

Evaluating the Benefit of Using Multiple Low-Cost Forward-Looking Sonar Beams for Collision Avoidance in Small AUVs

Christopher Morency

Virginia Tech

cmorency@vt.edu

Abstract: We seek to rigorously evaluate the benefit of using a few beams rather than a single beam for a low-cost obstacle avoidance sonar for small AUVs. We investigate the benefit of incorporating a port and starboard beam to a single-beam sonar system for collision avoidance. A methodology for collision avoidance is developed to obtain a fair comparison between a single-beam and multi-beam system, explicitly incorporating the geometry of the beam patterns from forward-looking sonars with large beam angles. The methodology for collision avoidance includes a detection model, a variant of a local occupancy grid and Bayesian expected loss. High fidelity simulations using the collision avoidance framework presented are performed to compare the benefit of using a forward-looking sonar with a single-beam and a forward-looking sonar with three beams. Simulations show the robustness of the method for data with high uncertainty and demonstrate the ability for the AUV to safely navigate cluttered environments.