



TOMASZ PIOTR KUCNER received his MSc degree in Automatics and Robotics from Wrocław University of Science and Technology, Poland, in 2012. In the same year, he became a doctoral student at the Center of Applied Autonomous Sensor Systems (AASS) at Örebro University, Sweden.

To bring robots closer to real-world autonomy, it is necessary to equip them with tools allowing them to perceive, model and behave adequately to dynamic changes in the environment. The idea of incorporating information about dynamics not only in the robots reactive behaviours but also in the global planning process stems from the fact that dynamic changes are typically not completely random but follow spatiotemporal patterns. The overarching idea behind the work presented in this thesis is to investigate methods allowing to represent the variety of real-world spatial motion patterns in a compact, yet expressive way. The primary focus of the presented work is on building maps that can capture both the motion patterns of moving objects and the flow of continuous media. The contribution of this thesis is twofold. First, I introduce a representation for modelling motion patterns of dynamic objects as a multimodal flow of occupancy over a grid map. The proposed representation connects the changes in occupancy among adjacent cells. In the second part of this thesis, I introduce a way of modelling flow without relying on an underlying spatial map. This representation employs a field of Gaussian Mixture Models, whose local elements are probability distributions of (instantaneous) velocities, to describe motion patterns. Since it assumes only velocity measurements, the proposed representation has been used to model a broad spectrum of dynamics including motion patterns of people and air flow. Using a Gaussian Mixture Model allows to capture the multimodal character of real-world dynamics (e.g. intersecting flows) and also to account for flow variability.

ISSN 1650-8580
ISBN 978-91-7529-255-7

TOMASZ PIOTR KUCNER Probabilistic Mapping of Spatial Motion Patterns for Mobile Robots

2018



Doctoral Dissertation

Probabilistic Mapping of Spatial Motion Patterns for Mobile Robots

TOMASZ PIOTR KUCNER
Computer Science

TOMASZ PIOTR KUCNER Probabilistic Mapping of Spatial Motion Patterns for Mobile Robots