

Bayesian SLAM Algorithms

Branko Ristic, RMIT University, Australia

THE INTENDED AUDIENCE

The tutorial is prepared for postgraduate students and researchers in electrical or mechatronic engineering with knowledge of probability and statistics.

PREREQUISITES

Fundamentals of recursive Bayesian estimation, including Kalman and particle filtering.

SUMMARY AND OUTLINE

Simultaneous localisation and mapping (SLAM) is a statistical estimation problem in which a moving robot, equipped with a ranging sensor(s) and using odometry data, gradually creates a map of an unknown environment. The tutorial will explain the Bayesian SLAM algorithms (including the famous Gmapping algorithm available in Robot Operating System) in the context of both feature-based and occupancy grid maps. The following topics will be covered:

- A brief review of sequential Bayesian estimation (Kalman and particle filter)
- Robot motion models
- Types of maps and sensor models
- Robot localisation (known map)
- Robotic mapping (known robot pose)

- Simultaneous localisation and mapping (SLAM)
- Active (autonomous) SLAM

LEARNING OBJECTIVE

Gain an understanding of Bayesian algorithms which allow the robots to navigate and map an unknown environment autonomously.

COURSE MATERIAL

All attendees will be supplied with the course notes and with the MATLAB source code for selected SLAM algorithms.

INSTRUCTOR'S SHORT BIOGRAPHY

Branko Ristic received Ph.D. in Electrical Engineering from QUT (Australia) in 1995 and joined Defence Science and Technology group (DSTG) in 1996 where he stayed until 2015. Currently, Dr Ristic is a Principal Research Fellow in the School of Engineering at RMIT University (on secondment from DSTG). During 2003/04 he was working in IRIDIA (Universite libre de Bruxelles, Belgium). Dr Ristic published two books, "Beyond the Kalman filter: Particle filters for tracking applications" (Artech House, 2004) and "Particle filters for random set models" (Springer, 2013), and over 80 journal papers and book chapters. He presented two plenary talks at international conferences (SSPD 2015, Edinburg, UK; MIIS Workshop 2014, Xian, China), and many short courses and tutorials at international conferences. Dr Ristic won several awards for his publications, including the IET RSN Premium Award in 2014, various best-paper awards at Information Fusion conferences (2005, 2010, 2016) and DICTA conferences (2005, 2009). His research interests are information fusion, target tracking, statistical signal processing, sensor control and robotics.