Autonomous Vehicle Path Planning With Remote Sensing Data

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KINGSTON AMIR

Contributions to Path Planning Algorithms for Autonomous Vehicles
Springer Nature
By Scott Douglas McKeever.
Path Planning for Autonomous Vehicles - Ensuring Reliable Driverless Navigation and Control Maneuver Springer
This work presents a behavior planning algorithm for automated driving in urban environments with an uncertain and dynamic nature. The algorithm allows to consider the prediction uncertainty (e.g. different intentions), perception uncertainty (e.g. occlusions) as well as the uncertain interactive behavior of the other agents explicitly. Simulating the most likely future scenarios allows to find an optimal policy online that enables non-conservative planning under uncertainty.
Autonomous Robot Vehicles Path Planning for Autonomous VehicleEnsuring Reliable Driverless Navigation and Control Maneuver
A unified view of the use of computer vision technology for different types of vehicles Computer Vision in Vehicle Technology focuses on computer vision as on-board technology, bringing together fields of research where computer vision is progressively penetrating: the automotive sector, unmanned aerial and underwater vehicles. It also serves as a reference for researchers of current developments and challenges in areas of the application of computer vision, involving vehicles such as advanced driver assistance (pedestrian detection, lane departure warning, traffic sign recognition), autonomous driving and robot navigation (with visual simultaneous localization and mapping) or unmanned aerial vehicles (obstacle avoidance, landscape classification and mapping, fire risk assessment). The overall role of computer vision for the navigation of different vehicles, as well as technology to address on-board applications, is analysed. Key features: Presents the latest advances in the field of computer vision and vehicle technologies in a highly informative and understandable way, including the basic mathematics for each problem. Provides a comprehensive summary of the state of the art computer vision techniques in vehicles from the navigation and the addressable applications points of view. Offers a detailed description of the open challenges and business opportunities for the immediate future in the field of vision based vehicle technologies. This is essential reading for computer vision researchers, as well as engineers working in vehicle technologies, and students of computer vision.
A Guide for Policymakers Linköping University Electronic Press
This book examines control of nonlinear systems. Coverage ranges from mathematical system theory to practical industrial control applications. The author offers web-based videos illustrating some dynamical aspects and case studies in simulation.
Augmented Reactive Mission and Motion Planning Architecture Springer Science & Business Media
This edited volume includes thoroughly collected on sensing and control for autonomous vehicles. Guidance, navigation and motion control systems for autonomous vehicles are increasingly important in land-based, marine and aerial operations. Autonomous underwater vehicles may be used for pipeline inspection, light intervention work, underwater survey and collection of oceanographic/biological data. Autonomous unmanned aerial systems can be used in a large number of applications such as inspection, monitoring, data collection, surveillance, etc. At present, vehicles operate with limited autonomy and a minimum of intelligence. There is a growing interest for cooperative and coordinated multi-vehicle systems, real-time re-planning, robust autonomous navigation systems and robust autonomous control of vehicles. Unmanned vehicles with high levels of autonomy may be used for safe and efficient collection of environmental data, for assimilation of climate and environmental models and to complement global satellite systems. The target audience primarily comprises research experts in the field of control theory, but the book may also be beneficial for graduate students.
Passivity-Based Model Predictive Control for Mobile Vehicle Motion Planning Artech House
Abstract : Connected and autonomous vehicles are becoming the major focus of research for the industry and academia in the automotive field. Many companies and research groups have demonstrated the advantages and the requirement of such technology to improve the energy efficiency of vehicles, decrease the number of crash and road accidents, and control emissions. This research delves into improving the autonomy of self-driving vehicles by implementing localized path planning algorithms to introduce motion control for obstacle avoidance during uncertainties. Lateral path planning is implemented using the A* algorithm combined with piecewise Bezier curve generation which provides an optimum trajectory reference to avoid a collision. Model Predictive Control (MPC) is used to implement longitudinal and lateral control of the vehicle. The data from vehicle-to-everything (V2X) communication infrastructure is used to navigate through multiple signalized intersections. Furthermore, a new method of developing Advanced Driver Assistance Systems (ADAS) algorithms and vehicle controllers using Model-In-the-Loop (MIL) testing is explored with the use of PreScan®. With PreScan®, various traffic scenarios are modeled and the sensor data are

