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 Modell von demjenigen Messer, mit welchem ein reitender Trabante, Frantz Laubler Herrn M. Hahn, Archi-Diaconum in der Creutz-Kirche zu Dreßden ... den 21. May 1726 mit 6 Stichen getödtet
 Probabilistic Robotics
 The Simultaneous Localization and Mapping Problem with Six Degrees of Freedom
 FastSLAM
 Simultaneous Localization and Mapping with Fingerprints of Places
 From Theory to Practice
 Algorithms and Implementations

*Simultaneous Localization And Mapping For Mobile Robots
 Introduction And Methods*

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Investigation of Simultaneous Localization and Mapping (SLAM) in Dynamic Settings

World Scientific

Abstract: "Simultaneous Localization and Mapping (SLAM) is an essential capability for mobile robots exploring unknown environments. The Extended Kalman Filter (EKF) has served as the de-facto approach to SLAM for the last fifteen years. However, EKF-based SLAM algorithms suffer from two well-known shortcomings that complicate their application to large, real-world environments: quadratic complexity and sensitivity to failures in data association. I will present an alternative approach to SLAM that specifically addresses these two areas. This approach, called FastSLAM, factors the full SLAM posterior exactly into a product of a robot path posterior, and N landmark posteriors conditioned on the robot path estimate. This factored posterior can be approximated efficiently using a particle filter. The time required to incorporate an observation into FastSLAM scales logarithmically with the number of landmarks in the map. In addition to sampling over robot

paths, FastSLAM can sample over potential data associations. Sampling over data associations enables FastSLAM to be used in environments with highly ambiguous landmark identities. This dissertation will describe the FastSLAM algorithm given both known and unknown data association. The performance of FastSLAM will be compared against the EKF on simulated and real-world data sets. Results will show that FastSLAM can produce accurate maps in extremely large environments, and in environments with substantial data association ambiguity. Finally, a convergence proof for FastSLAM in linear-Gaussian worlds will be presented."

[Simultaneous Localization and Mapping for Mobile Robots: Introduction and Methods](#) Springer Science & Business Media

This monograph describes a new family of algorithms for the simultaneous localization and mapping (SLAM) problem in robotics, called FastSLAM. The FastSLAM-type algorithms have enabled robots to acquire maps of unprecedented size and accuracy, in a number of robot application domains and have been successfully applied in different dynamic environments, including a solution to the problem of people tracking.

Exactly Sparse Information Filters World Scientific

An introduction to the techniques and algorithms of the newest field in robotics. Probabilistic

robotics is a new and growing area in robotics, concerned with perception and control in the face of uncertainty. Building on the field of mathematical statistics, probabilistic robotics endows robots with a new level of robustness in real-world situations. This book introduces the reader to a wealth of techniques and algorithms in the field. All algorithms are based on a single overarching mathematical foundation. Each chapter provides example implementations in pseudo code, detailed mathematical derivations, discussions from a practitioner's perspective, and extensive lists of exercises and class projects. The book's Web site, www.probablistic-robotics.org, has additional material. The book is relevant for anyone involved in robotic software development and scientific research. It will also be of interest to applied statisticians and engineers dealing with real-world sensor data.

Simultaneous Localization and Mapping with Robots Springer Science & Business Media

This monograph describes a new family of algorithms for the simultaneous localization and mapping (SLAM) problem in robotics, called FastSLAM. The FastSLAM-type algorithms have enabled robots to acquire maps of unprecedented size and accuracy, in a number of robot application domains and have been successfully applied in different dynamic environments, including a solution to the problem of people tracking.

Topological SLAM University of Coimbra

Papers from a flagship conference reflect the latest developments in the field, including work in such rapidly advancing areas as human-robot interaction and formal methods. Robotics: Science and Systems VIII spans a wide spectrum of robotics, bringing together contributions from researchers working on the mathematical foundations of robotics, robotics applications, and analysis of robotics systems. This volume presents the proceedings of the eighth annual Robotics: Science and Systems (RSS) conference, held in July 2012 at the University of Sydney. The contributions reflect the exciting diversity of the field, presenting the best, the newest, and the most challenging work on such topics as mechanisms, kinematics, dynamics and control, human-robot interaction and human-centered systems, distributed systems, mobile systems and mobility, manipulation, field robotics, medical robotics, biological robotics, robot perception, and estimation and learning in robotic systems. The conference and its proceedings reflect not only the tremendous growth of robotics as a discipline but also the desire in the robotics community for a flagship event at which the best of the research in the field can be presented.

