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Image Denoising Using Ant Colony Optimization

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ABSTRACT

The digital image processing deals with development of a digital system that performs operations on a digital image and there is manipulation through a digital computer. This system takes input as digital image, its processing through algorithm and gives a processed image as an output. Image noise is random variation of color or brightness information in images, and is usually an aspect of electronic noise. Electronic noise can be produced by the sensor, circuitry of a scanner, digital camera or dust particles. Filters are used to remove noise from digital images while keeping the details of image preserved is a necessary part of image processing to enhance the quality of the image many filters are used for the removal of noise. 2D FIR filter can be used for denoising the noisy images. Emphasis is made on denoising of Gaussian noised images through 2D FIR in the paper. At the first stage, we present a 2D finite impulse response filter design using ant colony algorithm. At the second stage, to demonstrate the robustness of the filter algorithm it was implemented for the Gaussian noise for the noisy image. The proposed approach will show improvements in filter design.

Keywords : Image Denoising, FIR Filter, Multi-Dimensional Filter Design

I. INTRODUCTION

Images are corrupted by random and unnecessary variations in intensity values called noise due to non perfect camera acquisition or environmental conditions. Different factors may be responsible for introduction of noise in the image insufficient light levels and sensor temperature may introduce noise in the image, the image may also corrupted due to interference in the transmission channel, the noise in the image can also be introduce if dust particles are present on the scanner screen. Filtering in an image processing is a basic function that is used to perform many tasks such as noise reduction.

Image de noising still remains a fact of risk because noise removal can result loss of details and can causes blurring of the images. Noise modeling in images differs accordingly as change in capturing instruments, data transmitting media, image quantization and discrete sources of radiation. Different algorithms used depending on the type of noise model present. Image denoising is a process of correction and modification in image so that the resultant image is well suited for further analysis by human or machine. The principal objective of image Denoising is the modification of the image attributes so that it becomes suitable for the observer. In this process image attributes are modified for improving the image quality.

II. NOISE MODELS

The main sources of noise in digital images arises during image digitization or during image transmission. The performance of image sensor is affected by variety of reasons such as environment condition during image acquisition or by the quality of the sensing element. For example, during images capturing with CCD camera, sensor temperature and light level are major factors that affects that amount of noise in the image. Images are corrupted while transmission of images. The principal reason of noise is due to interference in the channel which is used for the image transmission. We can model a noisy image as follows:

$$A(x, y) = B(x, y) + C(x, y)$$

where B(x, y) is the original image pixel value and C(x, y)is the noise in the image and A (x, y) is the resulting noisy image. Gaussian noise in digital images is

mainly raised during acquisition of image. The standard model of amplifier noise is additive or Gaussian or independent at each pixel and independent of the signal intensity. In color cameras due to more use of amplification in the blue color channel as compared to the green or red channel, there can be more noise in the blue channel. Amplifier noise is a major part of the read noise of an image sensor, that is, of the constant noise level in dark areas of the image. In digital image processing, Gaussian noise can be reduced using a spatial filter, though when smoothing an image, an undesirable outcome may result in the blurring of fine- scaled image edges and less details because they also correspond to blocked high frequencies.

III. RESULTS AND DISCUSSION

Original noiseless image is taken and some amount of noise is added into it. Original image is shown in figure 1. When noise is added to it the image with noise is shown in figure 2.

Figure 1: Original image without denoising

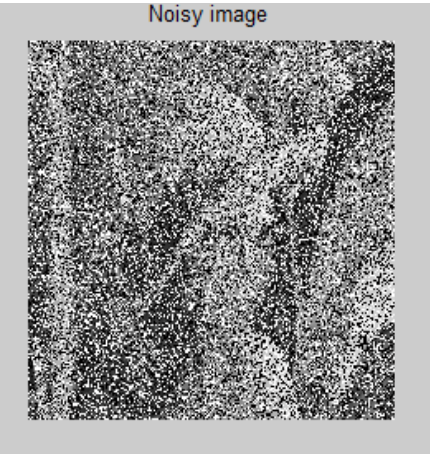

Figure 2 : Noisy image with Gaussian noise added to it

Figure 3: Denoised image after universal thresholding

The comparison of proposed ant colony algorithm has been outlined in table1.

Table 1: Comparison of PSNR

S. N.	ITER	PSNR (Noisy)	PSNR UT	PSNR Ant Colony
1.	10	66.6237	69.7652	75.5287
2.	15	66.6153	69.7498	75.5636
3.	20	66.5960	69.7141	75.6652
4.	30	66.6263	69.7671	75.7257
5.	40	66.5775	69.7266	75.8887

IV. CONCLUSION

This paper investigates noise models and includes an in-depth literature survey of denoising based on wavelets. Desirable features and complexities of denoising algorithms are discussed. In addition, it explains common mechanisms used to evaluate the performance of denoising algorithms. According to the current literature, denoising algorithms based on wavelet transform are the best choice for achieving the desired denoising performance. However, the computational complexity must also be considered. Thresholding techniques used with the Discrete Wavelet Transform are the simplest to implement. A universal denoising algorithm is a dream of researchers, although there are no universal method, in this study, the denoised results of the proposed algorithms and existing algorithms are compared under different noise models and variances by means of the evaluation methods introduced above.

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