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Effective Method for De-Noising of Water Submerged Image

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Abstract

Underwater objects are reconstructed from a sequence of images distorted by moving water waves. A new approach is presented in this work. We make use of the bi-spectrum technique to analyze the raw image sequences and recover the phase information of the true object. In this work, an original approach to obtaining the true image from the sequence of the distorted images is proposed. Fourier phase of the target image is estimated by analyzing the averaged bi-spectrum of the image ensemble. The algorithm is simulated using MATLAB 6.0 R2009b tool. Results show that the algorithm will be very promising. Such technique has wide applications to areas such as ocean study, underwater surveillance and submarine observation.

1. Introduction

The image restoration started from 1950's. The goal of restoration techniques is to improve an image in some predefined sense. Restoration attempts to recover an image that has been degraded by using a prior knowledge of the degradation phenomenon. Thus, restoration techniques are oriented toward modeling the degradation and applying the inverse process in order to recover the original image.

Image restoration includes process that attempt to remove degradations and restore an image to a previous state.Restoration is distinguished from enhancement in that degradation can be considered an external influence that is separate from the image signal. Assume that a degradation function exists, which together with additive noise, operates on the input image f(x, y) to produce a degraded image g(x, y). The objective of restoration is to obtain an estimate for the original image from its degraded version g(x, y) while having some knowledge about the degradation function H and the noise n(x,y).

2. Literature Survey:

In this chapter different restoration techniques are discussed and are presented as a literature survey. A. Efros, V. Isler, J. Shi, and M. Visontai, (2005) in the paper Seeing through Water: Image Restoration using Model-based Tracking proposed a methodology using a video sequence of an underwater scene taken from above the water surface suffers from severe distortions due to water fluctuations. The shape of the water surface is estimated and the planar underwater scene is recovered without using any calibration patterns, image priors, multiple viewpoints or active illumination. A compact spatial distortion model of the water surface using the wave equation is built.

In many imaging scenarios, the camera and the scene of interest are immersed in different media with an interface in-between .The image of the floor that is severely distorted by water fluctuation is recovered. Similar scenarios occur in turbulence imaging, astronomy and satellite imaging, underwater imaging, measuring objects in liquid and tunable liquid lensing. When the water surface fluctuates over time, the dependency of light transport on the interface renders any static model inapplicable. In this case, un-distortion is possible if the exact shape of the interface can be measured if the interface and the scene are illuminated by spectrally isolated red and green channels, and captured by a color camera.

The water surface and the underlying planar static scene given is recovered simultaneously but only for a video sequence with severe distortions. The key idea is to build a spatial distortion model of the water surface using the wave equation. In particular, a simulator for image distortion due to fluctuations of the water surface is formed from which a reduced space model of the image distortions is derived using PCA, yielding fewer number of parameters. This enables model-based tracking algorithm to estimate the water surface at every time instant, by fitting the model to each video frame. Finally, the estimated water surface is used to recover the original scene with reduced distortions.

Leung and Malik's method models the basic repetitive elements of texture images as cluster centers of responses of a bank of convolution filters. The center of each cluster will represent a texton (i.e., basic texture element). The textons are then grouped to form a dictionary that is used to "explain" the appearance of general textures. Classification is accomplished by comparing 1D frequency histograms of vector quantized maps of the original textures based on the texture dictionary. Histogram comparison is achieved using the chi-square similarity measure

$$x^2 = \Sigma_i \frac{(p_i - q_i)^2}{p_i + q_i} \quad (2.1)$$

where p_i and q_i are 1D histograms. The geometric distortion removal method and texture classification method is combined to solve the problem of classifying images of submerged textures when the water is disturbed by waves. An improvement on texture classification methods based on texton frequency histograms is suggested by adding spatial statistics measurements on the texton maps.

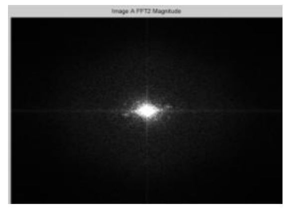
Geometric distortions via clustering are analyzed, while measuring the amount of motion blur by analysis in the frequency domain in an attempt to separate high and low distortion regions. Once these regions are acquired, they are then combined into single samples of neighboring low distortion regions to form a single image that best represents the object. First, the "leakage" Problem is considerably reduced (i.e., erroneous NCC correlations being classified as shortest distances) by clustering the sub-regions using a multi-stage approach that reduces the data to a small number of high-quality regions. Second, frequency-domain analysis is used which allows to quantify the level of distortion caused by motion blur in the local sub-regions.

3. Proposed Algorithm:

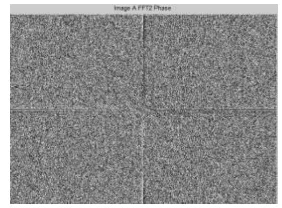
Step 1: Start
Step 2: Divide the raw image into small sized patches.
Step 3:Locate and discard the most distorted patches.
Step 4: Estimate the Fourier phase and Fourier magnitude of each patch after discarding the distorted patches.
Step 5: Each patch of the target image is reconstructed with the Fourier magnitude and phase obtained using morphological processing techniques.

5. Output:

Submerged Original Image



Magnitude Response



Phase Response

Restored Image using Bi-Spectrum Analysis

Fig 1: Output of Denoising Algorithm

4. Conclusion:

To conclude with the submerged image can be effectively restored with bispectral analysis with less complexity. To increase the effectivity further the patches are divided further.

7. Reference:

[1] R Shefer, M. Malhi, and A. Shenhar, "Waves distortion correction using cross correlation," *http://visl.technion.ac.il/projects/2000maor/*, 2001.
[2] A. Efros, V. Isler, J. Shi, and M. Visontai, "Seeing through water," *NIPS*, 2005.

3] A. Donate and E. Ribeiro, "Improved reconstruction of images distorted by water waves," *International conference on computer vision theory and applications*, 2006.

[4] C. Cox and W. Munk, "Slopes of the sea surface deduced from photographs of sun glitter," *Scripps Inst. Of Oceanogr*, vol. 6, pp. 401–479, 1956.

[5] A. Donate, G. Dahme, and E. Ribeiro, "Classification of textures distorted by water waves," *ICPR*, 2006.

[6] M. Roggemann and B. Welch, *Imaging Through turbulence*, CRC Press LLC, 1996.

[7] A. Lohmann and B. Wirnitzer, "Triple correlations," *Proc. of IEEE*, vol. 72, pp. 889–901, July 1984.

[8] C. Matson, "Weighted-least-squares phase reconstruction from the bispectrum," *J.Opt.Soc.Am.A*, vol. 8, pp.1905–1913, 1991.

[9] H. Bartle, A. Lohmann, and B. Wirnitzer, "Phase and amplitude recovery from bispectra," *J.Opt.Soc.Am*, vol.23, pp. 3121–3129, Sept. 1984.

[10] D. Fried, "Probability of getting a lucky short-exposure image through turbulence, J.Opt.Soc.Am.A" vol. 68, pp. 1651–1658, 1978.

[11] S. Weddell and R. Webb, "Data preprocessing on sequential data for improved astronomical imaging," *Image and Vision Computing*, Nov 2005.

[12] Z. Wang and A. Bovik, "A universal image quality index,"*IEEE Signal Processing Letters*, vol. 9, pp. 81–84, 2002.

[13] H. Murase, "Surface shape reconstruction of a non rigid transparent object using refraction and motion," *IEEE Transaction on Pattern Analysis and Machine Intelligence*, Oct. 1992.