

Introduction:

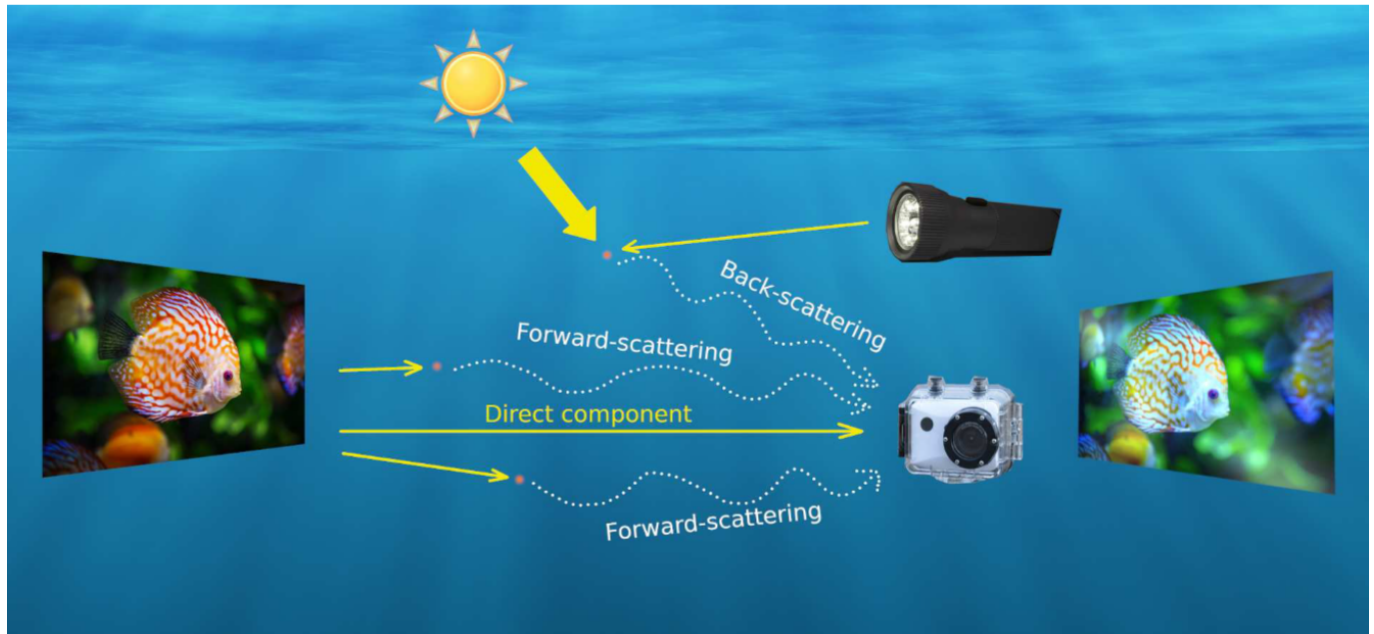
Challenges (some Solutions):

1. Light absorption and scattering

Water particles absorbing different wavelength of light distorting the captured image.

2. Back scattering:

The object getting illuminated by artificial light source at short distance cause intense light reflection.



Side-lighting instead of illuminating the object directly we illuminate the edges of the image. Using **light diffusers** to scatter the light smoothly across the region. This reduces the light range but improves the contrast.

3. Camera & lens Optics under water

Generally for AUV to analyse the surrounding we have to use wide angle lenses (e.g., fisheye lenses commonly used in underwater bots). These wide angle lenses have strong Barrel distortion due to the high concavity of the same.

4. Chromatic aberration

The refractive index between camera lens and air is different from that of lens and water. This makes the image edges and borders noticeably distorted. This image cannot be analysed via the model as it will give a lot of false positives.

There are some chromatic aberration correction algorithms which are based on image segmentation.

- Image segmentation:
 1. Grouping of Pixels based on some parameter
 2. Labeling of the sections

3. Outputting the segmented image Some of thees algos can even correct the false color filtering .

5. White Balance:

Under water images have high blue and green color biases and red channel degradation. this when combined with decreased contrast and blur creates a non infer-able image. There are some popular used algorithms some of which uses multiple images to sharpen and improve the contrast.

6. Color Reproduction

There are some model-based & DL color enhancement which increased the color accuracy of the same. One of the issues that this solves is, in cases like object casting shadow on bed which may be detected as another object creating issues.