Underwater Image Enhancement

Digital Image Processing (EEE F435) Assignment

Papers Referred to:

1. Color Balance and Fusion for Underwater Image Enhancement by Codruta O. Ancuti , Cosmin Ancuti, Christophe De Vleeschouwer , and Philippe Bekaert. IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 27, NO. 1, JANUARY 2018[1]
1. Underwater Image Enhancement Using Adaptive Retinal Mechanisms by Shao-Bing Gao , Member, IEEE, Ming Zhang , Qian Zhao, Xian-Shi Zhang , and Yong-Jie Li , Senior Member, IEEE. (IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 28, NO. 11, NOVEMBER 2019) [2]

Why is it important ?

Underwater images often suffer from noise, color distortion and low contrast, because light is attenuated when it propagates through water.

These problems increase the difficulty of various tasks such as inspection of underwater infrastructures and cables , detection of man made objects , control of underwater vehicles , marine biology research, and archeology automatic fish and plankton detection and recognition.

Why do images appear green-bluish underwater?

All the images can be divided into 3 color components : Red, Green, and Blue.

Out of three Colors the green channel is relatively well preserved and red gets lost first due to larger wavelength.

The blue channel may be significantly attenuated due to absorption by organic matter.

The order of the wavelength of the three colors are:

Red - 700-635 Nm

Green - 560- 520 Nm

Blue - 440 - 485 Nm

Color Balance and Image Fusion

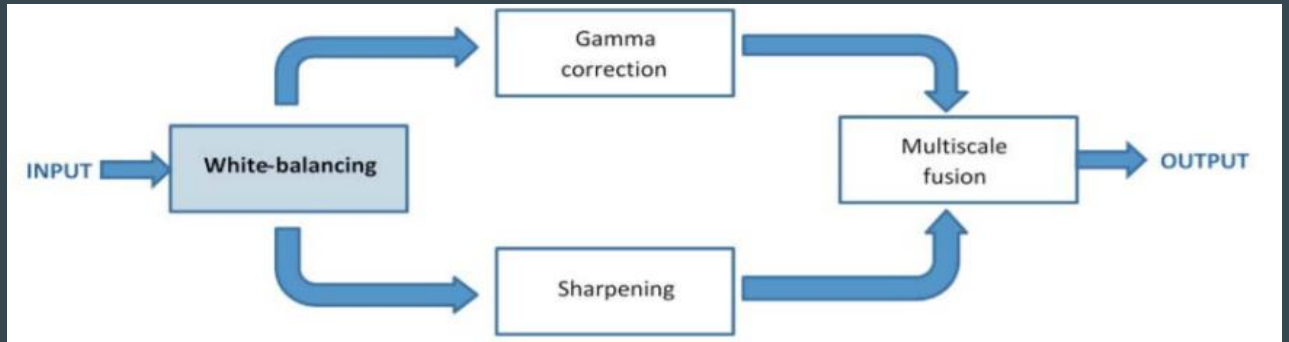


Fig. 1. Method overview: two images are derived from a white-balanced version of the single input, and are merged based on a (standard) multiscale fusion algorithm. the novelty of our approach lies in the proposed pipeline, but also in the definition of a white-balancing algorithm that is suited to our underwater enhancement problem.

White Balancing

White balancing stage aims at removing the color cast induced by underwater light scattering, so as to produce a natural appearance of the sub-sea images.

The multi-scale implementation of the fusion process results in an artifact-free blending.

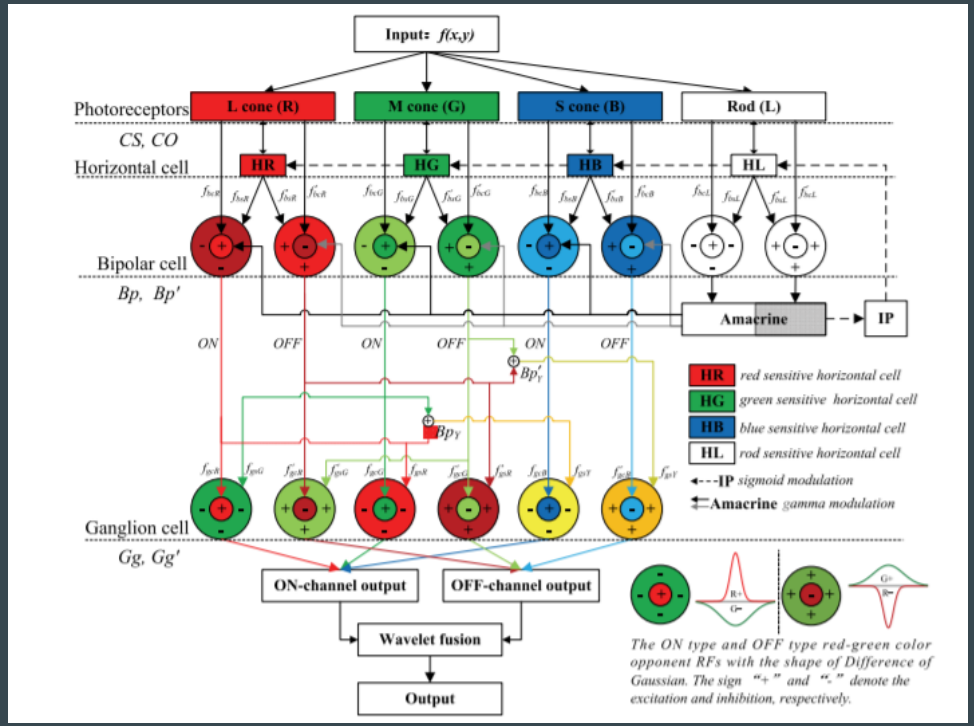
Why do Gamma Correction?

