Automatic system for improving underwater image contrast and color through recursive adaptive histogram modification

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ABSTRACT

Contrast and color are important attributes to extract and acquire much information from underwater images. However, normal underwater images contain bright foreground and dark background areas. Previous enhancement methods enhance the foreground areas but retain darkness and blue-green illumination of background areas. This study proposes a new method of enhancing underwater image, which is called recursive adaptive histogram modification (RAHIM), to modify image histograms column wisely in accordance with Rayleigh distribution. Modifying image saturation and brightness in the hue–saturation–value color model increases the natural impression of image color through the human visual system. Qualitative and quantitative evaluations prove the effectiveness of the proposed method. Comparison with state-of-the-art methods shows that the proposed method produces the highest average entropy, measure of enhancement (EME), and EME by entropy with the values of 7.618, 28.193, and 6.829, respectively.