Bayesian occupancy grid for active sonar detection and localization of moving targets

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Abstract:
Active sonar performance is highly dependent on the surrounding environment. Conventional detection algorithms apply thresholds to acoustic data passed through a normalizer in order to detect targets. These methods fail to fully exploit available knowledge of the environment, which leads to higher false alarm rates than necessary, particularly in littoral environments. Furthermore, they do not exploit negative information, e.g. the significance of the repeated lack of threshold crossings in a given area. Sonar performance models may estimate both the probability of detection and false alarm in a known environment. Proper exploitation of this data allows for reduced false alarm rates in cluttering and reverberating environments. Furthermore, areas lacking threshold crossings and with high probability of detection, may be classified as target free. Bayesian occupancy grids is a probabilistic approach that takes into account both sensor information and prior information of surrounding walls or topography for localization of robots. Here we apply the method on synthetic sonar data combined with a sonar performance model. The synthetic sonar data contains moving and stationary targets in a littoral environment. The method's performance is compared to conventional algorithms, and its robustness to errors in the sound speed profile used in the modelling is assessed.

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