Autonomous Vehicle Path Planning With Remote Sensing Data

Analysis and Control of Nonlinear Systems
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Passivity-Based Model Predictive Control for Mobile Vehicle Motion Planning
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10th International Munich Chassis Symposium 2019
Path Planning of an Autonomous Vehicle Through Regions of Fixed Obstacles

BRAEDON MARQUISE

Analysis and Control of Nonlinear Systems Artech House
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.
chassis.tech plus Springer
The market demand for skills, knowledge and adaptability have positioned robotics to be an important field in both engineering and science. One of the most highly visible applications of robotics has been the robotic automation of many industrial tasks in factories. In the future, a new era will come in which we will see a greater success for robotics in non-industrial environments. In order to anticipate a wider deployment of intelligent and autonomous robots for tasks such as manufacturing, healthcare, ent- tainment, search and rescue, surveillance, exploration, and security missions, it is essential to push the frontier of robotics into a new dimension, one in which motion and intelligence play equally important roles. The 2010 International Conference on Intelligent Robotics and Applications (ICIRA 2010) was held in Shanghai, China, November 10–12, 2010. The theme of the c- ference was “Robotics Harmonizing Life,” a theme that reflects the ever-growing interest in research, development and applications in the dynamic and exciting areas of intelligent robotics. These volumes of Springer’s Lecture Notes in Artificial Intel- gence and Lecture Notes in Computer Science contain 140 high-quality papers, which were selected at least for the papers in general sessions, with a 62% acceptance rate Traditionally, ICIRA 2010 holds a series of plenary talks, and we were fortunate to have two such keynote speakers who shared their expertise with us in diverse topic areas spanning the rang of intelligent robotics and application activities.
Evolution-based Path Planning and Management for Autonomous Vehicles Springer
This book addresses higher–lower level decision autonomy for autonomous vehicles, and discusses the addition of a novel architecture to cover both levels. The proposed framework’s performance and stability are subsequently investigated by employing different meta-heuristic algorithms. The performance of the proposed architecture is shown to be largely independent of the algorithms employed; the use of diverse algorithms (subjected to the real-time performance of the algorithm) does not negatively affect the system’s real-time performance. By analyzing the simulation results, the book demonstrates that the proposed model provides perfect mission timing and task management, while also guaranteeing secure deployment. Although mainly intended as a research work, the book’s review chapters and the new approaches developed here are also suitable for use in courses for advanced undergraduate or graduate students.
Passivity-Based Model Predictive Control for Mobile Vehicle Motion Planning IntechOpen
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 Vehicles BoD – Books on Demand
The Symposium is organized with the focus of bringing together scientists from any country working on computational intelligence and its applications with the aims at providing an opportunity for sharing and discussing the recent research developments in this field The idea is to have a small number of lecturers and participants in a relaxed and informal atmosphere
Path Planning for Autonomous Vehicles - Ensuring Reliable Driverless Navigation and Control Maneuver Springer
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.

