enhancement And Restoration

[4]Image enhancement mechanisms are ensured in order to increase the contrast of the image for better clarity. The noise from within the image can be handled efficiently by the use of image enhancement and restoration mechanism.

D. Image Segmentation

[5]Segmentation is the process of dividing the image into subparts. The parts include meaningful and non meaningful part. Unnecessary parts are removed from the image and necessary parts are retained known as segmentation.

E. Feature Selection

[6]Image contains distinct features that are required to be detected. Feature selection is the need of the hour. Feature selection can be utilised in remote sensing , defence surveillance and for medical image processing . it will select optimal features and used for checking abnormal conditions for disease detection. All the above image processing techniques has been utilised together for detecting abnormal parts from within the images. Noise handling mechanisms are discussed in this paper but before discussing those filters various noises present within the images are discussed. Reset of the paper is organised as under

Section 1 present general overview of image processing mechanism, section 2 presents noises present within the images, section 3 present literature survey of noise handling mechanisms, section 4 gives the comparison table and section 5 gives the conclusion of the studied techniques.

F. Various Noises Present Within The Images

Noise is the abnormality present within the image that distorts the information present within the image. The noises introduced within the image are discussed in this section along with its cause.

1) *Salt and pepper noise:* [7]This noise is introduced within the image through the capturing medium. This noise introduces white spot within the image and clarity of image is lost. The intensity value of the pixel lies between 0 to 255 and in case of salt and pepper noise, pixel intensity values exceed the threshold limit. In order to tackle such noise median filter is used.
2) *Gaussian Noise:* [8]This type of noise is statistical noise that has same probability density function as the normal distribution. A communication channel through which information is transmitted causes such noise. Since normal and probability density function for both original and affected image is same hence noise detection is difficult. Median filtering and Gaussian smoothening is used to tackle such noise.
3) *White Noise:* [9]Noise is identified by the use of noise power. Such noise is introduced through mediam or capturing mechanism. More power indicates less clarity within the image. Noise power spectrum is used in order to identify the white noise. White noise is detected using the power spectrum of the images.
4) *Periodic Noise:* [10]This type of noise is introduced due to electronic interference. The power to signal ratio is subsequently reduced in this case. This noise is spatial domain dependent. Contrast enhancement strategies are incorporated to tackle such noises.
5) *Shot Noise:* [11]This type of noise is introduced in the darker region of the image. this noise corrupts the information and intensity values of the image. The clarity of the image is completely lost through this noise. To tackle such noise histogram equalization along with median filtering technique is preferred. These are some of the noise introduced wither through the medium or through the acquisition mechanism. Next section describes the mechanisms used to tackle such noise from within the images.

G. Literature Survey

This section present analysis of all the filtering mechanisms used to tackle the noise present within the image. Filtering mechanisms used to tackle different types of noise is as under

1) *Median Filtering:* Median filtering is commonly used to tackle the impulse noise. The impulse noise is also known as salt and pepper noise. Median filter is one of the most common filters to tackle the issue of various types of noises and for this purpose continues modification to the median filter is made. [12] In addition to standard median filter, there are weighted median filter, iterative median filter, recursive median filter, directional median filter, switching median filter, and adaptive median filter. Use of these filters depends greatly on the complexity of noise present within the image. Actually, the concentration of impulse noise on an image is varied because impulse noise is a random noise. Therefore, there are regions of the image with high level of corruption, and there are also regions with low level of corruption. For an effective noise filtering process, a larger filter should be applied to regions with high level of corruption. In contrast, a smaller filter should be applied to regions with low level of corruption. Because the size of the filter is adapted to the local noise content, this type of median filter is known as adaptive median filter.
2) *Mean Filter:* [13], [14]This filter is also known as low pass filter. The frequency of noise is considered to be high as compared to the signal. Applying this filter removes the noise from the image by eliminating high frequency signals from the image being transmitted. Comparative to median filtering mean filter is least used since all types of noise cannot be tackled by t he application of this filter.
3) *Gaussian Filter:* [15], [16]This filter is used in order to handle Gaussian noise. This filter also falls under the category of low pass filter. In this case, the signals having distorted values are blocked and continue signals are allowed to pass. Salt and pepper noise can be tackled using this filtering mechanism. This is also known as Gaussian smoothening.
4) *Fuzzy Filters:* [17]These filters are neural network based approaches in which membership is defined. In case, the member falls under the threshold limit, then the signal is clipped otherwise signal is allowed to pass. This filter is easy and simple to implement and causes the noise to reduce significantly. High impulse and random noise is tackled using the fuzzy filter mechanism.

