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# Image Quality Measurement Based On Fuzzy Logic

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***Abstract* - Impulse noise is caused by errors in the data transmission generated in noisy sensors or communication channels, or by errors during the data capture from digital cameras. Noise is usually quantified by the percentage of pixels which are corrupted. Corrupted pixels are either set to the maximum value or have single bits flipped over. In some cases, single pixels are set alternatively to zero or to the maximum value. This is the most common form of impulse noise and is called salt and pepper noise. This paper work presents a two stage fuzzy based noise reduction-cum-edge detection filter i.e. INAFSM (image & noise adaptive fuzzy switching median) filter for efficient removal of impulse noise (salt and pepper noise) from grayscale images. So the main objective of this dissertation work is to get almost an actual image from the corrupted image and then finding the fine edges in the image using fuzzy logic.**

***Keywords* - Impulse Noise, Salt and Peeper Noise, Fuzzy Logic**

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## I. INTRODUCTION

In Image representation one is concerned with the characterization of the quantity that each picture element represents. An image could represent luminance of objects in a scene, the absorption characteristics of the body tissue, the radar cross section of the target, the temperature profile of the region or the gravitational field in an area. In general, any two dimensional function that bears information can be considered as an image. An important consideration in image representation is the fidelity or intelligibility criteria for measuring the quality of an image or the Performance of processing technique. Specification of such measures requires models of perception of contrast, spatial frequencies, and colors and so on. The fundamental requirement of digital processing is that images be sampled and quantized. The sampling rate has to be large enough to preserve the useful information in an image. It is determined by the bandwidth of the image.

## II. NOISE MODELS

The principal source of noise in digital images arises during image acquisition and/or transmission [1]. The performance of imaging sensors is affected by a variety of factors, such as environmental conditions during image acquisition, and by the quality of the sensing elements themselves. For instance, in acquiring images with a CCD camera, light levels and sensor temperature are major factors affecting the amount of noise in the resulting image. Images are corrupted during transmission principally due to interference in the channel used for transmission. For example, an image transmitted using a wireless network might be corrupted as a result of lightning or other atmosphere disturbance.

Here it is assumed that noise is independent of spatial coordinates, and that it is uncorrelated with respect to the image itself (that is, there is no correlation between pixel values and the values of noise components). Although these assumptions are at least partially invalid in some applications (quantum-limited imaging, such as in X-ray and nuclear-medicine imaging, is a good example). Following are among the most common PDFs found in image processing applications. Here it is assumed that noise is independent of spatial coordinates, and that it is uncorrelated with respect to the image itself.

### 1. *Salt-and-Pepper Noise*

An image containing salt-and-pepper noise will have dark pixels in bright regions and bright pixels in dark regions. This type of noise can be caused by dead pixels, analog-to-digital converter errors, bit errors in transmission, etc

### 2. *ImpulseNoise*

Noise consisting of random occurrences of energy spikes having random amplitude and and spectral content.

### 3. *Additive White Gaussian Noise (AWGN)*

AWGN is a channel model in which the only impairment to communication is a linear addition of wideband or white noise with a constant spectral density (expressed as watts per hertz of bandwidth) and a Distribution of amplitude. The model does not account for fading, frequency selectivity, interference, nonlinearity or dispersion. However, it produces simple and tractable mathematical models which are useful for gaining insight into the underlying behavior of a system before these other phenomena are considered. The AWGN channel is a good model for many satellite and deep space communication links. It is not a good model for most terrestrial links because of multipath, terrain blocking, interference, etc. mutate background noise of the channel under study, in addition to multipath, terrain blocking, interference, ground clutter and self interference that modern radio systems encounter in terrestrial operation.