Autonomy and Unmanned Vehicles Springer Science & Business Media
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.
Comparison of Path Planning Approaches of Autonomous Vehicles for Obstacle Avoidance Application BoD – Books on Demand
Tremendous industrial and academic progress and investments have been made in au-tonomous driving, but still many aspects are unknown and require further investigation,development and testing. A key part of an autonomous driving system is an efficient plan-ning algorithm with potential to reduce accidents, or even unpleasant and stressful drivingexperience. A higher degree of automated planning also makes it possible to have a betterenergy management strategy with improved performance through analysis of surroundingenvironment of autonomous vehicles and taking action in a timely manner. This thesis deals with planning of autonomous vehicles in different urban scenarios, road,and vehicle conditions. The main concerns in designing the planning algorithms, are realtime capability, safety and comfort. The planning algorithms developed in this thesis aretested in simulation traffic situations with multiple moving vehicles as obstacles. The re-search conducted in this thesis falls mainly into two parts, the first part investigates decou-pled trajectory planning algorithms with a focus on speed planning, and the second sectionexplores different coupled planning algorithms in spatiotemporal environments where pathand speed are calculated simultaneously. Additionally, a behavioral analysis is carried outto evaluate different tactical maneuvers the autonomous vehicle can have considering theinitial states of the ego and surrounding vehicles. Particularly relevant for heavy duty vehicles, the issues addressed in designing a safe speedplanner in the first part are road conditions such as banking, friction, road curvature andvehicle characteristics. The vehicle constraints on acceleration, jerk, steering, steer ratelimitations and other safety limitations such as rollover are further considerations in speedplanning algorithms. For real time purposes, a minimum working roll model is identified us-ing roll angle and lateral acceleration data collected in a heavy duty truck. In the decoupledplanners, collision avoiding is treated using a search and optimization based planner. In an autonomous vehicle, the structure of the road network is known to the vehicle throughmapping applications. Therefore, this key property can be used in planning algorithms toincrease efficiency. The second part of the thesis, is focused on handling moving obstaclesin a spatiotemporal environment and collision-free planning in complex urban structures.Spatiotemporal planning holds the benefits of exhaustive search and has advantages com-pared to decoupled planning, but the search space in spatiotemporal planning is complex.Support vector machine is used to simplify the search problem to make it more efficient.A SVM classifies the surrounding obstacles into two categories and efficiently calculate anobstacle free region for the ego vehicle. The formulation achieved by solving SVM, con-tains information about the initial point, destination, stationary and moving obstacles.These features, combined with smoothness property of the Gaussian kernel used in SVMformulation is proven to be able to solve complex planning missions in a safe way. Here, three algorithms are developed by taking advantages of SVM formulation, a greedysearch algorithm, an A* lattice based planner and a geometrical based planner. One general property used in all three algorithms is reduced search space through using SVM. In A*lattice based planner, significant improvement in calculation time, is achieved by using theinformation from SVM formulation to calculate a heuristic for planning. Using this heuristic,the planning algorithm treats a simple driving scenario and a complex urban structureequal, as the structure of the road network is included in SVM solution. Inspired byobserving significant improvements in calculation time using SVM heuristic and combiningthe collision information from SVM surfaces and smoothness property, a geometrical planneris proposed that leads to further improvements in calculation time. Realistic driving scenarios such as roundabouts, intersections and takeover maneuvers areused, to test the performance of the proposed algorithms in simulation. Different roadconditions with large banking, low friction and high curvature, and vehicles prone to safetyissues, specially rollover, are evaluated to calculate the speed profile limits. The trajectoriesachieved by the proposed algorithms are compared to profiles calculated by optimal controlsolutions.
Computer Vision in Vehicle Technology Linköping University Electronic Press
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".
Land, Sea, and Air Springer Nature
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.

Path Planning for an Autonomous Vehicle Rand Corporation

World population is growing at an alarming rate and is anticipated to reach about six billion by the end of year 2050. On the other hand, agricultural productivity is not increasing at a required rate to keep up with the food demand. The reasons for this are water shortages, depleting soil fertility and mainly various abiotic stresses. The fast pace at which developments and novel findings that are recently taking place in the cutting edge areas of molecular biology and basic genetics, have reinforced and augmented the efficiency of science outputs in dealing with plant abiotic stresses. In depth understanding of the stresses and their effects on plants is of paramount importance to evolve effective strategies to counter them. This book is broadly dived into sections on the stresses, their mechanisms and tolerance, genetics and adaptation, and focuses on the mechanic aspects in addition to touching some adaptation features. The chief objective of the book hence is to deliver state of the art information for comprehending the nature of abiotic stress in plants. We attempted here to present a judicious mixture of outlooks in order to interest workers in all areas of plant sciences.

Advances in Robotics Research: From Lab to Market Springer

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.

Experimental Robotics Springer

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.

Path Planning for an Autonomous Vehicle Springer

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.

