Single-Shot Underwater Image Restoration: A Visual Quality-Aware Method Based on Light Propagation Model

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Abstract

In this paper, we present a novel method to restore the visual quality of images from scenes immersed in participating media, in particular water. Our method builds upon existing physics-based model and estimates the scene radiance by removing the medium interference on light propagation. Our approach requires a single image as input and, by combining a physics-based model for light propagation and a set of quality metrics, reduces the artifacts and degradation imposed by the attenuation, forward scattering, and backscattering effects. We show that the resulting images produced by our technique from underwater images are amenable to be directly used as input to algorithms which do not assume disturbances from the media. Our experiments demonstrate that, as far as visual image quality is concerned, our methodology outperforms both traditional image based restoration approaches and the state-of-the-art methods. Our approach brings advantages regarding descriptor distinctiveness which enables the use of underwater images in legacy non-participating media algorithms such as keypoint detection and description.

Keywords: Image Restoration, Underwater Vision, Feature-preserving,

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