Performance Evaluation and Benchmarking of Intelligent Robotic Systems

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Motivation

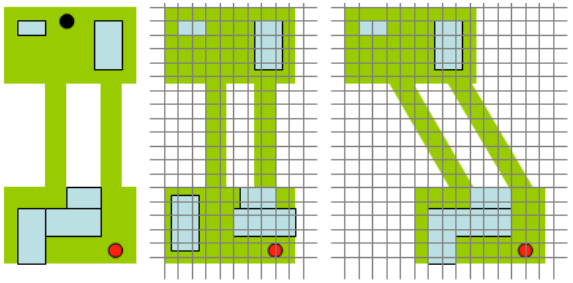
- Benchmarking and Standardization are critical enablers for wider acceptance and proliferation of existing and emerging technologies
- Objective and Quantitative performance evaluation of robots and robotic systems

Goals

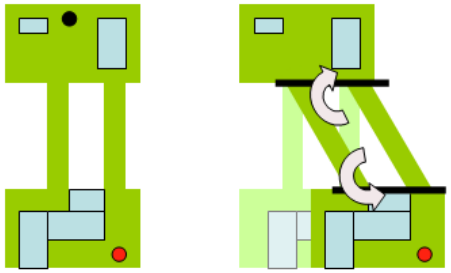
- Develop quantitative evaluation schemes for assessing the quality of robot-generated maps
- Development of a world modeling framework for unstructured and dynamic environments
- Data collection & development and verification of standard test methods for mobile robot mapping and navigation

Anticipated Benefits

- Tangible and meaningful performance measures and evaluation schemes for robotic and automation systems

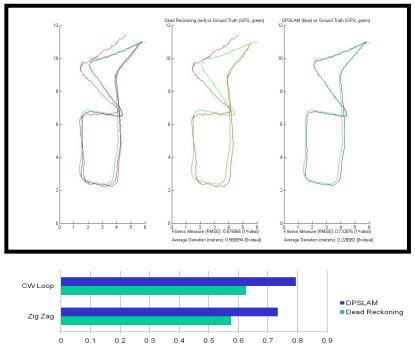


Grid-based evaluation. *Left: Ground truth map. Two rooms (green, top and bottom) with obstacles (gray) are connected by two hallways (green, center).The target (red dot) can only be reached from the current position (black dot) using the right hallway. Center: Mapping example with high global and low local correctness. Right: Mapping example with low global and high local correctness. A grid-based map evaluation will prefer the center map, although for robot navigation the right map is of higher utility.*

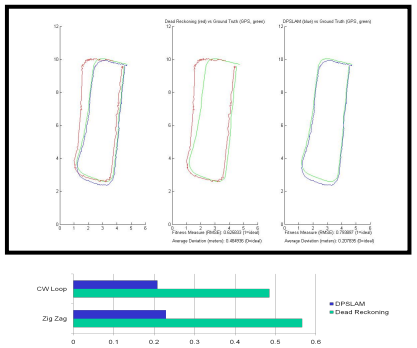


Pose-based evaluation. *The target map (right) is transformed to match the ground truth (left). The transformation parameters (here: rotation, arrows) are used to quantify the map quality.*

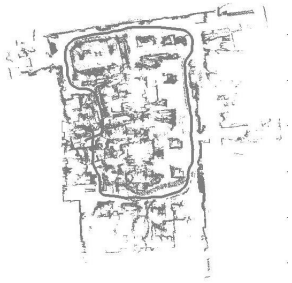
Benchmarking Open-source Simultaneous Localization And Mapping (SLAM) Algorithms



Fitness (1/(1+RMSE) , 1 = ideal)



Average Absolute Deviation (0 = ideal)



Dead Reckoning

DPSLAM

GMapping