

Robust Beacon Localization with Range-Only Measurements

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Abstract— Given one or more vehicles gathering range data to a number of stationary beacons, we present a solution for robustly estimating the location of the beacons. Our algorithm is composed of two stages: a robust outlier and multipath detection stage, followed by solution estimation. Poor geometry or noisy sensor data can yield multiple plausible solutions; our algorithm reports these multiple solutions along with a mathematically meaningful ranking of the solutions.

Our approach applies tools from machine learning to the filtering problem. We compose our algorithm as a series of clustering operations which employ singular value decomposition. We also discuss a conceptual similarity

between our approach and Random Sample Consensus (RANSAC), and compare results using both algorithms.

The method has been implemented using acoustic data acquired by a terrestrial robot platform, demonstrating the capability to perform robust data association with noisy range data. We are currently applying the method to underwater data acquired by an Odyssey III AUV at the GOATS 2002 experiment.

Keywords: Range-only SLAM, outlier detection

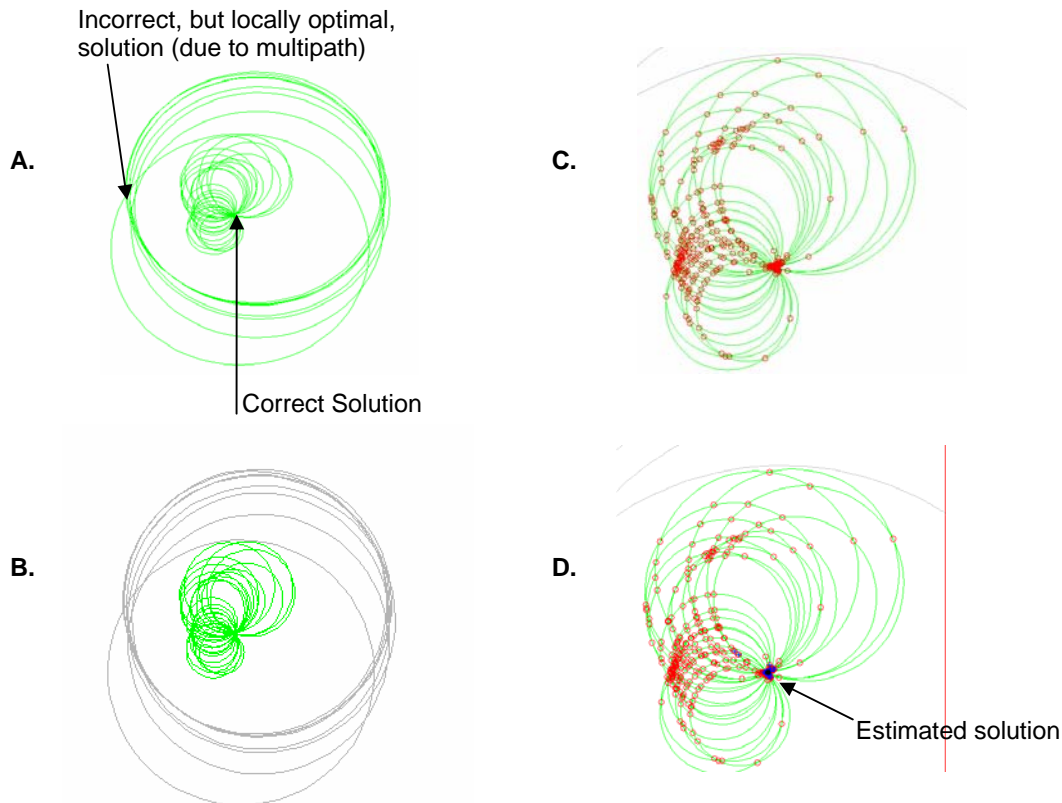


Figure 1. A) Raw range measurements, including many outliers due to multipath. B) After outlier/multipath detection; only those measurements corresponding to the correct range measurement remain. C) Enumeration of all possible intersections/solutions. D) Final solution estimation.