

Collaborative Exploration in Human-Robot Teams



S&T Campaign: Information Sciences
Intelligent Systems: Computational Intelligence

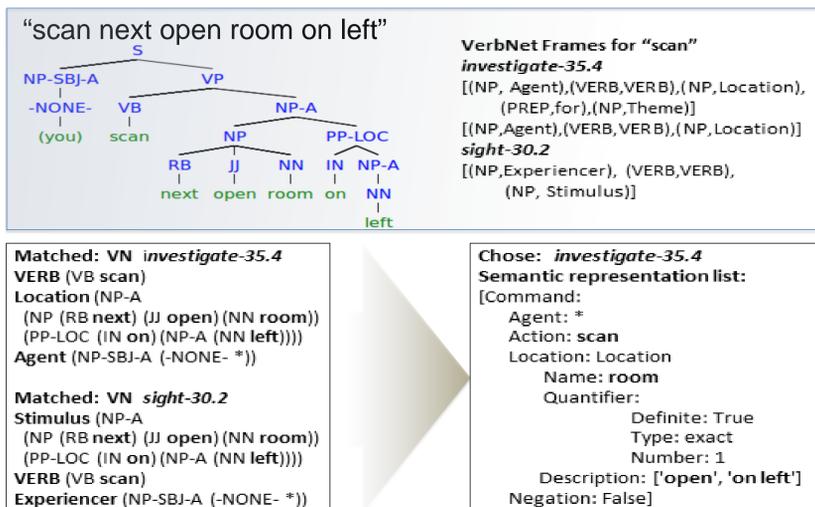
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S&T Campaign: Science for Maneuver
Vehicle Intelligence: Human-Robot Interaction

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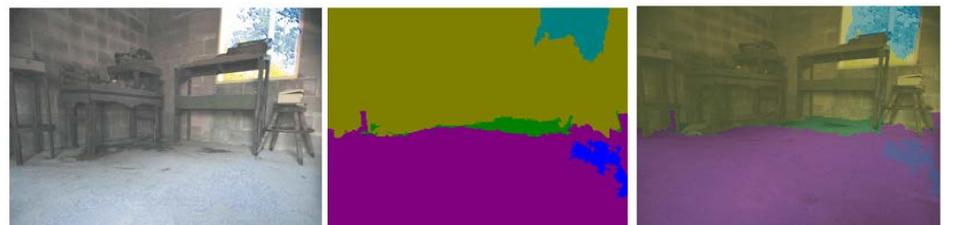
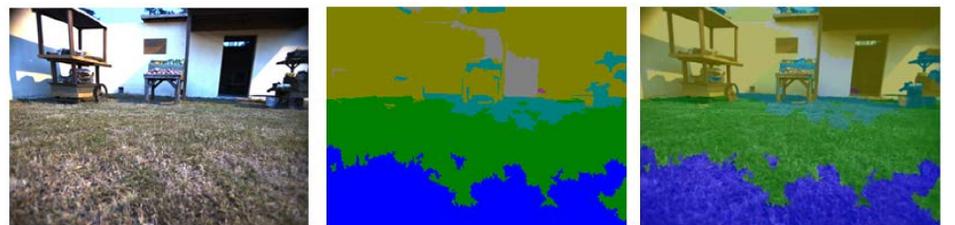
Research Objective

- Develop methods for mobile robots to understand their surroundings and communicate via natural language in order to autonomously complete mission objectives.



ARL Facilities and Capabilities Available to Support Collaborative Research

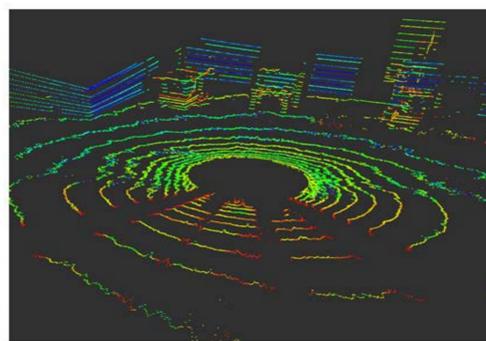
- Indoor urban test facility with full-size multi-story buildings for air and ground autonomous systems experimentation
- A fleet of mobile robots, including PackBots and Huskies, with a wide array of sensor capabilities
- High Performance Computing center with world-class supercomputer cluster



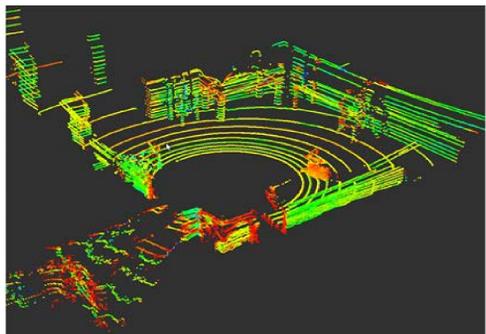
Outside & Inside: Camera Image (L), Semantic class labels (middle), Overlay (R)

Challenges

- Find ways of representing the semantics of spatial language
- Build models of scene from 2D and 3D data that can be used to ground sentences about the scene and for route planning.
- Test methods to id & align entities across modalities using NLP, Computer Vision, & SLAM (Simultaneous localization and mapping) to support more effective human-robot missions



R₄₁: I can see in the entrance
 C₄₂: Enter and scan first room



R₄₃: I see a door to the right and a door to the left
 C₄₄: Scan next open room on left

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Expertise in 3D scene understanding – going from registered point clouds and images to labeled objects
- Expertise in spatial semantics – turning natural language statements about the physical world into usable spatial representations
- Experience with machine learning the connections between physical scenes and natural language
- Undergraduate and graduate students to
 - design and conduct experiments,
 - develop annotation scheme for labeling and evaluation training data,
 - propose, implement, and test algorithms for natural language processing of collected dialog data.