A Scalable Method for the Simultaneous Localization and Mapping Problem in Robotics MIT Press

How can mobile robot navigate autonomously without the knowledge of its own state of pose and the model of the surrounding environment? Simultaneous Localization and Mapping (SLAM) is the mobile robot's significant and critical perceptual capability to achieve autonomous navigation, and it is applied in a wide range of application fields. Graph-based SLAM constructs a hierarchical topological graph to address the issues of localization and mapping, where the local relative spatial displacement of roto-translation and the global trajectory of the mobile robot are estimated, respectively. Then each local map can be transformed and integrated to the unique global frame for the construction of the global map. The theory, algorithm, and implementation of Graph-SLAM are explained in detail in this book. Scan matching is performed to estimate the local relative roto-translation, batch optimization is executed to estimate the global mobile robot's trajectory, and the global line-feature-based mapping is applied to construct the global line-feature model of the environment. The results in the experiments will verify the effectiveness of the proposed graph-based SLAM algorithm.

Sampling-based Motion Planning with 3D Simultaneous Localization and Mapping for Social Aware Service Robotics Applications Springer

Nothing provided

2019 IEEE 4th Advanced Information Technology, Electronic and Automation Control Conference (IAEAC) Springer Nature

Simultaneous Localization and Mapping Exactly Sparse Information Filters World Scientific
[Laser Range Finder and Advanced Sonar Based Simultaneous Localization and Mapping for Mobile Robots](#) Springer

This book offers a systematic and comprehensive introduction to the visual simultaneous localization and mapping (vSLAM) technology, which is a fundamental and essential component for many applications in robotics, wearable devices, and autonomous driving vehicles. The book starts from very basic mathematic background knowledge such as 3D rigid body geometry, the pinhole camera projection model, and nonlinear optimization techniques, before introducing readers to traditional computer vision topics like feature matching, optical flow, and bundle adjustment. The book employs a light writing style, instead of the rigorous yet dry approach that is common in academic literature. In addition, it includes a wealth of executable source code with increasing difficulty to help readers understand and use the practical techniques. The book can be used as a textbook for senior undergraduate or graduate students, or as reference material for researchers and engineers in related areas.

A Simultaneous Localization and Mapping Implementation Using Inexpensive Hardware Springer

Abstract: This thesis will present SLAM in the current literature to benefit from then it will present the investigation results for a hybrid approach used where different algorithms using laser, sonar, and camera sensors were tested and compared. The contribution of this thesis is the development of a hybrid approach for SLAM that uses different sensors and where different factors are taken into consideration such as dynamic objects, and the development of a scalable grid map model with new sensors models for real time update of the map. The thesis will show the success found, difficulties faced and limitations of the algorithms developed which were simulated and experimentally tested in an indoors environment.

Simultaneous Localization and Mapping for Navigation in Realistic Environments IGI Global

Nowadays, a collection of two or more autonomous mobile agents working together are denoted as teams or simply societies of mobile robots. In Multi-Robot Systems (MRS) robots are allowed to coordinate with each other in order to achieve a specific goal. In these systems, robots are far less capable as an entity, but the real power lies in the cooperation of the team. The simplicity of MRS has produced a wide set of applications such as in military tasks, searching for survivors in disaster hit areas, parallel and simultaneous transportations of vehicles and delivery of payloads. The success of single-robot Simultaneous Localization and Mapping (SLAM) in the past two decades has led to research on Multi-Robot Simultaneous Localization and Mapping (MRSLAM). A team of robots is able to map an unknown environment faster and more reliably. However, MRSLAM raises several challenging problems, including map fusion, unknown robot poses and scalability issues. Rao-Blackwellized Particle Filters (RBPFs) have been demonstrated as an effective solution to the problem of single robot Simultaneous Localization and Mapping (SLAM), and a few extensions to teams of robots exist. However, these approaches are usually characterized by strict assumptions on both communication bandwidth and prior knowledge on relative poses between teammates. In this dissertation, we describe in detail a distributed MRSLAM approach using RBPF in the case of possibly constrained communication and unknown relative initial poses using Robot Operating System (ROS). We consider the environment as a two dimensional space with several obstacles, which are explored by a team of cooperative mobile robots, equipped with laser sensors. In order to efficiently tackle the problem, the cooperation between agents and the memory space available for observations storage must be taken into account. Experimental results using a team of up to two robots in a large indoor area show the robustness and performance of the approach.

