

2Tutorial title: *Underwater photogrammetry: methods and challenges for mapping and monitoring*

Short description:

This tutorial aims at providing the audience with an introduction to the crucial aspects of underwater photogrammetry, as key techniques for studying and understanding the underwater world in many application fields, such as exploration and mapping, industry, metrology, archeology, biology, etc.

Specifically, the following topics will be covered:

- Image formation underwater: optical considerations
- Photographic aspects: light absorption, scatter, depth dependent white balance and color correction
- Flat vs Dome ports (from optical to geometric influences in underwater photogrammetry)
- Camera calibration approaches: implicit vs explicit modeling
- Reference systems, accuracy assessment and method of controls with scale bars, underwater geodetic measurements, acoustic positioning systems, pressure and inertial sensors, laser based optical scaling
- Platforms for underwater photogrammetry, from surface vehicles to scuba divers to ROVs and AUVs
- Underwater visual odometry and SLAM
- Mono, stereo and multi camera systems
- Two media bathymetric photogrammetry
- Overview of applications: needs and approaches in archeology, ecology, metrology and industry.

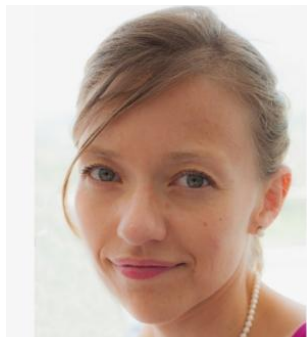
The attendees will 'dive' into the addressed topics and practice with provided datasets, off-the-shelf software applications and in-house developed algorithms. Participants are also encouraged to bring their own datasets, showcase their applications and discuss issues faced in their practices.

Resources that will be distributed: all the teaching material (i.e. the PowerPoint presentations, image datasets, python codes).

Target audience: PhD students, researchers and practitioners

Level: beginner to intermediate

SPEAKERS:



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Bios

Dr. Erica Nocerino is currently a tenure-track assistant professor in geomatics at the University of Sassari, Department of Humanities and Social Sciences. Her research interests are in 3D digitization techniques, with the aim of developing procedures and guidelines for the generation of 3D models of known and verified quality in application fields, such as cultural heritage, archaeology, biology and medicine. In the last four years, she has focused on underwater photogrammetry topics for autonomous navigation and image acquisition and processing for temporal monitoring. She is a scientific diver and participated to several underwater measurement campaigns (Costa Concordia shipwreck, coral monitoring in French Polynesia). She serves as secretary of the ISPRS Working Group II/7 in Vision Metrology.

Dr. Fabio Menna is a researcher at the 3D Optical Metrology (3DOM – <http://3dom.fbk.eu>) unit of FBK (Fondazione Bruno Kessler) Trento, Italy. His main interests are in photogrammetry, range sensors, geodetic surveying, 3D modeling, metrology. He is a scientific diver with experience in the domain of underwater photogrammetry, in particular for engineering and industrial applications (Costa Concordia photogrammetric survey, research and development for the COMEX ORUS3D subsea photogrammetry systems). Since 2016 he is Chair of the ISPRS WG II/9: Underwater Data Acquisition and Processing. He has organized a number of scientific events related to underwater photogrammetry and edited special issues on photogrammetry and underwater 3D recording and modeling. He has tutored more than 15 international summer schools and tutorials.

Dr. Dimitrios Skarlatos is Associate Professor at the Cyprus University of Technology, Department of Civil Engineering and Geomatics, serving currently as Vice Dean of School of Engineering. In 2009, he established the Photogrammetric Vision Lab at CUT and, since then, he has participated and coordinated

several research projects funded by the EU commission, as well as national and international public and private institutions. He is the lead surveyor in Mazotos (Classic era), Nisia (Ottoman era) and Protaras (Roman era) shipwreck underwater excavation sites, since 2010, 2014 and 2019 respectively. He coordinated the iMareCulture project, a H2020 2.7M Research and Innovation Action grant, for underwater VR museums, with 11 partners from Europe and Canada. The project focused on innovative Augmented and Virtual Reality technologies and methods to raise awareness of maritime Cultural Heritage. He has served as a member of the Hellenic Society of Photogrammetry and Remote Sensing. He is the academic representative of Cyprus in EuroSDR and co-chair in the International Society of Photogrammetry and Remote Sensing, Commission II, Working Group 9, about underwater photogrammetry.