### 4. *Multiplicative Speckle Noise*

Speckle noise is a granular noise that inherently exists in and degrades the quality of the active radar and synthetic aperture radar (SAR) .Speckle noise in conventional radar results from random fluctuations in the return signal from an object that is no bigger than a single image-processing element. It increases the mean grey level of a local and Speckle noise in SAR is generally more serious, causing difficulties for image interpretation. It is caused by coherent processing of backscattered signals from multiple distributed targets. In SAR oceanography, for example, speckle noise is caused by signals from elementary scatterers, the gravity-capillary ripples, and manifests as a pedestal image, beneath the image of the sea waves.Several different methods are used to eliminate speckle noise, based upon different mathematical models of the phenomenon.

- Speckle noise in SAR is a *multiplicative* noise, i.e. it is in direct proportion to the local grey level in any area
- The signal and the noise are statistically independent of each other
- The sample mean and variance of a single pixel are equal to the mean and variance of the local area that is centered on that pixels

## III. FUZZY LOGIC

Fuzzy logic is an approach to computing based on "degrees of truth" rather than the usual "true or false" (1 or 0) Boolean logic on which the modern computer is based. The idea of fuzzy logic was first advanced by Dr. Lotfi Zadeh of the University of California at Berkeley in the 1960s. Dr. Zadeh was working on the problem of computer understanding of natural language. Natural language (like most other activities in life and indeed the universe) is not easily translated into the absolute terms of 0 and 1. (Whether everything is ultimately describable in binary terms is a philosophical question worth pursuing, but in practice much data we might want to feed a computer is in some state in between and so, frequently, are the results of computing.)

### 1. Fuzzy Logic Toolbox

Working with the Fuzzy Logic Toolbox. The Fuzzy Logic Toolbox provides GUIs to let you perform classical fuzzy system development and pattern recognition. Using the toolbox, you can:

- Develop and analyze fuzzy inference systems
- Develop adaptive neurofuzzy inference systems
- Perform fuzzy clustering

Fuzzy Logic Toolbox provides functions, apps, and a Simulink block for analyzing, designing, and simulating systems based on fuzzy logic. The product guides you through the steps of designing fuzzy inference systems. Functions are provided for many common methods, including fuzzy clustering and adaptive neurofuzzy learning.

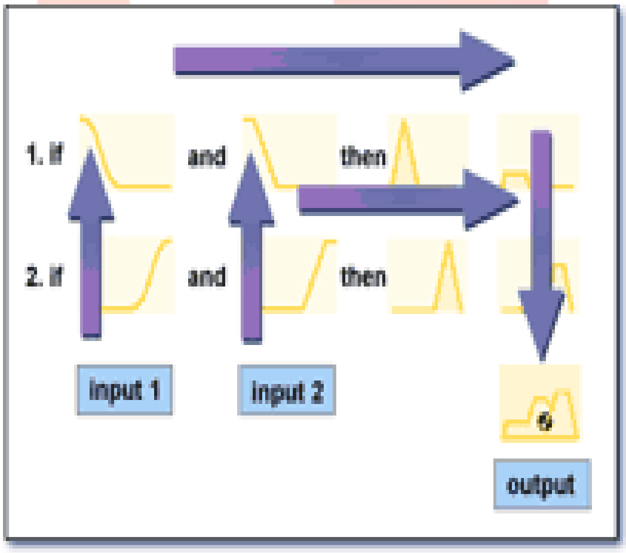



Fig 1Working with the Fuzzy Logic Toolbox

### 2. Fuzzy Logic Examples using Matlab

Consider a very simple example:

We need to control the speed of a motor by changing the input voltage. When a set point is defined, if for some reason, the motor runs faster, we need to slow it down by reducing the input voltage. If the motor slows below the set point, the input voltage must be increased so that the motor speed reaches the set point.

Let the input status words be:
*Too slow*
*Just right*
*Too fast*
Let the output action words be:
*Less voltage (Slow down)*
*No change*
*More voltage (Speed up)*
Define the rule-base:

1. If the motor is running too slow, then more voltage.
2. If motor speed is about right, then no change.
3. If motor speed is to fast, then less voltage

## IV. PURPOSED WORK

***Algorithm for Proposed Model***

1. Given the original image.
2. Add different noises salt and pepper noise, Multiplicative Speckle Noise and Additive White Noise to the original image and make noisy image.
3. Apply different type of filters like Median filter, Adaptive Filter and Average Filter to the the noisy image with some types of parameters.
4. Find the image quality measure
5. Use of Fuzzy Logic to describe the quality of an image.