simulated by using physics-based sensor models, which are fed to the controller for data processing and motion planning. Obstacle detection and collision avoidance are demonstrated using the presented MPC controller. The results of the proposed controller and the scope of the future work conclude the research.
Sensing and Control for Autonomous Vehicles Springer Science & Business Media
Autonomous robot vehicles are vehicles capable of intelligent motion and action without requiring either a guide or teleoperator control. The recent surge of interest in this subject will grow even grow further as their potential applications increase. Autonomous vehicles are currently being studied for use as reconnaissance/exploratory vehicles for planetary exploration, undersea, land and air environments, remote repair and maintenance, material handling systems for offices and factories, and even intelligent wheelchairs for the disabled. This reference is the first to deal directly with the unique and fundamental problems and recent progress associated with autonomous vehicles. The editors have assembled and combined significant material from a multitude of sources, and, in effect, now conviniently provide a coherent organization to a previously scattered and ill-defined field.
Optimal Navigation of Autonomous Vehicles BoD – Books on Demand
Offers a step-by-step guide to building autonomous vehicles and robots, with source code and accompanying videos The first book of its kind on the detailed steps for creating an autonomous vehicle or robot, this book provides an overview of the technology and introduction of the key elements involved in developing autonomous vehicles, and offers an excellent introduction to the basics for someone new to the topic of autonomous vehicles and the innovative, modular-based engineering approach called DragonFly. Engineering Autonomous Vehicles and Robots: The DragonFly Modular-based Approach covers everything that technical professionals need to know about: CAN bus, chassis, sonars, radars, GNSS, computer vision, localization, perception, motion planning, and more. Particularly, it covers Computer Vision for active perception and localization, as well as mapping and motion planning. The book offers several case studies on the building of an autonomous passenger pod, bus, and vending robot. It features a large amount of supplementary material, including the standard protocol and sample codes for chassis, sonar, and radar. GPSD protocol/NMEA protocol and GPS deployment methods are also provided. Most importantly, readers will learn the philosophy behind the DragonFly modular-based design approach, which empowers readers to design and build their own autonomous vehicles and robots with flexibility and affordability. Offers progressive guidance on building autonomous vehicles and robots Provides detailed steps and codes to create an autonomous machine, at affordable cost, and with a modular approach Written by one of the pioneers in the field building autonomous vehicles Includes case studies, source code, and state-of-the art research results Accompanied by a website with supplementary material, including sample code for chassis/sonar/radar; GPS deployment methods; Vision Calibration methods Engineering Autonomous Vehicles and Robots is an excellent book for students, researchers, and practitioners in the field of autonomous vehicles and robots.
IntechOpen
Abstract : Planning a path from source to destination avoiding collisions with obstacles is a basic requirement for navigation for any autonomous vehicle. Path generated using the algorithms should satisfy the constraints posed by the vehicle for which the path is being generated. Along with this, the path should also be smooth enough to avoid any jerky movements by the vehicle. Many algorithms have been designed to solve this problem. Among these algorithms, most of these come under graph search, sampling, interpolating and numerical optimization techniques. In this thesis, we have chosen two algorithms for comparison on various metrics. The first implementation is a graph based technique, A* algorithm, to find a collision free path from source to destination and using b-splines, an interpolating technique to smooth this obtained path. The second implementation is state lattice planner, which discretizes the whole search space and generates feasible trajectories which in-turn are used by A* algorithm to find a smooth path. The results obtained using these two techniques are compared on various performance metrics such as execution time, optimality, arc length, path cost, ability to find path in narrow spaces and feasibility of the generated path. Based on the observations, the execution time of the state lattice planner is less than A* based splines planner. However, the drawback of this approach is that it does not create a shortest path and that the path cost and arc length are greater than that of A* based splines approach.
10th International Munich Chassis Symposium 2019 Springer Science & Business Media
This is one of the first technical overviews of autonomous vehicles written for a general computing and engineering audience. Students will find a comprehensive overview of the entire autonomous technology stack and practitioners will find many practical techniques. Throughout the book, the authors share their practical experiences designing autonomous vehicle systems. These systems are complex, consisting of three major subsystems: (1) algorithms for localization, perception, and planning and control; (2) client systems, such as the robotics operating system and hardware platform; and (3) the cloud platform, which includes data storage, simulation, high-definition (HD) mapping, and deep learning model training. The algorithm subsystem extracts meaningful information from sensor raw data to understand its environment and make decisions as to its future actions. The client subsystem integrates these algorithms to meet real-time and reliability requirements. The cloud platform provides offline computing and storage capabilities for autonomous vehicles. Using the cloud platform, new algorithms can be tested so as to update the HD map in addition to training better recognition, tracking, and decision models. Since the first edition of this book was released, many universities have adopted it in their autonomous driving classes, and the authors received many helpful comments and feedback from readers. Based on this, the second edition was improved by extending and rewriting multiple chapters and adding two commercial test case studies. In addition, a new section entitled “Teaching and Learning from this Book” was added to help instructors better utilize this book in their classes. The second edition captures the latest advances in autonomous driving and that it also presents usable real-world case studies to help readers better understand how to utilize their lessons in commercial autonomous driving projects.
Autonomous Driving BoD – Books on Demand
As the editor, I feel extremely happy to present to the readers such a rich collection of chapters authored/co-authored by a large number of experts from around the world covering the broad field of guided wave optics and optoelectronics. Most of the chapters are state-of-the-art on respective topics or areas that are emerging. Several authors

