Underwater 3D Reconstruction for Survey Applications

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ABSTRACT. Robust, scalable Simultaneous Localization and Mapping (SLAM) algorithms support the successful deployment of robots in real-world applications. In many cases these platforms deliver vast amounts of sensor data from large scale, unstructured environments. This data may be difficult to interpret by end-users without further processing and suitable visualization tools. This talk presents a robust, automated system for large-scale 3D reconstruction and visualization that takes stereo imagery from an Autonomous Underwater Vehicle (AUV) to deliver detailed 3D models of the seafloor in the form of textured polygonal meshes.

The talk will cover the generation of self-consistent poses, the extraction of structure from visual data, consistency of lighting through an attenuating medium, the visualization of gigapixel textured models using a novel state-of-the-art rendering system and a crowd sourcing platform using smartphones and tablets to aid in the processing of vast volumes of visual data. The outputs of the proposed techniques will be displayed in real world applications including archaeology and marine science. The monitoring of coral reefs and the reconstruction of ancient submerged cities will demonstrate the power of the work. Finally a look towards one possible future for AUV technology in the domain of autonomous underwater intervention will be discussed.

Bio: Matthew Johnson-Roberson holds a Ph.D. in Robotics from the University of Sydney, there his thesis work focused on the problem of performing environmental monitoring through the visualization and reconstruction of massive datasets from image sensors. He is currently a research fellow at the Australian Centre for Field Robotics working on perception for AUVs. He previously worked as a postdoctoral researcher at KTH Royal Institute of Technology in Stockholm on perception for grasping and manipulation. Prior to that he was at Carnegie Mellon University where he obtained his B.S. in Computer Science and worked at the Robotics Institute on the first and second DARPA Grand Challenges.