The DragonFly Modular-based Approach John Wiley & Sons

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).

MPC-BASED AUTONOMOUS DRIVING CONTROL WITH LOCALIZED PATH PLANNING FOR OBSTACLE AVOIDANCE AND NAVIGATING SIGNALIZED INTERSECTIONS Springer Nature

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.

Frontiers in Guided Wave Optics and Optoelectronics BoD – Books on Demand

This is the fourth volume of the successful series Robot Operating Systems: The Complete Reference, providing a comprehensive overview of robot operating systems (ROS), which is currently the main development framework for robotics applications, as well as the latest trends and contributed systems. The book is divided into four parts: Part 1 features two papers on navigation,

discussing SLAM and path planning. Part 2 focuses on the integration of ROS into quadcopters and their control. Part 3 then discusses two emerging applications for robotics: cloud robotics, and video stabilization. Part 4 presents tools developed for ROS; the first is a practical alternative to the roslaunch system, and the second is related to penetration testing. This book is a valuable resource for ROS users and wanting to learn more about ROS capabilities and features.

Robot Operating System (ROS) John Wiley & Sons

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.

Methods and Models for Optimal Path Planning Springer Science & Business Media

Discover the latest research in path planning and robust path tracking control In Autonomous Road Vehicle Path Planning and Tracking Control, a team of distinguished researchers delivers a practical and insightful exploration of how to design robust path tracking control. The authors include easy to understand concepts that are immediately applicable to the work of practicing control engineers and graduate students working in autonomous driving applications. Controller parameters are presented graphically, and regions of guaranteed performance are simple to visualize and understand. The book discusses the limits of performance, as well as hardware-in-the-loop simulation and experimental results that are implementable in real-time. Concepts of collision and avoidance are explained within the same framework and a strong focus on the robustness of the introduced tracking controllers is maintained throughout. In addition to a continuous treatment of complex planning and control in one relevant application, the Autonomous Road Vehicle Path Planning and Tracking Control includes: A thorough introduction to path planning and robust path tracking control for autonomous road vehicles, as well as a literature review with key papers and recent developments in the area Comprehensive explorations of vehicle, path, and path tracking models, model-in-the-loop simulation models, and hardware-in-the-loop models Practical discussions of path generation and path modeling available in current literature In-depth examinations of collision free path planning and collision avoidance Perfect for advanced undergraduate and graduate students with an interest in autonomous vehicles, Autonomous Road Vehicle Path Planning and Tracking Control is also an indispensable reference for practicing engineers working in autonomous driving technologies and the mobility groups and sections of automotive OEMs.

Autonomous Road Vehicle Path Planning and Tracking Control Path Planning for Autonomous VehicleEnsuring Reliable Driverless Navigation and Control Maneuver

Abstract : The research in this report incorporates the improvement in the autonomous driving capability of self-driving cars in a dynamic environment. Global and local path planning are implemented using the D* path planning algorithm with a combined Cubic B-Spline trajectory generator, which generates an optimal obstacle free trajectory for the vehicle to follow and avoid collision. Model Predictive Control (MPC) is used for the longitudinal and the lateral control of the vehicle. The presented motion planning and control algorithm is tested using Model-In-the-Loop (MIL) method with the help of MATLAB® Driving Scenario Designer and Unreal Engine® Simulator by Epic Games®. Different traffic scenarios are built, and a camera sensor is configured to simulate the sensory data and feed it to the controller for further processing and vehicle motion planning. Simulation results of vehicle motion control with global and local path planning for dynamic obstacle avoidance are presented. The simulation results show that an autonomous vehicle follows a commanded velocity when the relative distance between the ego vehicle and an obstacle is greater than a calculated safe distance. When the relative distance is close to the safe distance, the ego vehicle maintains the headway. When an obstacle is detected by the ego vehicle and the ego vehicle wants to pass the obstacle, the ego vehicle performs obstacle avoidance maneuver by tracking desired lateral positions.

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