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# A REVIEW PAPER ON IMAGE DENOISING BY LOW RANK MATRIX DECOMPOSITION ANDGENETIC ALGORITHM

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## ABSTRACT

A great challenge in the field of image processing nowadays is image denoising. Although, there have beenproposed various methods and algorithms for the same, but,most of them have not attained the desirable results. Theperformance does not match with the assumed one.In the field of image denoising, nonlocal image denoising algorithm is a nonlinear, space average denoising algorithm, it will not cause boundary blurred, and it is an effective denoising algorithm. But its application still has limitations because of it taking much longer time, in this paper, the method was improved, image signal can be divided into high frequency and low frequency part using low rank matrix decomposition, nonlocal denoising algorithm is used in low-frequency approximate signal, for high frequency detail signals using wavelet filtering method for denoising. Then, noise and aliasing artifacts are removed from the structured matrix by applying low rank matrix decomposition method with Genetic Algorithm(GA). We use Genetic Algorithm for unwanted features reduction from the high and low frequency signals. The Denoising of image is implemented using Image Processing Toolbox. This work test and found suitable for its purpose.For the implementation of this proposed work we use the Matlabsoftware.

**KEYWORDS**: Denoising, Low rank matrix decomposition, Nonlocal algorithm, Genetic Algorithm(GA), PSNR SSIM and MSE.

## INTRODUCTION

Denoising is a process of removing noise from a signal. All recording devices, both analog and digital have traits which make them susceptible to noise. Noise can get introduced into the image while capturing or transmission of the image. For this, there have been introduced various linear (such as Weiner filtering) and non linear techniques (such as Thresholding). Thus, the traditional way of image denoising is filtering. But the wavelet transforms have also emerged during the last decade. There are two main types of wavelet transform that is continuous and discrete. Where, the Discrete Wavelet Transformation is now considered more suitable over methods like Fourier and Cosine transforms. Wavelets provide a framework for signal decomposition in the form of a sequence of signals known as approximation signals with decreasing resolution supplemented by a sequence of additional touches called details. Many other methods developed are anisotropic filtering, bilateral filtering, total variation method and non local methods.

In the general case, Digital image noise causes are diverse, and characteristic are different kinds of noise. All have a common characteristic. But the noise in different frequency bands and different channels (color image) will have different performance. For example, a certain amount of Gauss noise is mainly concentrated in the high frequency part of image, this also is the wavelet describes the main starting point of value to receive method, did it only for the high frequency of treatment: for digital camera photo. At the time of without any post-processing, red, green and blue (RGB) three color channels, blue channel is one of the largest channel noise contamination rates. In the case of Gauss noise, after multi-resolution decomposition, part of different frequencies of noise is different. For noise points, therefore, frequency of treatment or points of color channel has certain benefits, often can reduce processing time, or to different treatment for different parts, reduce the difficulty of processing, etc. This article discusses the different frequency processing is the case, the main point is the use of the characteristics

of multi-resolution for original while NLM algorithm In view of the noise in different frequency bands form, multi resolution analysis method is an efficient way. This method can effectively reduce the noise of the high frequency part of image. It will image is decomposed into different frequency bands, this approach than in the case of no decomposition, can give us more information of image information and noise. First of all, for an input image containing noise, on the two-dimensional wavelet decomposition, decomposition can get information of two parts, the low-frequency approximate information L and high-frequency details of the H, among them, the high frequency detail information and contains three parts: the level of detail, vertical details and diagonal detail information. After then, for the decomposition of two pieces of information, due to the low frequency part of the approximate information contained more image content, the mix of noise and image information, and no more obvious distinguish, therefore, need for a decomposition, decomposition process is similar to the above situation. In the experiment, we found that the need to break down the number of layers related to image quality and features in our experiments, normally we only decomposed to the second floor. Decomposed to the bottom of the time, for the low frequency part, due to containing noise is less, so we do not make any processing to its: for the high frequency part we can according to common practice, using the way of wavelet threshold filtering noise. Then the two pieces of information through the combined wavelet inverse transformation.