Complete evaluation of the performance of the algorithm is challenging. This chapter provides the result of the image denoising techniques like median filter ,Adaptive filter and average filter and proposed method which are describe previously and determine the best one for image denoising. Denoising technique is compared on the basis of different parameters. In this chapter, image denoising technique are compared on the basis of performance parameter like peak signal to noise Ratio (PSNR), Human Visual system (HVS), Mean square error (MSE), for gray scale image. Visual quality also determines the performance.

All the Filters technique ids implemented using MATLAB (7.9) and its image processing toolbox. Denoising technique has been applied to image such as "Lena" of size 512*512 with different noiselevel. Noise model used is salt and pepper, speckle noise and AWGN. The filter are used like median filter, adaptive filter and average filter. The HVS value can be computed on a block-by-block basis for the processed input images. Finally, the denoising images are there of different parameters and then we select the best image of one parameter by the use of fuzzy logic. The original image is taken then denoising with the different noises now we take one by one noise to denoise it by various filters with different parameters. After that we chose the best filter of some parameter that is suitable for denoising the image by the fuzzy logic technique.

**Add the Salt and pepper Noise to the original image and calculate for different filters with parameters**.

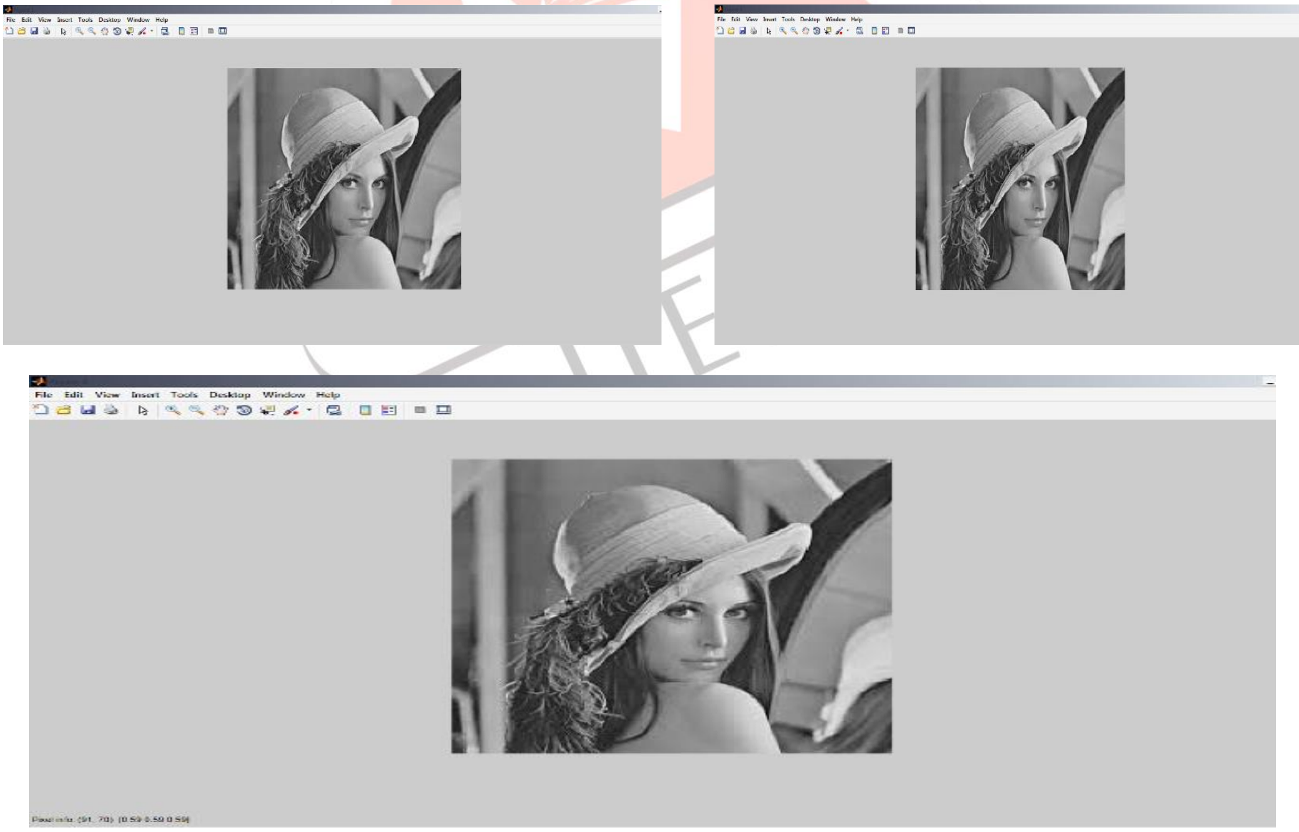
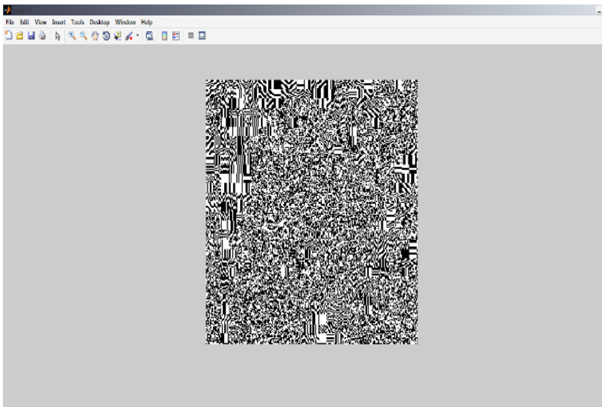
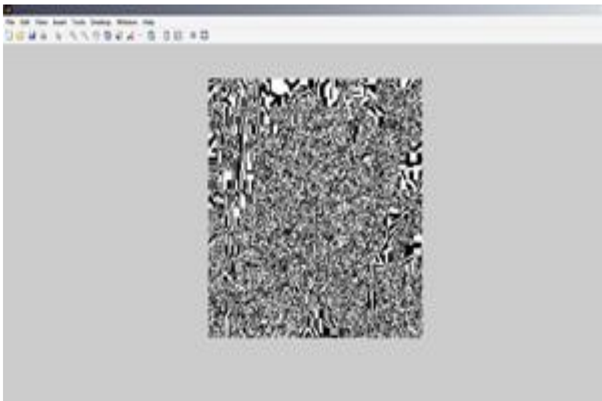
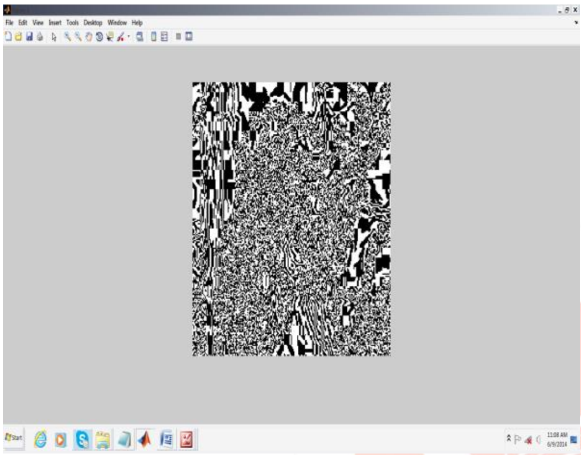
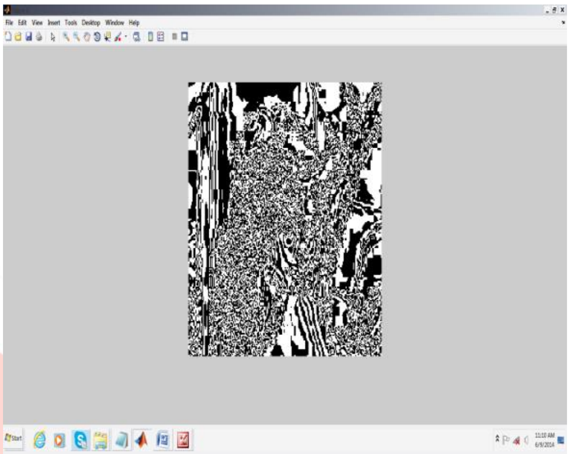