Simultaneous Localization and Mapping Exactly Sparse Information Filters

Simultaneous Localization and Mapping (SLAM) is one of the most widely researched topics in Robotics. It addresses building and maintaining maps within unknown environments, while the robot keeps the information about its location. It is a basic requirement for autonomous mobile robotic navigation in many scenarios, including military applications, search and rescue, environmental monitoring, etc. Although SLAM techniques have evolved considerably in the last years, there are many situations which are not easily handled, such as the case of smoky environments where commonly used range sensors for SLAM, like Laser Range Finders (LRF) and cameras, are highly disturbed by noise induced in the measurement process by particles of smoke. There is an evident lack of solutions to this issue in the literature. This work focuses on SLAM techniques for reduced visibility scenarios. The main objective of this work is to develop and validate a SLAM technique for those scenarios, using dissimilar range sensors and by evaluating their behavior in such conditions. To that end, a study of several laser-based 2D SLAM techniques available in Robot Operating System (ROS) is firstly conducted. All the tested approaches are evaluated and compared in 2D simulations as well as real world experiments using a mobile robot. Such analysis is fundamental to decide which technique to adopt according to the final application of the work. The developed technique uses the complementary characteristics between a LRF and an array of sonars in order to successfully map the aforementioned environments. In order to validate the developed technique, several experimental tests were conducted using a real scenario. It was verified that this approach is adequate to decrease the impact of smoke particles in the mapping task. However, due to hardware limitations, the resulting map is comprehensibly not outstanding, but much better than using a single range sensor modality. This work is part of the Cooperation between Human and robotic teams in catastrophic Incidents (CHOPIN) R&D project, which intends to develop a support system for small scale SaR missions in urban catastrophic scenarios by exploiting the human-robot symbiosis.

LAP Lambert Academic Publishing

Simultaneous localization and mapping (SLAM) is a process where an autonomous vehicle builds a map of an unknown environment while concurrently generating an estimate for its location. This book is concerned with computationally efficient solutions to the large scale SLAM problems using exactly sparse Extended Information Filters (EIF). The invaluable book also provides a comprehensive theoretical analysis of the properties of the information matrix in EIF-based algorithms for SLAM. Three exactly sparse information filters for SLAM are described in detail, together with two efficient and exact methods for recovering the state vector and the covariance matrix. Proposed algorithms are extensively evaluated both in simulation and through experiments.

A Large Scale Inertial Aided Visual Simultaneous Localization and Mapping (SLAM) System for Small Mobile Platforms MIT Press

Simultaneous localization and mapping (SLAM) is a process where an autonomous vehicle builds a map of an unknown environment while concurrently generating an estimate for its location. This book is concerned with computationally efficient solutions to the large scale SLAM problems using exactly sparse Extended Information Filters (EIF). The invaluable book also provides a comprehensive theoretical analysis of the properties of the information matrix in EIF-based algorithms for SLAM. Three exactly sparse information filters for SLAM are described in detail, together with two efficient and exact methods for recovering the state vector and the covariance matrix. Proposed algorithms are extensively evaluated both in simulation and through experiments.

Vision Based Autonomous Robot Navigation University of Coimbra

Autonomous mobile robots have become more popular over the past few decades, influencing both industry and academia. The strategy of making robots navigate autonomously adds many problems however. Many of these problems are directly related to the robot's ability to localize and autonomously map its environment. A solution to this problem is called simultaneous localization and mapping (SLAM). SLAM is the concept of localizing the robot while simultaneously generating a map of the environment, and then using the map in subsequent localization steps. The success of SLAM lies in a filter algorithm. One of the more common and successful filters is the extended Kalman filter (EKF), and there are many different algorithms that could be used to implement this filter. However, the computational complexity and physical cost of implementing the algorithm place the SLAM solution beyond the scope of many low-cost robotics projects. This thesis analyzes many of these cost issues related to the implementation of SLAM on autonomous robots. First, the types of sensing hardware are discussed, and potential low-cost solutions are suggested. Next, timing aspects of two different methods for data association are examined in order to evaluate tradeoffs between speed and accuracy. Finally, optimizations to the filter's update step involving matrix multiplication are presented. These three changes are presented as a customized EKF SLAM algorithm, called inexpensive hardware SLAM (IH-SLAM), which is applicable to small-scale robotics applications.