**Low rank Matrix decomposition**

Matrix representations of complex systems and models arising in various areas often have the character that such a matrix is composed of a sparse matrix and a low-rank matrix. Such applications include the model selection in statistics, system identification in engineering, partially coherent decomposition in optical systems, and matrix rigidity in computer science.

**Genetic Algorithm (GA)**

Genetic Algorithm (GA) based optimization techniques for Image Denoising is proposed in this work. The Genetic Algorithm belongs to the field of Optimization Algorithms and Swarm Optimization, and more broadly to the fields of Computational Intelligence and Metaheuristics. It is related to other Optimization Algorithms such as the Chemotaxis Algorithm and other Swarm Intelligence algorithms such as Ant Colony Optimization and Particle Swarm Optimization. There have been many extensions of the approach that attempt to hybridize the algorithm with other Computational Intelligence algorithms and Metaheuristics such as Particle Swarm Optimization, Genetic Algorithm, and Tabu Search. The Genetic Optimization Algorithm is inspired by the group foraging behavior of such as E.coli and M.xanthus. Specifically, the BFOA is inspired by the Chemotaxis behavior of that will perceive chemical gradients in the environment (such as nutrients) and move toward or away from specific signals. Perceive the direction to food based on the gradients of chemicals in their environment. Similarly, secrete attracting and repelling chemicals into the environment and can perceive each other in a similar way. Using locomotion mechanisms (such as flagella) can move around in their environment, sometimes moving chaotically (tumbling and spinning), and other times moving in a directed manner that may be referred to as swimming. l cells are treated like agents in an environment, using their perception of food and other cells as motivation to move, and stochastic tumbling and swimming like movement to re-locate. Depending on the cell-cell interactions, cells may swarm a food source, and/or may aggressively repel or ignore each other.
There are some parameters given which is useful in our implementation.

A. MSE:

Mean Squared Error is essentially a signal fidelity measure. The goal of a signal fidelity measure is to compare two signals by providing a quantitative score that describes the degree of similarity/fidelity or, conversely, the level of error/distortion between them. Usually, it is assumed that one of the signals is a pristine original, while the other is distorted or contaminated by errors. The MSE between the signals is given by the following formula:

$$MSE = (1/N)\Sigma i|x(i)- e(i)|2$$

Here x and e are the encrypted watermarked audio signals respectively and N is the number of samples in the audio signal.

B. PSNR

Embedding this extra data must not degrade human perception about the object. Namely, the watermark should be “invisible” in a watermarked image or “inaudible” in watermarked digital music. Evaluation of

imperceptibility is usually based on an objective measure of quality, called peak signal to noise ratio (PSNR), or a subjective test with specified procedures. The PSNR values can be obtained using following formula-

PSNR = 20log10 (PIXEL_VALUE/√MSE)

## METHODOLOGY

To verify the effectiveness (qualities and robustness) of the proposed Image Denoising we conduct several experiments with this procedure on several images. The methodology of our proposed work is given below:
Phase1: Firstly we develop a particular GUI for this implementation.
Phase2: Develop a code for the add noise in the load image from the database of the images.
Phase3:Develop a code for the Denoising by the uses of Denoising Low Rank Matrix Decomposition and Genetic Algorithm (GA).
Phase4:After that we calculate PSNR, SSIM and processing time.

## CONCLUSION

In our propose work we present “Image Denoising by Low Rank Matrix Decomposition and Genetic Algorithm”. This proposed method removes noise simultaneously and computes the components of the image to be processed in a moving frame that encodes its local geometry (directions of gradients and level lines). Then, the strategy we develop is to denoise the components of the image in the moving frame in order to preserve its local geometry, which would have been more affected if processing the image directly. In our proposed method that extended to multiple dimensions and obtained a higher SNR by the using of Genetic Algorithm (GA) to reduce unwanted information from High and Low frequency signal.

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