



CHALLENGE 48

CMU-PMR-05

Ambiguity-aware Perception for Mobile Robots

The Robot Perception Lab:
rpl.ri.cmu.edu

Meet the expectations of this US Node
 through the technology challenge
 described below



GOALS

Mobile robots such as self-driving cars, service and household robots, will help people in their daily lives. They operate outside controlled factory environments where they need to perceive the world around them using onboard sensors such as cameras to self-localize, create maps, and perform tasks. Challenges arise when there is ambiguity in the sensor data, for example when there are repetitive structures in the environment. Typical approaches try to find the best solution to state estimation and mapping problems including an estimate of uncertainty, often represented as a Gaussian density. However, the best solution according to all sensor data available at a given time might not correspond to reality. Realizing that there is ambiguity and being able to suggest multiple possible solutions that can then for example be considered for planning will allow for more robust systems. The key questions are how to know when there is ambiguity, how to track relevant solutions, how to make use of that knowledge, and how to do all that efficiently.

DETAILS

The main objectives for this challenge are to investigate novel approaches to dealing with ambiguity, similar to our recent work on ambiguity-aware robust active SLAM [Hsiao et al. IROS 20]. Of particular interest are efficient inference solutions that will likely need to involve approximations. Also of interest is the use of such inference solutions in the context of active perception. The investigation is expected to involve both simulated and real-world experiments in environments where ambiguity is prevalent.

SKILLS REQUIRED

Experience with graph-based SLAM algorithms required Background in probabilistic inference preferred Familiarity with planning / active SLAM advantageous