CSC466: Artificial Intelligence Two

Project Framework and Timeline

Ace DeSiena - Feb 2015

Sebastian Thrun, Wolfram Burgard, and Dieter Fox. 2005. *Probabilistic Robotics (Intelligent Robotics and Autonomous Agents).* The MIT Press.

This book will be my main source for this project. It contains pseudocode, mathematical principles, and explanations of each of the algorithms that will be used for this project.

Roland Siegwart and Illah R. Nourbakhsh. 2004. *Introduction to Autonomous Mobile Robots.* Bradford Co., Scituate, MA, USA.

This book will provide a broader context for the project. It contains information about the practical design and capabilities of mobile autonomous robots.

Michael Montemerlo, Sebastian Thrun, Daphne Koller, and Ben Wegbreit. 2002. FastSLAM: a factored solution to the simultaneous localization and mapping problem. In *Eighteenth national conference on Artificial intelligence*, Rina Dechter, Michael Kearns, and Rich Sutton (Eds.). American Association for Artificial Intelligence, Menlo Park, CA, USA, 593-598.

This is the paper that first presents the FastSLAM algorithm that will be used in phase 7.

Hannah Hoersting, Lesia Bilitchenko, and Zachary Dodds. 2009. Visual loop-closing with image profiles. In *Proceedings of the 2009 ACM symposium on Applied Computing* (SAC '09). ACM, New York, NY, USA, 1166-1170. DOI=10.1145/1529282.1529541 http://doi.acm.org/10.1145/1529282.1529541

This paper presents a solution to the monocular vision problem.

Jeong-Gwan Kang, Su-Yong An, Sunhyo Kim, and Se-Young Oh. 2009. Sonar based simultaneous localization and mapping using a neuro evolutionary optimization. In *Proceedings of the 2009 international joint conference on Neural Networks* (IJCNN'09). IEEE Press, Piscataway, NJ, USA, 1720-1727.

This paper discusses the use of evolutionary programming in selecting a neural network suitable for solving a SLAM problem.

Patrick Robertson, Michael Angermann, and Bernhard Krach. 2009. Simultaneous localization and mapping for pedestrians using only foot-mounted inertial sensors. In *Proceedings of the 11th international conference on Ubiquitous computing (UbiComp '09)*. ACM, New York, NY, USA, 93-96. DOI=10.1145/1620545.1620560 http://doi.acm.org/10.1145/1620545.1620560

SLAM using shoe based inertia sensors.

Esteban Tobias Bayro Kaiser. 2010. Indoor simultaneous localization and mapping for pedestrian with wearable computing. In *Proceedings of the 12th international conference on Human computer interaction with mobile devices and services (MobileHCI '10)*. ACM, New York, NY, USA, 487-488. DOI=10.1145/1851600.1851719 http://doi.acm.org/10.1145/1851600.1851719

This source, like it's three immediate predecessors is tangentially related and will serve mostly to provide an even broader context to the project.

Phase One – Motion – Mar 3

Goal: Create instances of robot, world, and wall class. Change the state using robot's motion methods.

Work: Create robot, world, and wall classes. Create Movement methods for the robot so that the world is affected correctly.

Phase Two – Perception – Mar 10

Goal: Create instance of robot with input sensor array. Update array as robot moves around the world.

Work: Create sense method for robot class which creates a simulated sensor input based on robot pose and walls. This input will mimic a variable number of beam range finders.

Phase Three – Localization – Mar 19

Goal: Create instance of robot with a map representation that corresponds to the walls and the world. Use robots localize method to create belief space about the robots location using Extended Kalman Filter Localization Demonstrate the changing location estimation as the robot moves through the world. Repeat using Grid Localization. Repeat using Monte Carlo localization.

Work: Create localize methods for robot class each using a different algorithm. Create map class which will be contained in the robot class. Create location belief space class which may need to be specific to each type of localization.

Phase Four – Mapping – Mar 31

Goal: Create instance of robot with uninformed map. Demonstrate the recursive estimation of the map as the robot moves through the world.

Work: Recursively update the map using the occupancy grid mapping algorithm.

Phase Five – Extended Kalman Filter SLAM – Apr 14

Goal: Create instance of robot with uninformed map and location. Recursively estimate map and location using Extended Kalman Filter Slam.

Work: Learn about and implement EKF SLAM algorithm.

Phase Six – Sparse Extended Information Filter SLAM – Apr 23

Goal: Create instance of robot with uninformed map and location. Recursively estimate map and location using Sparse Extended Information Filter Slam.

Work: Learn about and implement SEIF SLAM algorithm.

Phase Seven – Fast SLAM – May 5

Goal: Create instance of robot with uninformed map and location. Recursively estimate map and location using Fast Slam.

Work: Learn about and implement Fast SLAM algorithm.