narrated technological challenges in a lucid manner, which was possible because of individual expertise of the authors in their own subject specialties. I have no doubt that this book will be useful to graduate students, teachers, researchers, and practicing engineers and technologists and that they would love to have it on their book shelves for ready reference at any time.

COMPARISON BETWEEN A* BASED SPLINES AND STATE LATTICE PATH PLANNING FOR AUTONOMOUS VEHICLES Springer

Path Planning (PP) is one of the prerequisites in ensuring safe navigation and manoeuvrability control for driverless vehicles. Due to the dynamic nature of the real world, PP needs to address changing environments and how autonomous vehicles respond to them. This book explores PP in the context of road vehicles, robots, off-road scenarios, multi-robot motion, and unmanned aerial vehicles (UAVs).

Autonomous Road Vehicle Path Planning and Tracking Control BoD – Books on Demand

The automotive industry appears close to substantial change engendered by “self-driving” technologies. This technology offers the possibility of significant benefits to social welfare—saving lives; reducing crashes, congestion, fuel consumption, and pollution; increasing mobility for the disabled; and ultimately improving land use. This report is intended as a guide for state and federal policymakers on the many issues that this technology raises.

The 17th International Symposium Morgan & Claypool Publishers

This edited volume, Autonomous Vehicles, is a collection of reviewed and relevant research chapters, offering a comprehensive overview of recent developments in the field of vehicle autonomy. The book comprises nine chapters authored by various researchers and edited by an expert active in the field of study. All chapters are complete in itself but united under a common research study topic. This publication aims to provide a thorough overview of the latest research efforts by international authors, open new possible research paths for further novel developments, and to inspire the younger generations into pursuing relevant academic studies and professional careers within the autonomous vehicle field.

Autonomous Vehicles BoD – Books on Demand

This book takes a look at fully automated, autonomous vehicles and discusses many open questions: How can autonomous vehicles be integrated into the current transportation system with diverse users and human drivers? Where do automated vehicles fall under current legal frameworks? What risks are associated with automation and how will society respond to these risks? How will the marketplace react to automated vehicles and what changes may be necessary for companies? Experts from Germany and the United States define key societal, engineering, and mobility issues related to the automation of vehicles. They discuss the decisions programmers of automated vehicles must make to enable vehicles to perceive their environment, interact with other road users, and choose actions that may have ethical consequences. The authors further identify expectations and concerns that will form the basis for individual and societal acceptance of autonomous driving. While the safety benefits of such vehicles are tremendous, the authors demonstrate that these benefits will only be achieved if vehicles have an appropriate safety concept at the heart of their design. Realizing the potential of automated vehicles to reorganize traffic and transform mobility of people and goods requires similar care in the design of vehicles and networks. By covering all of these topics, the book aims to provide a current, comprehensive, and scientifically sound treatment of the emerging field of “autonomous driving".

Autonomous Ground Vehicles Springer Nature

Abstract : This report investigates path planning and trajectory generation algorithms for the application in autonomous vehicles for obstacle avoidance. A literature review is conducted to select path planning and trajectory generation algorithms that are suitable for the obstacle avoidance application. Two path planning approaches are designed in this work. Approach 1 (RRT*-Spline) uses rapidly exploring random trees* (RRT*) path planning algorithm combined with cubic spline trajectory generation algorithm. Approach 2 (A*-Polynomial Curve) plans a feasible path by using A* algorithm and generates a smooth trajectory using 5th order polynomial curve fitting algorithm. To demonstrate obstacle avoidance of autonomous vehicles, Prescan and Matlab/Simulink are used to build an integrated model consisting of path planning and trajectory generation algorithms, an ego vehicle model, a Model Predictive Control (MPC) controller to control the longitudinal and lateral motion of the ego vehicle, and obstacle avoidance scenarios. Simulation tests are performed to validate the developed algorithms and compare the performances of two approaches for both stationary and moving obstacles. A summary of the performance comparison is provided with respect to the smoothness of the reference path, the smoothness of the reference trajectory, and the ego vehicle steering angle change while it performs an obstacle avoidance task.

