Image Filtering and Entropy Calculation

Priya Pandey, Anupam Agarwal

Abstract*—In this paper we are analyzing the entropy after and before removing the noise. Images with noise contains the information but the noise deteriorate the information content of by using the several filters the entropy of an image can be restored and hence the information can be extracted from it. The measured parameters has been included in this paper to verify the proposed work. Also in this paper the focus remains over the image quality as well window size choosen will directly effect the image qualiity hence smaller the window size more will be the sharpness in the image and vice versa.*

***Keywords*—**Image, filter, entropy, window

I. INTRODUCTION

Human beings are predominantly visual creatures: we rely heavily on our vision to make sense of the world around us. We not only look at things to identify and classify them, but we can scan for differences, and obtain an overall rough feeling for a scene with a quick glance. Humans have evolved very precise visual skills: we can identify a face in an instant; we can differentiate colours; we can process a large amount of visual information very quickly. However, the world is in constant motion: stare at something for long enough and it will change in some way. Even a large solid structure, like a building or a mountain, will change its appearance depending on the time of day (day or night); amount of sunlight (clear or cloudy), or various shadows falling upon it.[1] We are concerned with single images: snapshots, if you like, of a visual scene. Although image processing can deal with changing scenes, we shall not discuss it in any detail in this text. For our purposes, an image is a single picture which represents something.[2] It may be a picture of a person, of people or animals, or of an outdoor scene, or a microphotograph of an electronic component, or the result of medical imaging. Even if the picture is not immediately recognizable, it will not be just a random blur.

Removing noise becomes very important when it come to medical imaging and also in the case space science as more the image is filtered more information it will provide which can help the scientist to extract more and more information.

Image filters plays and important role in photo editing softwares and now a days many DSLRs have the inbuilt filters which enhances the image quality at a very low specification, low specifications here means to have lower end processor and less megapixel so with all these low specification by using the filters image quality can still be enhanced.

Entropy of an image determines the information content of that image.[3]

$$Entropy = -\sum_{i} p_i log_2 p_i$$

II. PREVIOUS WORK

In 2010, a method for removing impulse noises from images was proposed whereby the filtering scheme is based on replacing the central pixel value by the generalized mean value of all pixels inside a sliding window. The concepts of thresholding and complementation which are shown to improve the performance of the generalized mean filter are introduced. The threshold is derived using a statistical theory. The actual performance of the proposed filter is compared with that of file commonly used median filter by filtering noise corrupted real images. The hardware complexity of the two types of filters is compared indicating the advantages of the generalized mean filter [4].

By 2011, two algorithms using adaptive-length median filters are proposed for improving impulse-noise-removal performance for image processing. The algorithms achieved significantly better image quality than regular (fixed-length) median filters when the images are corrupted by impulse noise. One of the algorithms, when realized in hardware, requires rather simple additional circuitry. Both algorithms can easily be integrated into efficient hardware realizations for median filters [5].

By the beginning of 2012, a filter with variable window size for removal of impulses while preserving sharpness was proposed. The first one, called the ranked-order based adaptive median fllter (RAMF), is based on a test for the presence of impulses in the center pixel itself followed by the test for the presence of residual impulses in the median filter output. The second one, called the impulse size based adaptive median filter (SAMF), is based on the detection of the size of the impulse noise. It is shown that the RAMF is superior to the nonlinear mean L, filter in removing positive and negative impulses while simultaneously preserving sharpness; the SAMF is superior to Lin's adaptive scheme because it is simpler and better performing in removing the

high density of impulsive noise as well as non impulsive noise and in preserving fine details. Simulations on standard images confirmed that these algorithms are superior to standard median filter [6].

Two more fast algorithms were developed to compute a set of parameters, called Mi's, of weighted median filters for integer weights and real weights, respectively. The Mi's, which characterize the statistical properties of weighted median filters and are the critical parameters in designing optimal weighted median filters, are defined as the cardinality of the positive subsets of weighted median filters. The first algorithm, which is for integer weights, is about four times faster than the existing algorithm. The second algorithm, which applies for real weights, reduces the computational complexity significantly for many applications where the symmetric weight structures are assumed. Applications of these new algorithms include design of optimal weighted filters, computations of the output distributions, the output moments, and the rank selection probabilities, and evaluation of noise attenuation for weighted median filters[7].