The median filtering is used heavily in modern research because of its diverse and flexible adaptation. It can be used to tackle wide range of noises.

H. Comparison Of Noise Handling Techniques

From the literature surveys comparison of parameters are derived. Comparison table is given as under

Title	Technology	Parameters	Merits	Demerits
A Modified Method for Speckle Noise Removal in Ultrasound Medical Images[18]	Morphological image Cleaning method	PSNR MSE	PSNR is enhanced and MSE is reduced	Entropy is not considered in this approach
Comparison between Bit Error Rate And Signal To Noise Ratio in OFDM Using LSE Algorithm[19]	LSE algorithm	Bit error rate PSNR	Bit error rate from the image is reduced and Peak signal	Entropy can be further enhanced
Filtering Techniques to reduce Speckle Noise and Image Quality Enhancement methods on Satellite Images[20]	Filtering mechanism for speckle noise handling	PSNR RMSE	PSNR is increased and Root mean square error is decreased	Contrast enhancement that leads to entropy enhancement is missing
Fuzzy Based New Algorithm For Noise Removal And Edge Detection[21]	Fuzzy based algorithm for noise removal	PSNR MSE	PSNR and MSE is optimised	Histogram equalization can be merged to enhance entropy of image
Analysis of Image Noise Removal Methodologies for High Density Impulse Noise[7]	Filtering mechanism for noise removal from high density images	MSE	MSE is reduced significantly	PSNR is not optimised
Salt-and-pepper noise removal by adaptive median-based lifting filter using second-generation wavelets[22]	Adaptive median filter	MSE PSNR	PSNR is enhanced and MSE is reduced	Entropy indicating degree of relationship between pixel is not optimised
A Zero-Watermarking Scheme using Discrete Wavelet Transform[8]	Watermarking using DCT for attack handling	Reliability	Reliability is improved	No image enhancement mechanism is specified.
Computational Redundancy in Image Processing[23]	Redundancy handling mechanism	MSE PSNR	MSE and PSNR is optimised	Entropy can be further enhanced
Image Noise Removal The New Approach[24]	Noise removal mechanism from digital image	MSE	MSE is reduced	PSNR and entropy is not considered
A new filter to remove salt and pepper noise in color images[25]	Filter to tackle salt and pepper noise from the digital image	MSE PSNR	MSE and PSNR are optimised	Entropy is not consider
Image Denoising Via Sparse and Redundant Representations Over Learned Dictionaries[26]	K-SVD technique for redundant information	Reliability MSE	Reliability is increased and MSE is reduced	Entropy associated with text does not optimised

Table 1: Comparison of various Techniques used to tackle noise from the image

1) *Research Gap:* Most of the existing techniques deals with the noise handling but optimised parameter like entropy is never considered. Entropy described degree of relationship between pixels. Median filtering by considering redundancy removal strategy is also missing in existing literature. Redundancy handling mechanism if incorporated within the noise handling mechanism then size of image representation can be reduced considerably. Hence in future adaptive median filtering with redundancy handling mechanism can be used to enhance parameters like PSNR and entropy. MSE can be reduced using this mechanism.

II. CONCLUSION

Noise within the image can distort the image. Distortion can corrupt the information represented through the digital media. Source noise could be many like image acquisition mechanisms, transmission mechanisms etc. Noise handling mechanisms have been devised that tackles the issue of noise. Commonly used mechanism includes filtering. Adaptive median filtering mechanism can be used to tackle almost any kind of noise. Size of the image representation is not adjusted using this technique. In order to tackle this issue redundancy handling mechanism can be incorporated within the median filter to achieve optimization in terms of PSNR, MSE and entropy.

