**A Frontier-Based Approach for Autonomous Exploration**

**Summary:** Summarize the paper, what are the main contributions? Where does the work fit in the literature? What advances does it make?

The paper from Naval Research Laboratory attempts to solve the problem of exploration using the notion of frontiers and laser-limited sonar. The key idea used is that the robot should move to the boundary between open and unexplored space to map out the unexplored territory in the most efficient manner. The paper address issues of specular reflections in sonar using a laser in combination with it & evaluation is done on a real robot (Nomad 200) moving in a real room of standard size of 20 X 25 sq. ft.

**Significance:** What is the significance of those advances? Which communities/application areas would benefit from the contributions in the paper?

* The paper takes a Bayesian approach to subdividing the space into 3 regions: open, unknown and occupied regions;
* They leverage techniques from Computer Vision such as edge detection and region extraction.
* Some of the applications range from domestic use of robots to using robots in unsafe areas such as mines.
* The paper does evaluation on a real-world scenario which is impressive﻿﻿﻿﻿﻿﻿﻿﻿﻿﻿.

**Technical   commentary:** Are the methods correct? Do the derivations make sense? Are the assumptions employed reasonable? If there are experiments, are they described in sufficient detail?

* The algorithm used is very intuitive and easy to understand. The paper does not go into mathematical details since it is the standard depth first search algorithm. The experiments are described in sufficient detail by subdividing each figure into several sub-figures. They also take two scenarios for the same and show us the evidence grid change every step the robot takes. This makes the paper easy to follow.
* The assumptions of independence of sensor readings (LASER & SONAR) and the experiments with walls and obstacles in arbitrary orientations combined with walls blocked by obstacles make the evaluation very impressive.

**Speculative   commentary:** How could the work be improved? What are some glaring flaws? Are there any subtle flaws? What could be some extensions?

* The algorithm is claimed to be independent of the value of prior occupancy probability chosen. A graph on accuracy vs prior probability would have been insightful.
* A figure detailing the algorithm can be added as a representation in addition to the section 2.3.
* The experiments can be expanded by trying on different shapes of rooms and different obstacle sizes.
* The paper mentions some of the specular reflections that lead to inaccurate exploration. We can have multiple laser-limited sonar sensors to reduce the specular reflections.
* The paper can also evaluate other edge detection algorithms.

Literature   trail: Provide 3 papers that are cited in this paper. Provide 3 papers that cite this paper (if there are any)

Cites:

* Connell, Jonathan H., and Sridhar Mahadevan. "Rapid task learning for real robots." *Robot Learning*. Springer, Boston, MA, 1993. 105-139.
* Engelson, Sean Philip. *Passive map learning and visual place recognition*. Diss. Yale University, 2000.
* Kortenkamp, David Michael. *Cognitive maps for mobile robots: A representation for mapping and navigation*. Diss. 1993.

Cited by:

* Howard, Andrew, Maja J. Matarić, and Gaurav S. Sukhatme. "An incremental self-deployment algorithm for mobile sensor networks." *Autonomous Robots* 13.2 (2002): 113-126.
* Yamauchi, Brian. "Frontier-based exploration using multiple robots." *Proceedings of the second international conference on Autonomous agents*. ACM, 1998.
* Thrun, Sebastian. "Learning occupancy grid maps with forward sensor models." *Autonomous robots* 15.2 (2003): 111-127.

Other comments: Things that you want to say that are not covered by above.

N/A