In 2013 a novel median-type filter controlled by fuzzy rules was proposed in order to remove impulsive noises on signals such as images. The filter was obtained as a weighted sum of the input signal and the output of the median filter, and the weight is set based on fuzzy rules concerning the states of the input signal sequence. Moreover, this weight is obtained optimally by a learning method, so that the mean square error of the filter output for some training signal data can be the minimum. Some results of image processing showed the high performance of this filter [8].

Convolution and Correlation is that for Convolution you have to mirror the filter matrix, but usually it's symmetrical anyway so there's no difference.

III. METHODOLOGY

The compiled paper looks for a model which can restore the entropy of an Image. Entropy of an image can be defined as the measure of amount of information content in an image or in a matrix.

Image filtering allows you to apply various effects on photos. The type of image filtering described here uses a 2D filter similar to the one included in Paint Shop Pro as User Defined Filter and in Photoshop as Custom Filter.

The trick of image filtering is that you have a 2D filter matrix, and the 2D image. Then, for every pixel of the image, take the sum of products. Each product is the colour value of the current pixel or a neighbour of it, with the corresponding value of the filter matrix. The center of the filter matrix has to be multiplied with the current pixel, the other elements of the filter matrix with corresponding neighbour pixels.

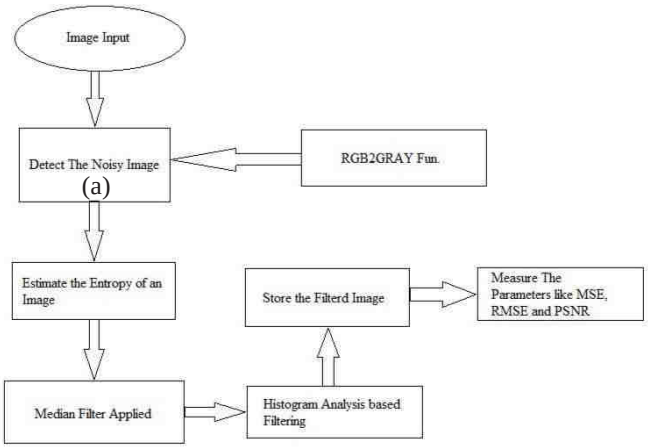

Fig. 1 Proposed Model

The proposed model consists of sevral filters and attacks to analyze the entropy estimation of an image.

IV. RESULTS

From the above explained methodology and the study done over the filters, the following results are obtained.

(a)Noisy Images (b)Filtered Image

Fig. 1 Images

PSNR ratio determines the quality degradation factor after the filters applied ideally it needs to be around 95 - 115 db, which is practically quite impossible to achieve with low information images.

Table I PSNR RATIO OF THE F OUR I MAGES OBTAINED I N FULL R EFERENCES

ImageName	PSNR(db)
Test1	32.12

Test2	33.06
Test3	29.36
Test4	31.25

In this paper entropy is also calculated and presented in the form of graph.

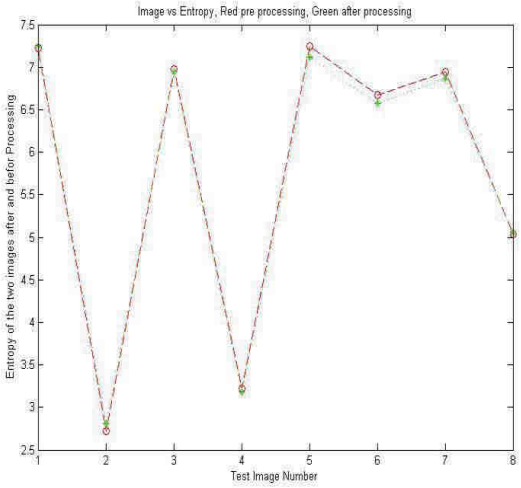

Fig 3. Entropy Graph

V. CONCLUSIONS

From the above compiled paper and the results obtained it can be easily said that the results are overwhelming and from the naked eye it is difficult to observe that any noise is left in the image or not, however as we have examine that the psnr ratio can be extended upto 95 -115db more efforts can be put into the filter methodology.

Also the use of filters can be extended into real time imaging systems to enhance the quality of image during the time of recording an image.

This operation where you take the sum of products of elements from two 2D functions, where you let one of the two functions move over every element of the other function, is called Convolution or Correlation. The difference between

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