Enabling Distributed Unsupervised Scene Understanding in Low Bandwidth Environments

INT: Co-Multi-Robotic Exploration of the Benthic Seafloor

New Methods for Distributed Scene Understanding and Exploration in the Presence of Communication Constraints

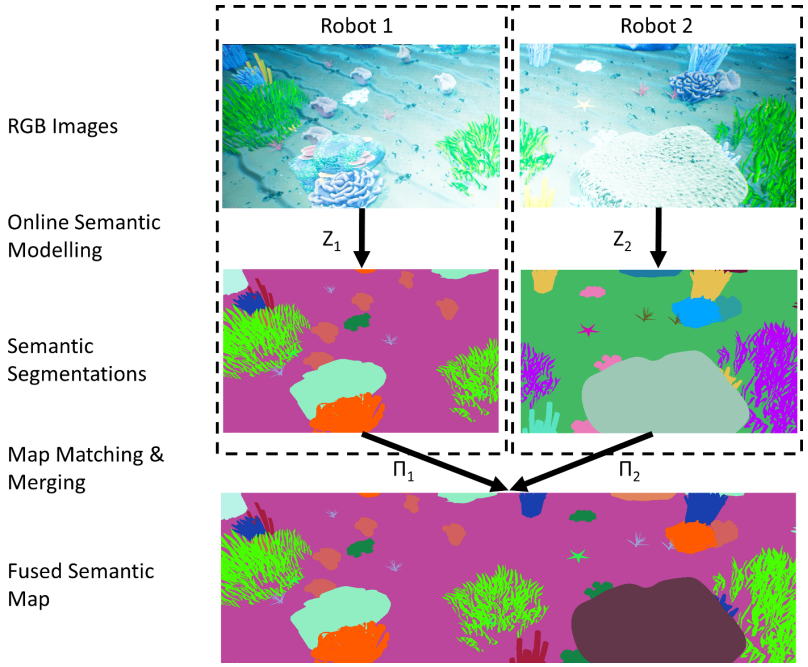
PIs: Yogesh Girdhar and Brian Claus {ygirdhar, bclaus}@whoi.edu Award ID#: 1734400 Start Date: January 1, 2018

Challenge

- Unsupervised learning based approaches can be used to characterize unknown environments
- Scaling to multiple robots requires learning terrain labels that are consistent across robots

Solution

- Use CLEAR, a spectral clustering based approach to match labels between robots
- Suitable for online use and multiway matching