REFERENCES

[1] S. Huda, J. Yearwood, H. F. Jelinek, M. M. Hassan, and M. Buckland, “A hybrid feature selection with ensemble classification for imbalanced healthcare data : A case study for brain tumor diagnosis,” vol. 3536, no. c, pp. 1–13, 2016.
[2] P. Yuvarani, “Image Denoising and Enhancement for Lung Cancer Detection using Soft Computing Technique,” pp. 27–30, 2012.
[3] I. H. Witten, A. Moffat, and T. C. Bell, Managing gigabytes : compressing and indexing documents and images. 1999.
[4] B. V Kiranmayee, T. V Rajinikanth, and S. Nagini, “Enhancement of SVM based MRI Brain Image Classification using Pre-Processing Techniques,” vol. 9, no. August, pp. 1–7, 2016.
[5] D. Selvaraj, “MRI BRAIN IMAGE SEGMENTATION TECHNIQUES - A REVIEW,” vol. 4, no. 5, pp. 364–381, 2013.
[6] S. Begum, D. Chakraborty, and R. Sarkar, “Data Classification Using Feature Selection and kNN Machine Learning Approach,” 2015 Int. Conf. Comput. Intell. Commun. Networks, pp. 811–814, 2015.
[7] A. Singh, “Analysis of Image Noise Removal Methodologies for High Density Impulse Noise,” vol. 3, no. 6, pp. 659–665, 2014.
[8] A. Rani, A. K. Bhullar, D. Dangwal, and S. Kumar, “A Zero-Watermarking Scheme using Discrete Wavelet Transform,” vol. 70, pp. 603–609, 2015.
[9] I. D. T, B. Goossens, and W. Philips, “MRI Segmentation of the Human Brain : Challenges , Methods , and Applications,” vol. 2015, 2015.
[10] P. Singh, “A Comparative Study to Noise Models and Image Restoration Techniques,” vol. 149, no. 1, pp. 18–27, 2016.
[11] T. K. Djidjou, D. A. Bevans, S. Li, and A. Rogachev, “Observation of Shot Noise in Phosphorescent Organic Light-Emitting Diodes,” vol. 61, no. 9, pp. 3252–3257, 2014.
[12] S. H. Teoh and H. Ibrahim, “Median Filtering Frameworks for Reducing Impulse Noise from Grayscale Digital Images : A Literature Survey,” vol. 1, no. 4, pp. 4–7, 2012.
[13] C. Khare and K. K. Nagwanshi, “Image Restoration Technique with Non Linear Filters,” pp. 1–5, 2011.
[14] S. Shrestha, “Image Denoising Using New Adaptive Based Median Filter,” Signal Image Process., vol. 5, no. 4, pp. 1–13, 2014.
[15] E. A. Kumari, “A Survey on Filtering Technique for Denoising Images in Digital Image Processing,” vol. 4, no. 8, pp. 612–614, 2014.
[16] G. Deng and L. W. Cahill, “An adaptive Gaussian filter for noise reduction and edge detection,” in 1993 IEEE Conference Record Nuclear Science Symposium and Medical Imaging Conference, pp. 1615–1619.
[17] E. E. Kerre, D. Van De Ville, M. Nachtegael, D. Van Der Weken, and E. E. Kerre, “Noise reduction by fuzzy image filtering . IEEE,” vol. 125050, no. January 2013, 2003.
[18] T. R. Jeyalakshmi and K. Ramar, “A Modified Method for Speckle Noise Removal in Ultrasound Medical Images,” vol. 2, no. 1, pp. 54–58, 2010.
[19] R. Pandey, A. Awasthi, and V. Srivastava, “Comparison between Bit Error Rate And Signal To Noise Ratio in OFDM Using LSE,” vol. 2013, no. Cac2s, pp. 463–466, 2013.
[20] K. M. S. Raju, M. S. Nasir, and T. M. Devi, “Filtering Techniques to reduce Speckle Noise and Image Quality Enhancement methods on Satellite Images,” vol. 15, no. 4, pp. 10–15, 2013.
[21] A. June, “Fuzzy Based New Algorithm For Noise Removal And Edge Detection,” vol. 2, no. 2, 2014.
[22] P. S. J. Sree, P. Kumar, R. Siddavatam, and R. Verma, “Salt-and-pepper noise removal by adaptive median-based lifting filter using second-generation wavelets,” Signal, Image Video Process., vol. 7, no. 1, pp. 111–118, Feb. 2011.
[23] F. Khalvati, “Computational Redundancy in Image Processing,” Image (Rochester, N.Y.), no. November, 2008.
[24] A. Fabija and D. Sankowski, “Image Noise Removal – The New Approach,” pp. 457–459, 2007.
[25] A. H. Pilevar, S. Saien, M. Khandel, and B. Mansoori, “A new filter to remove salt and pepper noise in color images,” Signal, Image Video Process., vol. 9, no. 4, pp. 779–786, 2015.
[26] M. Elad and M. Aharon, “Image denoising via sparse and redundant representations over learned dictionaries.,” IEEE Trans. Image Process., vol. 15, no. 12, pp. 3736–45, 2006.