

Semantic Spatial Understanding

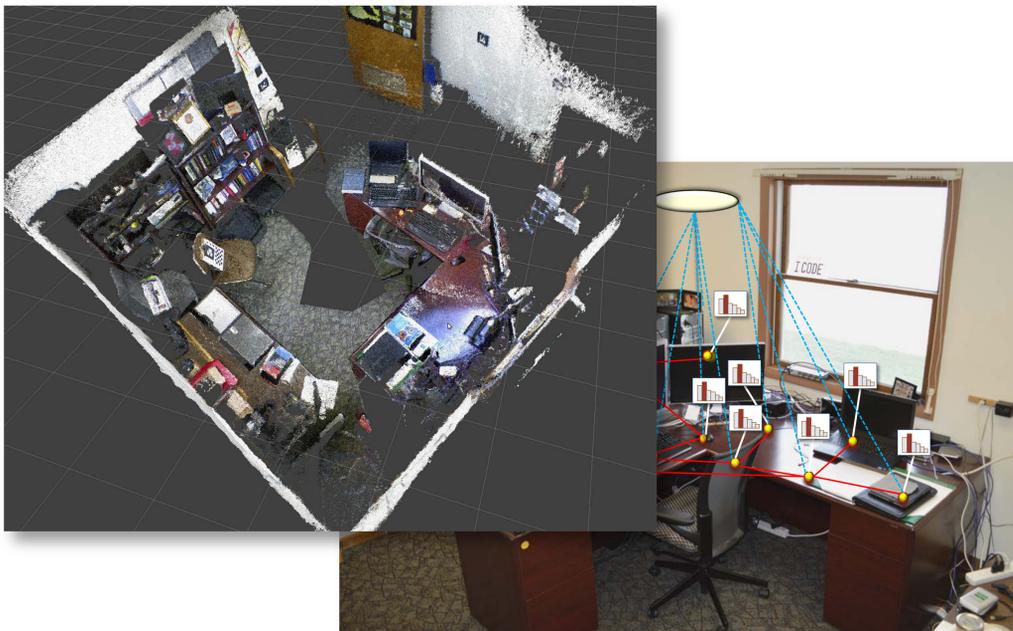


S&T Campaign: Sciences for Maneuver
Vehicle Intelligence

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Research Objective

- Develop novel techniques that enable intelligent systems to describe their environment in human understandable terms, including the relationships between objects and places.
- Surpass the state of the art in object and place recognition through the integration of advanced learning techniques, motion estimation, visual localization and mapping, and spatially organized object graphs.



ARL Facilities and Capabilities Available to Support Collaborative Research

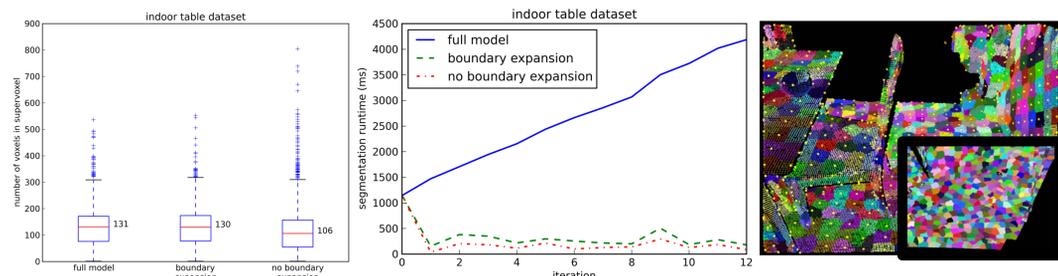
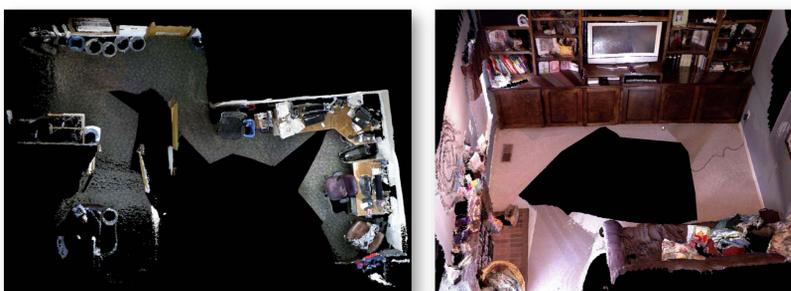
- Large indoor bays for controlled mobility and perception testing; access to outdoor testing facilities
- Large, two-tier, motion capture system for localized ground truth
- Multiple ground robots with diverse sensors
 - Velodyne HDL-32
 - Ladybug 5
 - Slipring-mounted spinning Hokuyo LRF



Challenges

- Collecting and harnessing the availability of unlabeled visual data.
- Scaling traditional learning algorithms to varied robot environments. Adapting algorithms online and accommodating sensor noise.
- Integrating and exploiting multiple modalities including image, laser, and depth sensors.

- Tron, Osteen, Owens, Daniilidis. *Pose optimization for the registration of multiple heterogeneous views*. MViGRo 14
- Owens, Osteen, Daniilidis. *Temporally consistent segmentation of point clouds*. SPIE DSS 14
- Osteen, Owens, Kessens. *Online egomotion estimation of RGB-D sensors using spherical harmonics*. ICRA 2012
- Owens. *Object detection using the Kinect*. ARL TR 2012
- Owens, Fields. *Incremental region segmentation*. ASC 10



Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Unsupervised learning and feature discovery
- Scene understanding
- Knowledge representation
- Object recognition
- Statistical relational learning