

Restorasi Citra Bawah Air Untuk Deteksi Objek Menggunakan Metode Hibrida Global-Local Network = Underwater Image Restoration for Object Detection with Hybrid Global-Local Network Approach

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Abstrak

Di dalam air, pergerakan cahaya dipengaruhi oleh partikel tersuspensi dan redaman gelombang cahaya. Hal ini menyebabkan citra bawah air memiliki masalah distorsi warna, kontras rendah, dan visibilitas buruk, sehingga banyak informasi yang hilang dari citra bawah air. Banyak metode restorasi citra bawah air sudah diteliti, baik konvensional dan network-based. Untuk mengatasi keterbatasan dari kedua metode, penelitian ini menggunakan metode hibrida Global-Local Network dan Compressed-Histogram Equalization GLNet-CHE. Pada eksperimen pertama, penulis melakukan restorasi citra bawah air menggunakan GLNet-CHE dan menguji berbagai metode restorasi pada tahap konvensional. Metode restorasi konvensional yang diuji yaitu metode asal Compressed-Histogram Equalization (CHE), dan metode lainnya yaitu Locally Adaptive Contrast Enhancement (LACE) dan Bayesian Retinex. Hasil restorasi citra pada dataset UIEB menunjukkan bahwa GLNet dengan metode konvensional CHE memperoleh nilai terbaik PSNR 21.2101 ± 3.4080 dan SSIM 0.8585 ± 0.0741 , mengungguli kombinasi metode lainnya. Pada eksperimen kedua, penulis meneliti pengaruh restorasi citra bawah air terhadap task deteksi objek. Penulis menggunakan model YOLO-NAS untuk mendeteksi objek pada citra bawah air yang belum dan sudah direstorasi. Hasil pada dataset BrackishMOT menunjukkan bahwa deteksi objek pada citra yang telah direstorasi memperoleh nilai precision, recall, dan F1 terbaik dengan nilai 0.6214, 0.3791, dan 0.3901. Sementara itu, nilai mAP tertinggi diperoleh citra bawah air asli dengan nilai 0.3851 yang menandakan performa yang lebih konsisten pada berbagai threshold.

.....High-quality underwater images are quite difficult to obtain due to light distortion caused by suspended particles and the attenuation of light waves. This causes underwater images to have problems of color distortion, low contrast, and poor visibility, leading to considerable information loss. Many methods for underwater image restoration, both conventional and network based, have been researched. To overcome the limitation of both methods, this research uses the hybrid Global-Local Network and Compressed-Histogram Equalization (GLNet-CHE) approach. In the first experiment, the author conducts underwater image restoration using GLNet-CHE with various restoration methods for the conventional step. The conventional restoration methods used are the original Compressed-Histogram Equalization (CHE) and other methods, i.e., Locally Adaptive Contrast Enhancement (LACE) and Bayesian Retinex. The image restoration results on the UIEB dataset shows that GLNet with CHE as the conventional method obtained the best PSNR and SSIM value of 21.2101 ± 3.4080 and 0.8585 ± 0.0741 respectively, outperforming the other combinations. In the second experiment, the author investigated the effect of underwater image restoration on the object detection task. YOLO-NAS is used for object detection on restored and original underwater images. The results on the BrackishMOT dataset show that object detection on the restored images obtained the best precision, recall and F1 values with values of 0.6214, 0.3791 and 0.3901 respectively. Meanwhile, the highest mAP value was obtained from the original underwater images with a value of 0.3851, which indicates more consistent performance at various thresholds.