The Complete Reference (Volume 4) John Wiley & Sons

This book is the volume of the proceedings for the 17th Edition of ISER. The goal of ISER (International Symposium on Experimental Robotics) symposia is to provide a single-track forum on the current developments and new directions of experimental robotics. The series has traditionally attracted a wide readership of researchers and practitioners interested to the advances and innovations of robotics technology. The 54 contributions cover a wide range of topics in robotics and are organized in 9 chapters: aerial robots, design and prototyping, field robotics, human–robot interaction, machine learning, mapping and localization, multi-robots, perception, planning and control. Experimental validation of algorithms, concepts, or techniques is the common thread running through this large research collection.

Engineering Autonomous Vehicles and Robots KIT Scientific Publishing

In this book Part I presents first an overview of the ECHORD++ project, with its mission and vision together with a detailed structure of its functionalities and instruments: Experiments, Robotic Innovation Facilities and Public end-user Driven Technology Innovation PDTI. Chapter 1 explains how the project is born, the partners, the different instruments and the new concept of cascade funding projects. This novelty made ECHORD++ a special project along the huge number of research groups and consortia involved in the whole project. So far, it is the European funded project with more research team and partners involved in the robotic field. In Chapter 2, one of the instruments in ECHORD++ is explained in detail: RIF. Robotic innovation facilities are a set of laboratories across Europe funded with the project with the goal of hosting consortia involved in any experiment that have special needs when testing their robotic research. In the chapter the three different and specific RIFs will be described and analyzed. Chapter 3 explains an important instrument in ECHORD++: the Experiments. In this part, a big number of research groups have been involve in short time funded research

projects. The chapter explains the management of such Experiments, from the call for participation, the candidate’s selection, the monitoring, reviews and funding for each of the 36 experiments funded for Echord. Chapter 4 is very special because it presents the innovation of funding public end-user driven technology, in particular, robotic technology. The robotic challenge is the key of such an instruments together with the management of the different consortia that participated competitively in the success of the robotic challenge proposed by a public entity, selected also with a very special and innovative process.

Creating Autonomous Vehicle Systems
Springer Nature
This book on computing systems for autonomous driving takes a comprehensive look at the state-of-the-art computing technologies, including computing frameworks, algorithm deployment optimizations, systems runtime optimizations, dataset and benchmarking, simulators, hardware platforms, and smart infrastructures. The objectives of level 4 and level 5 autonomous driving require colossal improvement in the computing for this cyber-physical system. Beginning with a definition of computing systems for autonomous driving, this book introduces promising research topics and serves as a useful starting point for those interested in starting in the field. In addition to the current landscape, the authors examine the remaining open challenges to achieve L4/L5 autonomous driving. Computing Systems for Autonomous Driving provides a good introduction for researchers and prospective practitioners in the field. The book can also serve as a useful reference for university courses on autonomous vehicle technologies.This book on computing systems for autonomous driving takes a comprehensive look at the state-of-the-art computing technologies, including computing frameworks, algorithm deployment optimizations, systems runtime optimizations, dataset and benchmarking, simulators, hardware platforms, and smart infrastructures. The objectives of level 4 and level 5 autonomous driving require colossal improvement in the computing for this cyber-physical system. Beginning with a definition of computing systems for autonomous driving, this book introduces promising research topics and serves as a useful starting point for those interested in starting in the field. In addition to the current landscape, the authors examine the remaining open challenges to achieve L4/L5 autonomous driving. Computing Systems for Autonomous Driving provides a good introduction for researchers and prospective practitioners in the field. The book can also serve as a useful reference for university courses on autonomous vehicle technologies.

Path Planning for an Autonomous Vehicle
John Wiley & Sons
It is very important for an autonomous mobile vehicle to navigate properly without any collision or unsafe conditions in its environment. Mobile robot navigation is a very important exercise in all robotic application from a domestic household cleaner to highly dangerous life threatening situations like bomb diffusing and nuclear decommissioning. Path planning is the main issue related to navigation. Path planning in mobile robots must ensure the optimal path with least cost and collision free path. The standard A* algorithm is capable of finding the shortest path. Modified A* path planning algorithm takes into consideration the robot size and safe diagonal movement of autonomous vehicle. In this thesis, a known model of Autonomous Control Engineering (ACE) lab is made to test the A* and modified A* path planning algorithm. An algorithm to reduce the search process approximately into half by leaving a node and searching for the end result with the successor node is proposed. The outcome of this thesis is a comparison between the three algorithms mentioned above with taking into consideration the search steps, expanded nodes and cost. To test the planning algorithms in real time TurtleBot 2 is used.