Deep Learning Under Water Image Enhancement

Underwater image enhancement is a crucial task in various fields, including marine biology, oceanography, underwater archaeology, and surveillance. However, underwater environments pose several challenges that degrade the quality of images and videos captured beneath the surface.

Title: Underwater Image Enhancement for Improved Visibility and Analysis.

The mysteries of deep-sea ecosystems can be unlocked to reveal new sources, for developing medical drugs, food and energy resources, and renewable energy products. Research in underwater image processing has increased significantly in the last decade. This is primarily due to the dependence of human beings on the valuable resources existing underwater.

Effective work in exploring the underwater environment is achievable by having excellent methods for underwater image enhancement. The work presented in this article highlights the survey of underwater image enhancement algorithms. This work presents an overview of various underwater image enhancement techniques and their broad classifications. The methods under each classification are briefly discussed.

Problem Statement

Description:

Images and videos captured in underwater environments are often plagued by poor visibility, reduced contrast, color distortion, and noise. These issues are primarily caused by the absorption and scattering of light as it passes through water, which leads to a degradation in image quality and hinders the analysis and interpretation of underwater scenes.

The goal of this project is to develop effective image enhancement techniques to address the following key challenges in underwater imaging:

Color Correction: Underwater scenes exhibit a strong color cast, often with a blue or green tint due to the selective absorption of different wavelengths of light. Correcting these color biases and restoring natural colors is a fundamental aspect of enhancement.

Contrast Enhancement: Poor contrast in underwater images makes it difficult to discern fine details and objects. Enhancing the contrast while preserving the integrity of the image is essential for improved visibility.

Dealing with Backscatter: Backscatter occurs when suspended particles, such as plankton or sediments, scatter light toward the camera, resulting in white specks and haze in the image. Effective techniques to reduce or eliminate the effects of backscatter are needed.

Noise Reduction: Underwater images often suffer from noise, which can be attributed to the low-light conditions and the electronic sensors used in underwater cameras. Reducing noise while maintaining image sharpness is crucial.

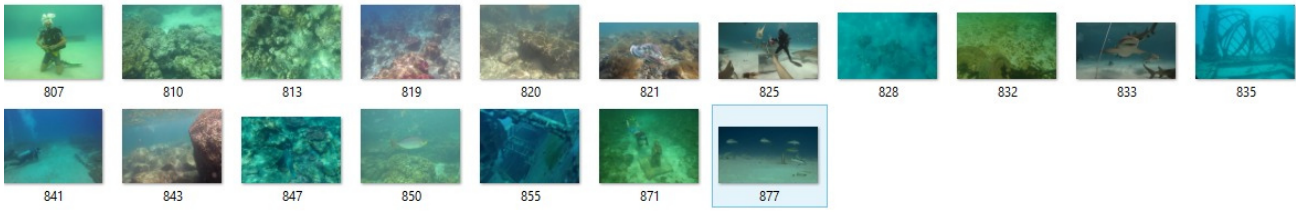
Enhanced Image Fusion: Combining multiple images taken at different exposure levels or with different lighting sources (e.g., artificial and natural light) to create a single, enhanced image is a common technique for improving underwater visibility.

Real-time Processing: In applications like underwater robotics and live streaming from submersibles, it is essential to develop algorithms and systems capable of real-time or near-real-time image enhancement to support timely decision-making and analysis.

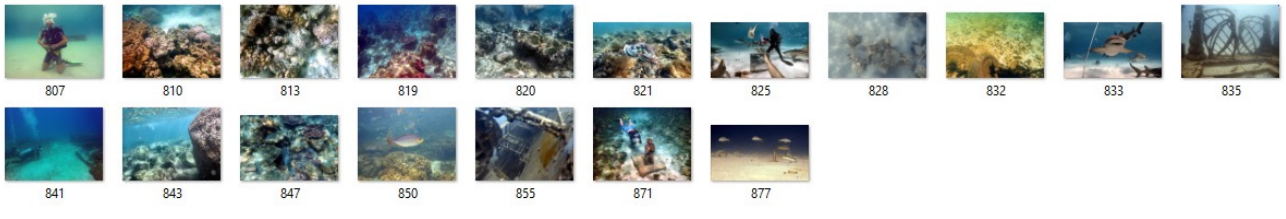
Adaptability to Varying Conditions: Underwater conditions can vary greatly, from clear, tropical waters to turbid and dark environments. The enhancement techniques should be adaptable to different underwater conditions.

Classes for Training the Deep Learning Model Include Photos Sample :

Input Images :



Output Images :



The choice of technique depends on the specific goals of the underwater imaging project, the quality of the input data, and the computational resources available. Researchers and engineers often combine multiple methods to address the various challenges associated with underwater image enhancement, ultimately aiming to produce clear, high-quality images for scientific, research, and industrial purposes.

Approach

1. Matrix Perform: Confusion Matrix, Translation Matrix.

2. Histogram Analysis and PCA.

2. Google Research Papers

Deep Learning Framework Used

Tensorlfow, Pytorch.

Extensive Solution

Software Development for Solving the Underwater Images Enhancement.

PLAY-A (PLAY) (github.com)

Future: Improvising the Deep Learning Models and Solving More Complex Problems. with the Models.

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Reference Help

UIEB Dataset | Papers With Code

Extensive Solution

Under Water Robot with Integrated Software Solution

PLAY-A/PROTCAM: An AI Cam Software. (github.com) .

Looking Out for Continuous Improvement and Innovation in this field.

Thank You && Regards.