Getting the Big Picture in Underwater Vision

Oct/14/2024 (Mon) 10:00-11:00 AM (EST)

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Kevin Köser is a computer science professor at Christian-Albrechts-Universität Kiel (Marine Data Science). Prior to joining Kiel university he led the research group Oceanic Machine Vision at the GEOMAR Helmholtz Centre for Ocean Research, Kiel. His main research interest lies in 3D underwater robot vision and novel, automated, camera-based measurement techniques for (deep) sea environments and processes (3D underwater machine vision). These help to explore, map and monitor (deep) sea habitats, to study resources, or to assess hazards. This involves physical models of underwater light transport and imaging, as well as models on how marine quantities can be observed. Based on such insights, novel, automated vision methods (inspired by human vision abilities with respect to distances, sizes, semantics) are sought that allow to quantify and measure different environments in 2D, 3D or 4D. Here, 3D mapping and reconstruction from deep sea photos is one of the big challenges.

Abstract of the talk

The deep sea is the last uncharted territory on Earth, and although it covers more than 50% of our planet, we have far less visual coverage of the deep seafloor than of Moon or Mars. Since water blocks virtually all electromagnetic radiation, the only way of getting pictures from below a few tens of meters (diver depths) is to send camera-equiped platforms to photograph the seafloor from a close range. Cameras have to be protected from the water, and I will discuss the influence of refraction of light rays at underwater housings for unbiased geometric photogrammetry.

The capture platforms however also have to carry their own light sources and mapping the deep ocean floor or turbid coastal waters can be imagined as exploring unknown land with a torchlight in a foggy night. Besides uneven light cones, strong scattering effects can degrade image quality, which already suffers from wavelength-dependent light absorption by the water. These distance-dependant effects also depend on the actual composition of the local water body. Recovering both the surface albedo as well as the water properties from deteriorated photos is the goal of radiometric photogrammetry. Besides image restoration, this forms the basis for future applications such as change detection or material classification. I will discuss our efforts in (auto-)calibration of light sources and medium and obtaining physically meaningful explanations of underwater image observations.