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Comparing Effectiveness of GAN and CLAHE for Enhancing Underwater Images

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Abstract:
Underwater image enhancement is a necessary process to improve the quality of images captured in underwater environments. The underwater environment presents unique challenges that can significantly impact the quality of images, including reduced light and color, distortion and blurring, limited visibility and reflections, and the effects of particles and debris. Enhancing underwater images can help to overcome these challenges and improve the visibility of the captured scene. This can be especially important in applications such as underwater exploration, marine biology, and underwater archaeology, where clear and detailed images are crucial for analysis and decision-making. This study compares Contrast Limited Adaptive Histogram Equalization (CLAHE) and Generative Adversarial Networks (GAN). Images generated from both algorithms are compared on the basis of Peak Signal Noise Ratio (PSNR) values. PSNR value of image generated by GAN is greater than PSNR value obtained by CLAHE, so in order to obtain a highly enhanced underwater image GAN will be suitable.

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I. Introduction

Underwater images face several difficulties that make them challenging to capture and process. Water has a number of light properties due to which water absorbs light, reducing the amount of light that penetrates to underwater scenes. Underwater images are affected by reduced light and color due to the behavior of light in water. Water absorbs light, and the amount of light that penetrates to underwater scenes decreases as the depth of the water increases. The reduction in light causes the colors of objects to appear less vibrant and less contrasting. The water also scatters light, which makes images appear blue or green in color. The longer wavelengths of light, such as red and orange, are absorbed more quickly in water, leaving the shorter wavelengths, such as blue and green, to be scattered and reflected back to the camera. As a result, underwater images can appear monochromatic and lack the color variety seen in above-water images.

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