Image De-Noising using Efficient Filtering Techniques

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Abstract—*Image denoising is an important research area in the field of image processing and computer vision. It finds its application in various areas such as iage restoration, object recognition, image classification and medical imaging. The challenge of any denoising algorithm is to reconstruct the original image by suppressing unwanted noise from a corrupted image. The goal of image de-noising is to remove noise, while preserving the useful information. The technologies for acquiring digital medicl images continue to improve resulting in image of higher and higher resolution and quality, removing noise in these digital images remains one of the major challenges in the subtle feauters in the images many proposed de-noising techniques have their own problems.*

Keywords: Image de-noising, Image restoration and reconstruction, K-SVD Denoising, Guided filter.

I. INTRODUCTION

Image de-noising method based on spatial domain and image de-noising method based on transform domain. The first type mainly deals with the noisy image with filters, and the other uses a different filter with function. Common spatial domain methods include median filtering, mean filtering, wiener filtering, and so on. However, the image de-noising method based on transform domain make use of the fact that the noise not sparse. At first, we can represent the image by a fixed orthogonal transform function and obtain many frequency coefficients. Then, we conduct the image de-noising by processing these frequency coefficients. Finally, the de-noised image can be obtained by the inverse transform.

II. LITERATURE REVIEW

Underwater Image Enhancement by Dark Channel Prior.

Author:R. Sathya, M. Bharathi and G. Dhivyasri

Description: A Dark channel prior method which is used for removing the haze present in the underwater image. This approach is based on a local patches in haze-free underwater images contain some pixels which have very low intensities in at least one color channel. By means of this prior with the haze imaging color model estimates the thickness of the haze and recovers a high quality haze free image. This method does not require images with different exposure values. This technique is completely based on the attenuation experienced by point across multiple frames.

The Research of Underwater Image De-noising Method Based on Adaptive Wavelet Transform

Author: LeiFei, Wang Yingying

Description: A technique for the crisis of underwater image denoising. This method based on adaptive wavelet combining adaptive threshold selection with adaptive threshold selection with adaptive output of the threshold function. In this, first taking into consideration the underwater image with low signal to noise ratio (SNR), contrast imbalance and poor image quality. After this the next step is some pre-processingshould be done before wavelet threshold denoising. Then, they adopt adaptive wavelet combining adaptive threshold selection with adaptive output of the threshold function for the image de-noising. Finally the simulation results show that this proposed method not only removes noise effectively, improves image output peak signal-to-noise ratio (PSNR), but also yields superior vision quality and embodies the superiority of wavelet denoising.

III. PROPOSED METHODOLOGY

In this, the proposed scheme designs the architecture for to denoise and enhance the underwater image. The image denoising algorithm achieves near optimal soft thresholding in the K-SVD domain for recovering original signal from the noisy one. During the K-SVD de-noising, the most important steps are the choices of an appropriate threshold and effective threshold function, which have direct impacts on the performance of a K-SVD de-noising algorithm. The key of the K-SVD threshold de-noising is the relation between K-SVD coefficient and threshold. The choice of the threshold determines the coefficient of the K-SVD reconstruction. So the selection of adaptive K-SVD threshold will help to achieve better de-noising effect. To achieve an enhancement of the underwater image our proposed scheme uses a method which is based on Guided filtering. Guided filtering is used to enhance the contrast of an image. In this a method to enhance contrast is proposed; the methodology consists in solving an optimization problem that maximizes the average local contrast of an image. The optimization formulation includes a perceptual constraint derived directly from human threshold contrast sensitivity function. Here it applies the proposed operators to some images with poor lighting with good results. On the other hand a methodology to enhance contrast based on color statistics from a training set of images which look visually appealing is presented. In this way, even though the reported algorithms to compensate changes in lighting are varied, some are more adequate than others.

The proposed scheme uses K-svd algorithm for to denoise the image whereas Guided filtering is used to enhance the quality of image. Here the preprocessing, noise estimation and threshold selection includes multiscale product thresholding algorithm.

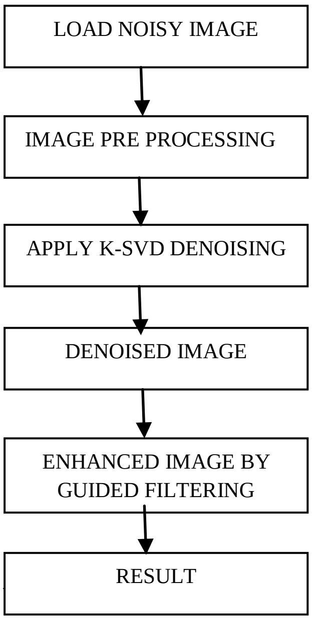

Fig.1:BLOCK DIAGRAM

A. K-SVD

Effective image representation plays a vital role in image SR reconstruction. Various dictionarylearning algorithms have been developed to replicate the image representations from the observedtraining images. From the last decade, K-SVD dictionary learning procedures have been deployedsuccessfully for image de-noising and super resolution. Literature reviews indicate that anappropriate modification both in sparse recovery and in dictionary updating stages can improve theperformance of the dictionary learned through the K-SVD dictionary training procedure.The training procedure of the K-SVD consists of two parts: 1) sparse recovery method and 2)dictionary updating. The objective function for sparse recovery posed can be decoupled intoN distinct problems.

