Enhancement of Peak Signal to Noise Ratio (PSNR) in Image Denoising by using DWT

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ABSTRACT

The term peak signal-to-noise ratio (PSNR) is an expression for the ratio between the maximum possible value (power) of a signal and the power of disturbing noise that affects the quality of its representation. Because many signals have a very wide dynamic range, (ratio between the largest and smallest possible values of a changeable quantity) the PSNR is usually expressed in terms of the logarithmic decibel scale. Image enhancement or improving the visual quality of a digital image can be subjective. Saying that one method provides a better-quality image could vary from person to person. For this reason, it is necessary to establish quantitative/empirical measures to compare the effects of image enhancement algorithms on image quality. This paper introduces an audit of some huge work in the zone of picture de noising. After a short presentation, some famous methodologies are characterized into various gatherings and a review of different calculations and examination is given. Wavelet calculations are extremely helpful device for flag handling, for example, picture pressure and picture de noising. The principal point demonstrates the aftereffect of Mathematical parameter new premise, clamor with depends limit expelled information. Experiences and potential future patterns in the region of de noising are likewise examined.

Keyword:
Wavelet transform, MATLAB, DWT, De noising, PSNR, Dynamic Range, Mean Square error (MSE), Structural Similarity index (SSIM).

1. INTRODUCTION

Computerized photos assume a crucial job each in day by day life applications, as an example, satellite television, engaging reverberation imaging, computer picturing whilst in territories of study and innovation, as an example, land knowledge frameworks and house science [1]. Informational indexes gathered by image sensors square measure unremarkably impure by commotion. Defective instruments, problems with the data Compression method, and meddling regular marvels would all be ready to debase the info of intrigue. Moreover, clamor may be conferred by transmission blunders and pressure. Later on, image blurriesss vital and also the initial Method calculation info is examined [2-3] Its vital to use a productive de-noising strategy to make up for such info debase. Image de-noising still remains a check for scientists since clamor evacuation presents antiques and causes obscuring of the pictures. This Research depicts distinctive systems for clamor decrease (or de-noising) giving a knowledge with regard to that calculation got to be utilized to seek out the foremost dependable gauge of the primary image info given its debased rendition. Clamor demonstrating in photos is very influenced by catching instruments, info transmission media, image quantization and distinct wellsprings of radiation. Various calculations square measure. The Rest of this paper Section II describes the Image Denoising and Compression Process. Section III is discussed the Inspiration for Development. In section IV explained the DWT Decomposition method. Inverse DWT describes method explained in the Section V. Proposed methodology describes in Section.

2. Image Quality Metric

The proposal is that the higher the PSNR, the better degraded image has been reconstructed to match the original image and the better the reconstructive algorithm. This would occur because we wish to minimize the MSE between images with respect the maximum signal value of the image. The mean squared error (MSE) for our practical purposes allows us to compare the “true” pixel values of our original image to our degraded image. The MSE represents the average of the squares of the “errors” between our actual image and our noisy image. The error is the amount by which the values of the original image differ from the degraded image [4][5]. Image denoising process to improve the quality of image every algorithm has some filtering and threshold parameters. Image denoising is necessary to improve the quality of image [6]. The efficient image denoising methods is still a valid challenge at statistics and functional analysis wavelet algorithms are most useful tool for signal processing such as image compression and denoising multiple wavelets are considered for extension of scalar wavelets [7]. To remove noise from original image still exists over past two decades different types
noise reduction techniques have been developed [8] it reviews the transform based denoising techniques and performs comparative study and put results for different approaches.

3. **Proposed Fusion Technique: DWT Based Image Fusion**

In improvement of ceaseless wavelet change by Morlet and Grossman, numerous Wavelet Changes (WT) have been broadened their utilization in picture handling applications like de-noising. Wavelets are numerical apparatuses that deteroiate the information into number of various recurrence segments, and after that considering every segment with great goals, coordinated to its scale,[9] Wavelet changes have favorable circumstances over. conventional Fourier techniques in breaking down the flag containing discontinuities and sharp spikes. Fundamentally wavelet changes are arranged into persistent wavelet change and discrete wavelet change. The advanced flag processors and figures are discrete in nature, picture preparing calculations utilize discrete wavelet change

![Figure 1: Process Flow of PSNR Deduction](image)

4. **DWT based PSNR Calculation**

At first, it is confirmed that the digitized defect information is accessible in the forces of 2 for making the viable decay. The different advances engaged with the element extraction calculation are as per the following.

**Step 1:** Defect information are disintegrated into four detail sub groups utilizing Discrete Wavelet Transform (DWT). The sub groups are high recurrence detail band coefficients and low recurrence estimation band coefficients [10].

**Step 2:** The estimate Mathematical parameter are additionally deteriorated utilizing DWT to extricate limited data from the sub-band of detail coefficients. In this work, four dimensions of decay have been finished utilizing bi-orthogonal wavelet.

**Step 3:** For further investigating and handling, all the four-dimension detail band coefficients have been taken.

**Step 4:** The recurrence vector (in radians/test) is removed for four detail sub groups utilizing work in MATLAB.[11]

**Step 5:** The highlights are processed either by utilizing sentence structure or by executing the formulae. They are mean, fluctuation, mean of vitality, most extreme adequacy, least sufficiency, greatest vitality, least vitality, normal recurrence, mid recurrence, most extreme recurrence, least recurrence, half purpose of the capacity. The M-record program for four-dimension flag deterioration and highlights extraction utilizing DWT are given.[12]

**Step 6:** Finally, the separated highlights for the six classes of deformities are arranged and broke down for order.

5. **Performance Parameter and Results Analysis**

To compute the PSNR first calculate the mean-squared error using the following equation:

$$MSE = \frac{\sum_{M,N}[(I_1(m,n) - I_2(m,n))^2]}{M \times N}$$

In the previous equation, M and N are the number of rows and columns in the input images. Then computes the PSNR using the following equation:
In the equation 2, \( R \) is the maximum fluctuation in the input image data type. For example, if the input image has a double-precision floating-point data type, then \( R \) is 1. If it has an 8-bit unsigned integer data type, \( R \) is 255, etc.

**Figure 1:** Data Set 1, Input and output image  

**Figure 2:** Data Set 2, Input and output image

Comparison of PSNR of DWT based Decomposition Technique. Different approaches exist for computing the PSNR of a color image. Because the human eye is most sensitive to luma information, you can compute the PSNR for color images by converting the image to a color space that separates the intensity (luma) channel.\(^{[13]}\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>First Decomposition</th>
<th>Second Decomposition</th>
<th>Third Decomposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE</td>
<td>0.000001</td>
<td>0.000001</td>
<td>0.0001</td>
</tr>
<tr>
<td>PSNR</td>
<td>613.9574</td>
<td>621.5812</td>
<td>622.6526</td>
</tr>
</tbody>
</table>

**6. Conclusion**

PSNR is most commonly used to measure the quality of reconstruction of lossy compression codecs (e.g., for image compression). The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression codecs, PSNR is an approximation to human perception of reconstruction quality. The relative investigation of different de-noising strategies for computerized pictures demonstrates that wavelet channels beats the other standard spatial area channels. Albeit all the spatial channels perform well on advanced pictures however they have a few requirements in regards to goals debasement. These channels work by smoothing over a fixed window and it produces ancient rarities around the article and some of the time causes over smoothing accordingly causing obscuring of picture.
7. Reference