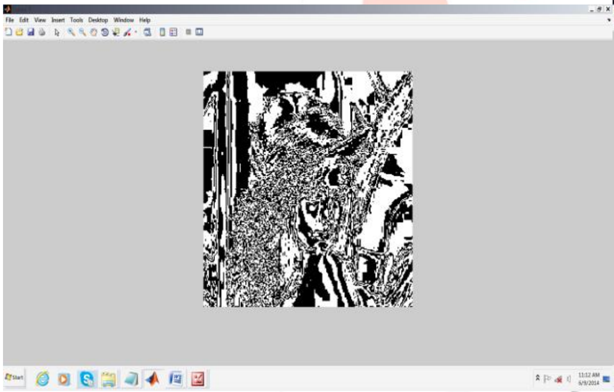

Fig 2 Leena Image show Pixel Info

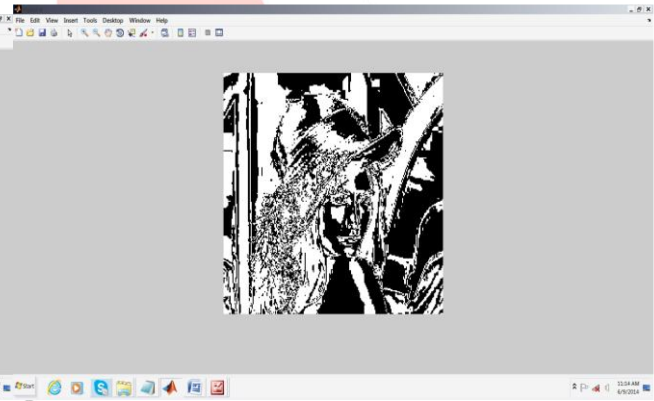


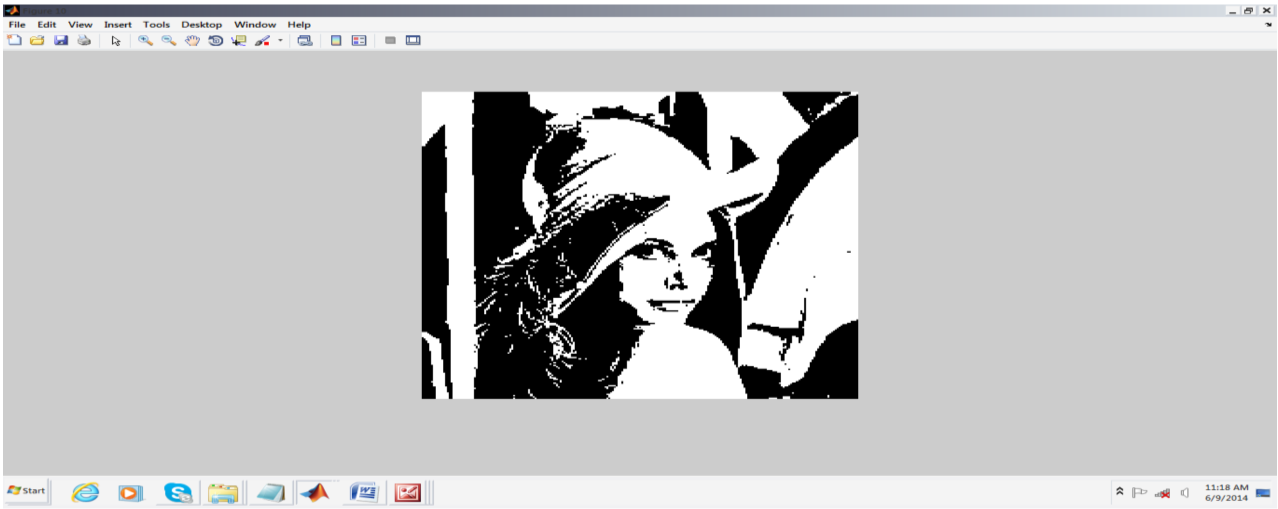












## V. CONCLUSION

Images in this document are shown in their normal size. Their size was reduced so that two images can fit into one page, which significantly increase the number of pages. Therefore, their subjective visual quality cannot be judged based on images shown here, it can only be judged when images are viewed in their normal size and when display device can display 256 different gray levels. If the display device cannot display 256 gray levels some information from the input images will be discarded and some quantization noise will be introduced. This is particularly significant if the difference between the input images is small, because then this difference can be masked by the quantization noise introduced by the display device.

The HVS value can be computed on a block-by-block basis for the processed input images. Finally, the denoising images are there of different parameters and then we select the best image of one parameter by the use of fuzzy logic. The original image is taken then denoising with the different noises now we take one by one noise to denoise it by various filters with different parameters. After that we chose the best filter of some parameter that is suitable for denoising the image by the fuzzy logic technique.

## REFERENCES


[1] H. Sheikh et al.. "Blind quality assessment for JPEG2000 compressed images:' in Asilomar Conf'O2.

[2] N. B. Nil1 and B. H. Bouzas. "Objectivc image quality measure derived from digital image power spectm" Optical Engineering. vol. 31, pp. 813-825. 1992.