Rn is the training patch randomly taken from the HR training image Y. The image patch yis involved in dictionary learning if the standard deviation σ of its intensity is greater than a thresholdΔ, i.e., σ > Δ. The L0-minization in this problem is solved by applying ROMP. ROMP is a simpleregularized extension of OMP which has the transparency and greediness of OMP and the robustnessof the L1-minization. In ROMP, the local approximation property recommends using the K biggestcoordinates of the observation vector u=G*x instead of one biggest coordinate as OMP does. Theobservation vector u does better as a local approximation while reconstructing the HR patch a from themeasurement x =Ga. ROMP emphasizes that the selected coordinates I must be more regular. Thus,coordinates J0 with maximum energy and comparable sizes are selected and are added with the indexset: I←I∪J0. For selected coordinates I, we solve a least square problem and update the residual r toeliminate any contribution of the coordinates,where residual r is initialized to y at the start. The regularization step does not involvecombinatorialcomplexity and can be performed in linear time.

B.*Experimental Results and Discussion:*

The performance of the K-Svd and guided filtering is evaluated for images using MATLAB 2-D function. These can be used for image de-noising and enhancement. We have evaluated the performance of the proposed scheme using metrics such as MSE, RMSE, PSNR and Correlation etc. The images taken as an input are shown below. Then these images are taken into a standard format of the MATLAB. The proposed scheme is applied on gray scale images.

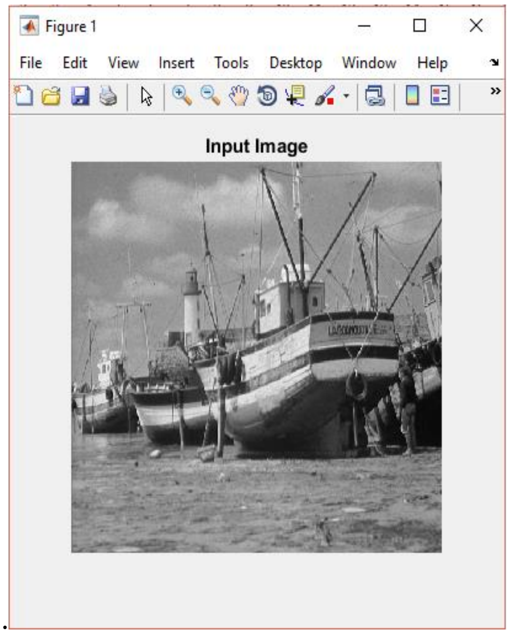

Fig.2:INPUT IMAGE

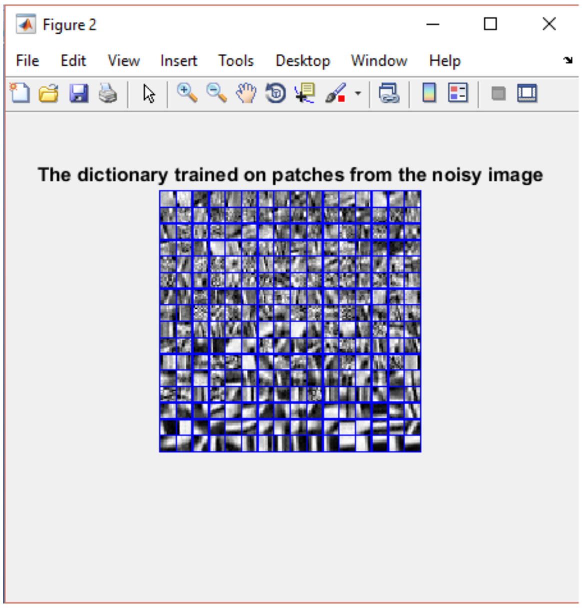

Fig.3: DICTIONARY

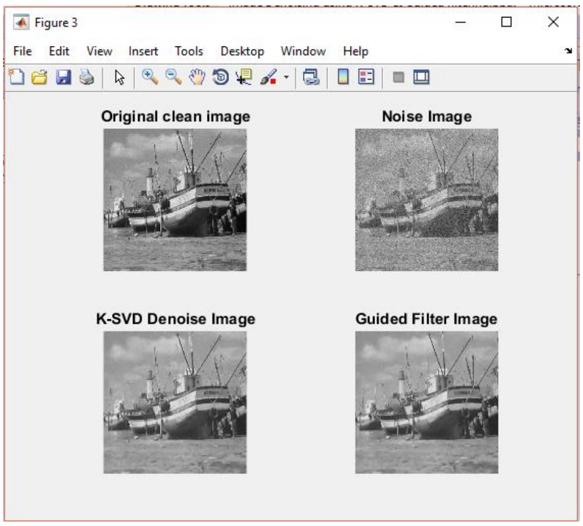

Fig.4: PROCESSED IMAGES

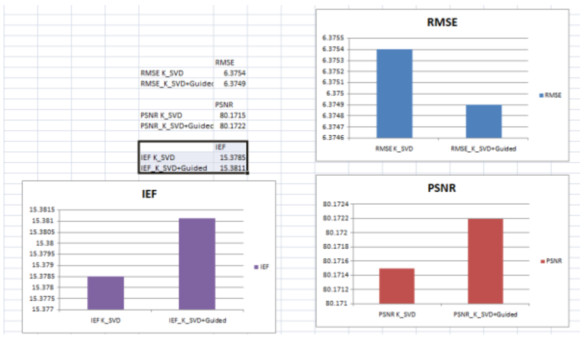

Fig.5: PARAMETERS

IV. CONCLUSION

At present, scientists are eager to explore the underwater world. However, the area is still lacking in image processing analysis and methods that could be used to improve the quality of underwater images. Underwater image de-noising and enhancement techniques provide a way to improve the object identification in underwater environment. The proposed algorithm not only removes noise, improve the PSNR, but also get a better visual effect. There is a lot of research started for the improvement of image quality, but limited work has been done in the area of underwater images. As our proposed method is applied on only Greyscale and RGB colour images, so the further research will apply on other image types.

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