Gamma correction aims at correcting the global contrast and is relevant since, in general, white balanced underwater images tend to appear too bright. This correction increases the difference between darker/lighter regions at the cost of a loss of details in the under-/over-exposed regions.

Image Sharpening

To compensate for the loss of details due to Gamma Correction , we derive a second input that corresponds to a sharpened version of the white balanced image. Therefore, we follow the unsharp masking principle,in the sense that we blend a blurred or unsharp (here Gaussian filtered) version of the image with the image to sharpen.

Using Adaptive Retinal Mechanisms [2]



In this paper they have use the adaptive mechanisms of the telepost Fish retina.

Experimentally they have proven that this method can eliminate the haze and the non-uniform color bias.

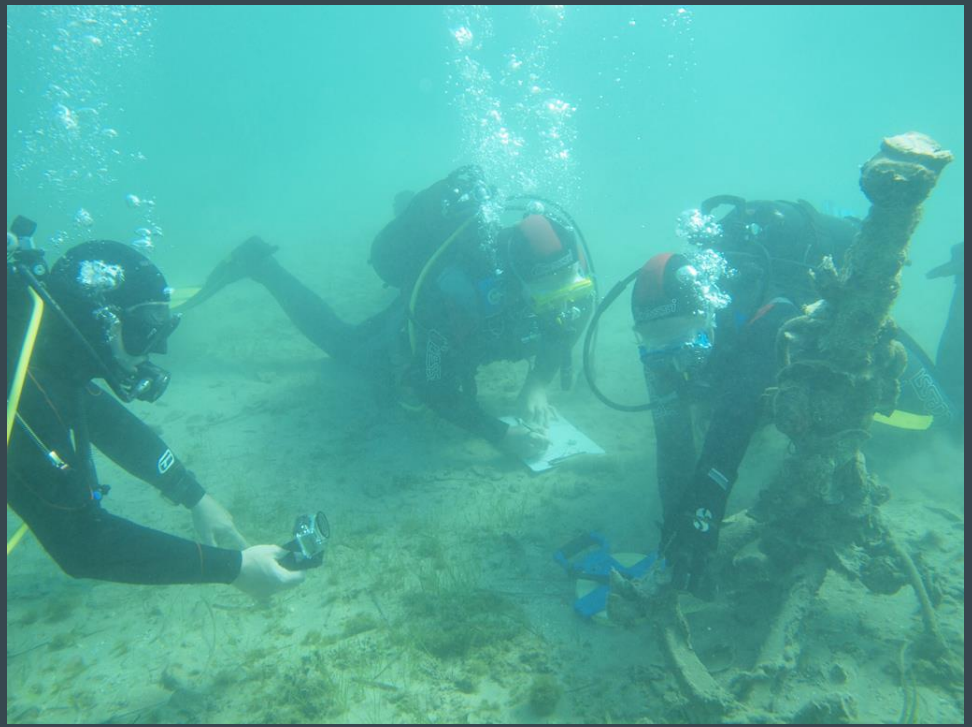
Source[2]

Original Image

Comparison of the final results ([1] , [2] , Our):

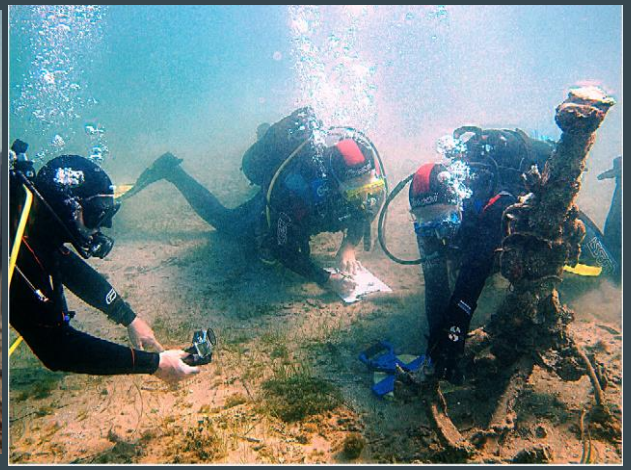


Original Image



Comparison of the final results ([1] , [2] , Our):





Thank you

Ashish Sinha - 2017AAPS0400G

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Ojit Mehta - 2017A3PS0372G

Riddhesh Sawant - 2017AAPS0261G