[3] Zhou Wang, Alan Conrad Bovik, Hamid Rahim Sheikh and Eero P. Simoncelli "Image Quality Assessment: From Error Visibility to Structural Similarity" IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 13, NO. 4, APRIL 2004

[4] B. Girod, "What's wrong with mean-squared error," in Digital Images and Human Vision, A. B. Watson, Ed. Cambridge, MA: MIT Press,1993, pp. 207–220.

[5] P. C. Teo and D. J. Heeger, "Perceptual image distortion," in Proc. SPIE,vol. 2179, 1994, pp. 127–141.

[6] A. M. Eskicioglu and P. S. Fisher, "Image quality measures and their performance,"IEEE Trans. Commun., vol. 43, pp. 2959–2965, Dec. 1995.

[7] M. P. Eckert and A. P. Bradley, "Perceptual quality metrics applied to still image compression," Signal Processing, vol. 70, pp. 177–200, Nov.1998.

[8] S. Winkler, "A perceptual distortion metric for digital color video," inProc. SPIE, vol. 3644, 1999, pp. 175–184.

[9] Mathworks. The Matlab image processing toolbox. http://www.mathworks.com/access/helpdesk/help/toolbox/images/

[10] Z. Wang, "Rate scalable Foveated image and video communications,"Ph.D. dissertation, Dept. Elect. Comput. Eng., Univ. Texas at Austin,Austin, TX, Dec. 2001.

[11] Z. Wang and A. C. Bovik, "A universal image quality index," IEEE Signal Processing Letters, vol. 9, pp. 81–84, Mar. 2002.

[12] Bishwa sheth , "Modern image quality assessment", Morgan & Claypool Publishers, Jan. 2006.

[13] Z. Wang and A. C. Bovik, "Image quality assessment: from error visibility to structural similarity," IEEE Trans. Image Processing, vol. 13, pp. 600 – 612, Apr. 2004.

[14] M. Sendashonga and F Labeau, "Low complexity image quality assessment using frequency domain transforms," IEEE International Conference on Image Processing, pp. 385 – 388, Oct. 2006.