Robust Techniques for Monocular Simultaneous Localization and Mapping University of Coimbra

This work describes the design, development and implementation of a SLAM (Simultaneous Localization And Mapping) consists of two subsystems: low-cost autonomous robot and a ground station where telemetry data and information of the robot are displayed. The goal of a SLAM algorithm is to leave the robot in an unknown environment identify the environment through sensors and extract a map. The self-location of the robot is important in order to locate properly in the space all the sensor data. So the main objective of this project is to develop a low cost SLAM. In this work it will be used hardware for fast prototyping for the proof of concept and so can use it in future teaching. It compares different SLAM algorithms and choosing the most suitable for this system. The chosen algorithm is studied in depth and implemented in the system. Also it is studied one of the common errors in all the terrestrial robots localization: the odometry errors. It is studied these errors and the needed corrections. Then it is studied the hardware components for the construction of an autonomous robot. All parts are analysed individually and it is explained what task realizes each element. Then also is explained the design of the software (both the robot and the ground station) as well as its implementation and functionalities. The software is separated into small pieces to make it more modular and this document explains each of these parts and their functions. Finally, it is shown the results obtained after the development of the system. It has designed a series of tests and analysed the results of each one.

Simultaneous Localization and Mapping for Structured Indoor Environments

As mobile robots become more common in general knowledge and practices, as opposed to simply in research labs, there is an increased need for the introduction and methods to Simultaneous Localization and Mapping (SLAM) and its techniques and concepts related to robotics. Simultaneous Localization and Mapping for Mobile Robots: Introduction and Methods investigates the complexities of the theory of probabilistic localization and mapping of mobile robots as well as providing the most current and concrete developments. This reference source aims to be useful for practitioners, graduate and postgraduate students, and active researchers alike.

Robotics

This paper provides an introduction to two Simultaneous Localization and Mapping (SLAM) algorithms: EKF SLAM and Fast-SLAM. SLAM allows an autonomous robot to accurately map an

unknown environment as well as locate itself within the environment. These algorithms work iteratively, by moving about the environment and extracting and observing various landmarks in the environment. EKF SLAM and Fast-SLAM solve the SLAM problem by using probabilities to control for errors in the robot's sensors. This paper provides a discussion of these two algorithms and compares their run times and the accuracy of the maps they produce.

MRSLAM - Multi-Robot Simultaneous Localization and Mapping

This important work is an attempt to synthesize two areas that need to be treated in tandem. The book brings together the fields of robot spatial mapping and cognitive spatial mapping, which share some common core problems. One would expect some cross-fertilization of research between the two areas to have occurred, yet this has begun only recently. There are now signs

that some synthesis is happening, so this work is a timely one for students and engineers in robotics.

Using Negative Information in Simultaneous Localization and Mapping

This monograph is devoted to the theory and development of autonomous navigation of mobile robots using computer vision based sensing mechanism. The conventional robot navigation systems, utilizing traditional sensors like ultrasonic, IR, GPS, laser sensors etc., suffer several drawbacks related to either the physical limitations of the sensor or incur high cost. Vision sensing has emerged as a popular alternative where cameras can be used to reduce the overall cost, maintaining high degree of intelligence, flexibility and robustness. This book includes a detailed

description of several new approaches for real life vision based autonomous navigation algorithms and SLAM. It presents the concept of how subgoal based goal-driven navigation can be carried out using vision sensing. The development concept of vision based robots for path/line tracking using fuzzy logic is presented, as well as how a low-cost robot can be indigenously developed in the laboratory with microcontroller based sensor systems. The book describes successful implementation of integration of low-cost, external peripherals, with off-the-shelf procured robots. An important highlight of the book is that it presents a detailed, step-by-step sample demonstration of how vision-based navigation modules can be actually implemented in real life, under 32-bit Windows environment. The book also discusses the concept of implementing vision based SLAM employing a two camera based system.