

Underwater Imaging Color Restoration using Dehazing Priors with Adaptive Color Correction

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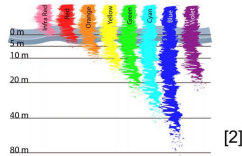
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Motivation

- How do we reconstruct an underwater image with correct color accuracy?

$$E_T = E_d + E_f + E_b$$

- Implement Dark Channel Prior with Color Correction



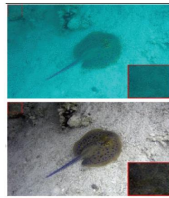
[2]

Related Work

$$I(x) = J(x)t(x) + A(1 - t(x)) \quad [1]$$

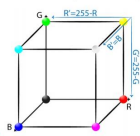
- I: Observed image (hazy)
- J: Image radiance (recover)
- T: Transmission
- A: Atmospheric light

Adaptive Color Correction Algorithm



[4]

$$\min_{y \in \Omega(x)} \left(\min_{c \in \{r, g, b\}} \dots \right) = DC(\dots)$$



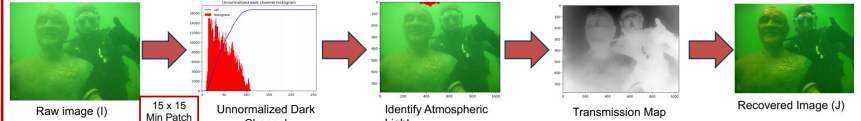
[2]

References

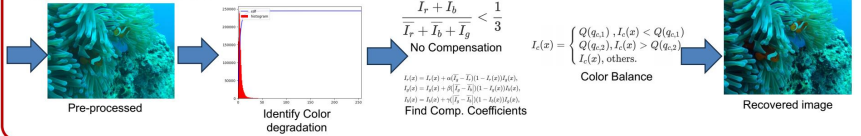
- [1] K. He, J. Sun, X. Tang, Single Image Haze Removal Using Dark Channel Prior, IEEE Conference on Computer Vision and Pattern Recognition, 2009
 [2] T. Luczynski, A. Birk, Underwater Image Haze Removal and Color Correction with an Underwater-ready Dark Channel Prior, arXiv Computer Vision and Pattern Recognition, 2018
 [3] X. Fu et al., Two-Step Approach for Single Underwater Image Enhancement, IEEE International Symposium on Intelligent Signal Processing and Communication Systems, 2017
 [4] S. Lin et al., Underwater Image Enhancement Based on Adaptive Color Correction and Improved Retinex Algorithm, IEEE Access vol. 11 pp 27620 – 27630, 2023

Image Processing Pipeline

Dark Channel Prior



Color Correction



Experimental Results

Color Correction:

- Color correction are inconsistent depending on underwater scenery
- Easily overcorrects
- Prefiltering needed

Dehazing Priors:

- Naive DC: No significant effect on underwater images
- UDC saturates blue channels
- UWRDC slight improvement
- Proposed algorithm most promising

	Ref.	Raw	Two-Step	Adaptive
Best Two-Step				
Best Adaptive				

	Ref.	Raw	Naive DC	UDC	UWRDC	Ours
Image						
PSNR	N/A	13.4	13.4	11.8	13.5	14.9