Abstract 21 – Paper ID: 031

Underwater Image Hyper-Resolution Using MLDRG

Buddi Reethika Chovudary[1], Sai Keerthana Sandhiri[1], Sama Rohith Reddy[1], M Gayatri[2]

[1]CSE (AI&ML), Geethanjali College of Engineering and Technology (GCET), Hyderabad, India
[2]AIML, Geethanjali College of Engineering and Technology (GCET), Hyderabad, India

Email: buddireethika@gmail.com

Abstract

The combination of underwater environment conditions with suspended particles and wavelength-dependent light absorption creates severe image degradation. The combination of these effects results in distorted colors and decreased contrast and lost details, which makes visual interpretation challenging. The traditional enhancement methods including histogram equalization and white balancing produce limited improvements because they fail to address the complex nonlinear distortions which occur in actual underwater environments. The latest deep learning models demonstrate promising results, but they fail to achieve simultaneous structure recovery and color correction and resolution enhancement.

The Hyper-resolution Generative Framework (HGF) represents an end-to-end deep learning system which restores and enhances underwater images with high clarity. The MLDRG component of the model addresses noise and haze and color distortion, while the HFLM module specializes in texture recovery and detailed structural element restoration. The framework receives training data from the UIEB dataset which contains matched underwater image pairs between degraded and reference images. The model trains through a combination of reconstruction loss and perceptual loss and structural loss and adversarial loss to achieve both realistic and faithful results.

The evaluation results demonstrate that HGF delivers top results in PSNR and SSIM metrics and perceptual quality assessment, particularly when dealing with scenes that have severe color distortion. The model generates natural-looking output with improved definition and accurate color representation. The framework demonstrates practical value for marine research and underwater robotics and coastal monitoring and scientific documentation because of its improved performance. The research presents a single method which restores and enhances underwater images while maintaining essential high-frequency details required for underwater analysis in real-world scenarios.

Keywords: Underwater Imaging, Hyper-Resolution, Image Restoration, MLDRG, HFLM, Deep Learning, UIEB Dataset, PSNR, SSIM, GAN-based Enhancement

ISBN: 978-81-989164-2-6; DOI: 10.21467/abstracts.8.1