Toward Robust Active Semantic SLAM via Max-Mixtures

David Baxter

ABSTRACT

In a step towards the level of autonomy seen in humans, this work attempts to emulate a high level and low level approach to world representation and short term adaptation. Specifically, this work demonstrates an implementation of robotic perception that transforms stereo camera and LIDAR sensor data into a sparse map of semantic objects and a locally consistent flexible occupancy grid. This provides a topological representation for grouping objects into higher level classes and a geometric map for traditional planning. Additionally, a reactive dynamic window obstacle avoidance system is shown to quickly plan short term trajectories that avoid both static and dynamic objects while progressing towards a goal. To combine computational efficiency with the robust advantages of multimodal inference, this work uses Semantic Max Mixture factors to approximate multimodal belief in a manner compatible to nonlinear least squares solvers. Experimental results are presented using a RACECAR mobile robot operating in several hallways of MIT, using AprilTags as surrogates for objects in the Semantic Max Mixtures Algorithm. Future work will seek to further integrate the components to create a closed-loop active semantic navigation and mapping algorithm.