JAIST Repository
https://dspace.jaist.ac.jp/

Title	複数の放射線源推定のための移動ロボットによる調査
Author(s)	PINKAM, NANTAWAT
Citation	
Issue Date	2020-09
Type	Thesis or Dissertation
Text version	ETD
URL	http://hdl.handle.net/10119/17000
Rights	
Description	Supervisor:丁　洛榮，情報科学研究科，博士

JAIST
JAPAN
ADVANCED INSTITUTE OF
SCIENCE AND TECHNOLOGY

Japan Advanced Institute of Science and Technology

Abstract

In this work, we consider the localization problem of multiple unknown radiation sources with measurement uncertainty by using robotic systems in a geometric environment. The goal is to give an accurate map of radiation which contains a number of sources, locations, and intensities. Furthermore, the exploration cost must be minimized. We proposed the scheme for the localization of multiple radioactive sources using the particle filter. In a normal circumstance, a robot will estimate the source location by pursuing the intensive intensity site. However, a low radiation area has little information which makes an unpredictable estimation. Thus, an exploration algorithm must be utilized. In consequence, the exploration cost must be minimized because the exploration time might be restricted. We propose the exploration method using frontier-based exploration which involves the target point selection algorithm by considering the minimum distance from a robot to an unexplored region, and the increasing gradient direction. In addition, the area pruning algorithm is introduced to further decrease the exploration time by overlooking less important areas and applying Bayesian estimation to further eliminate the potentially no source area. After every source is discovered, we proposed the sources intensity separation algorithm to further raise the estimation accuracy. The proposed method has been verified by the simulations using MATLAB in both ideal environment and SLAM dataset of a real building. In addition, the uncertainty in the robot self-localization was introduced and experimented. The effect of environment attenuation that decreases the radiation measurement is also investigated and the robot is successfully localized the radiation source inside a single entrance room. The proposed strategy can incredibly decrease the exploration cost compared to the regular techniques and increment the accuracy of multiple sources localization.

Keywords: Bayes' theorem, source localization, information theory, exploration and path planning, mobile robot