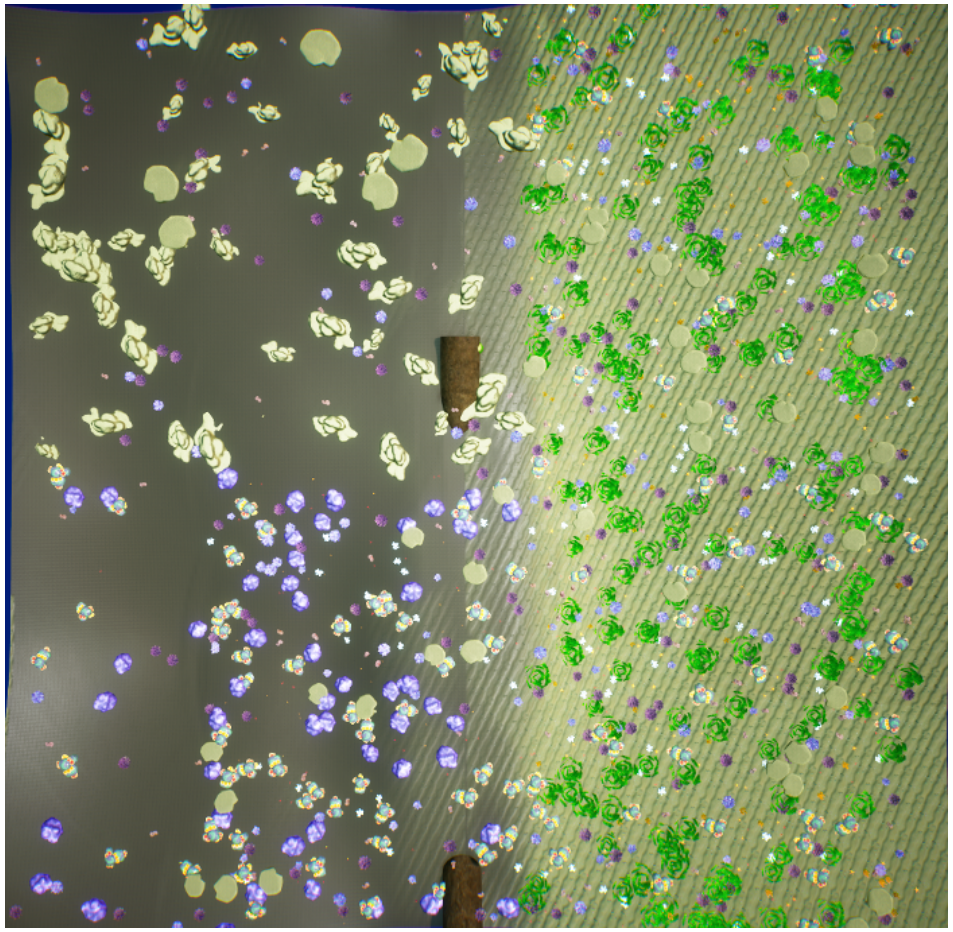
Scientific Impact

- Enables an exploration and monitoring approach that is robust under communication bottlenecks

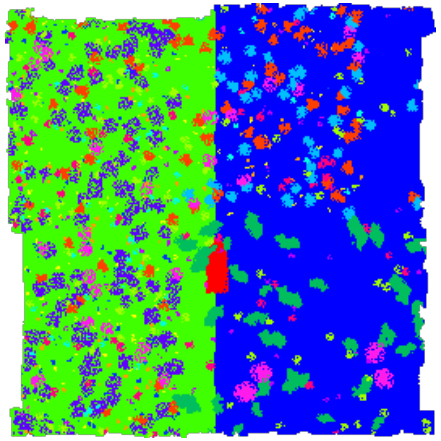
Broader Impact

- Space and ocean exploration
- Collaboration with marine ecologists
- Graduate and undergraduate student training

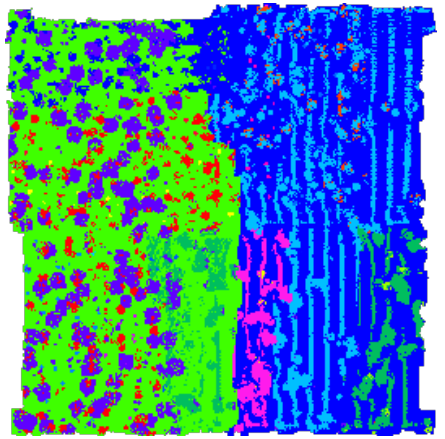
Simulated underwater exploration with 12 robots in a 250mx250m patch results in 20-40% high quality maps (Mutual Information)



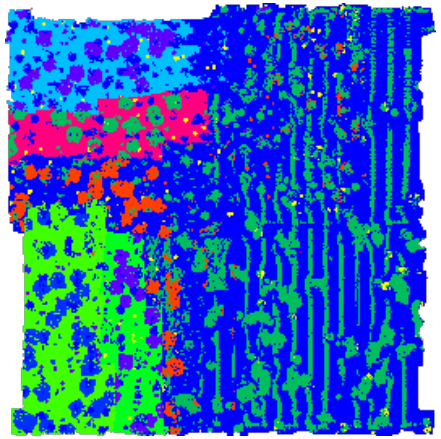
Test environment



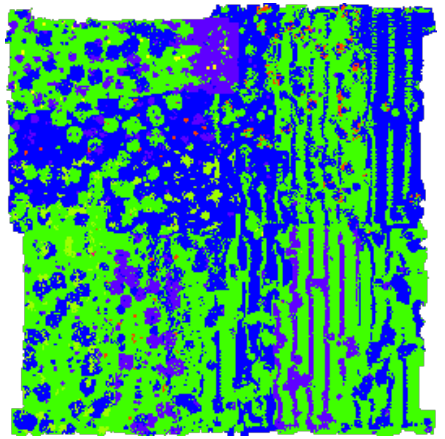
(a) Ground truth segmentation.



(b) *Ours* (CLEAR Based).



(c) Hungarian matching.



(d) ID-Based matching.