능동안전 Ⅰ : 알고리즘 개발

자율주행 차량을 위한 계층적 거동전략 기반의 중재 프레임워크를 활용한 의사결정 알고리즘

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Decision-Making Algorithm for Autonomous Vehicles Using a Hierarchical Maneuver Based Arbitration Framework

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Key Words : Autonomous driving(자율 주행), Global path planning(전역 경로 계획), Decision-making(의사 결정), Hierarchical framework(계층적 프레임워크)

ABSTRACT

This paper proposes a high-level decision-making algorithm for autonomous vehicles based on an arbitration framework utilizing a hierarchical maneuver. The algorithm combines global path planning (GPP) and high-level maneuver decisions, allowing the vehicle to perform maneuvers in consideration of the current driving environment and road conditions. Basic maneuver blocks such as lane keeping, lane changing, and merging are stacked to form arbitrators, which can be classified as either cost-based or priority-based. The proposed algorithm is designed to achieve the maximum expected velocity during throughout its trajectory, thereby allowing the vehicle to reach the destination in the shortest possible time. The algorithm's parameters were tuned via simulations and was validated through real-world experiments with comparisons to human-driving data. Results of the simulations and validations showed the proposed algorithm to be effective at significantly improving the safety and efficiency of autonomous vehicles.

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라이다 처리 효율 향상을 위한 주행상황 및 경로 기반 동적 라이다 관심영역 설정 알고리즘

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Dynamic LiDAR Region-of-Interest Setting Algorithm Based on Driving Situations and Path for Improved Efficiency

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Key Words : Autonomous driving(자율주행), LiDAR region of interest(라이다 관심영역), LiDAR preprocessing (라이다 전처리), Point cloud processing(점군집 데이터 처리)

ABSTRACT

This paper presents an algorithm for setting dynamic LiDAR regions-of-interest (ROI) based on driving situations and paths to improve efficiency in autonomous vehicle perception using LiDAR data. The proposed algorithm selects only the relevant ROI for the vehicle movements, eliminating unnecessary computations and ensuring real-time, computationally efficient operations. Different driving situations, such as lane keeping, lane change, and passing intersections, are considered for dynamic ROI settings. In these situations, the algorithm considers the interested area based on the driving path and determines the required perception range for safety, considering vehicle speed and acceleration values. To select LiDAR points more flexibly, the proposed algorithm uses a boundary-setting method that assigns indices to the LiDAR points instead of the conventional box-based ROI selection method. The algorithm has been validated using LiDAR data obtained from actual driving tests conducted at the Sangam Autonomous Driving Test Area. It has demonstrated improved efficiency by reducing the total number of points and processing times.

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UGV의 운용적합성 평가를 위한 운용 시험 시나리오 연구

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Study on the Operational Test Scenarios for Assessment of Unmanned Ground Vehicle's Operational Suitability

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Key Words : Unmanned ground vehicle(무인지상차량), Autonomous driving(자율주행), Pegasus project(페가수스 프로젝트), 6-Layer format(6-레이어 포맷), Operational test scenario(안전성 평가 시나리오), Army(육군)

ABSTRACT

This paper develops scenarios to evaluate the safety performance of Unmanned Ground Vehicle on military circumstances. The scenarios were created using Pegasus Project 6-layer format. These scenarios consist of straight road, curved road, merging road and crossroad. We adapt these scenarios to unpaved road. The characteristics of unpaved roads were divided into roughness, friction coefficient and road frequency. This adaption is validated via computer simulation. We observe the scan lines of vehicle become tangled of the straight road that make the cognitive abilities of the vehicle low and the lane-keeping is unable when vehicles entering curved off-roads over 40km/h. The developed scenarios will contribute to enhancing stability from the perspective of introducing autonomous driving technology to Korean military.

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자율주행 차량을 위한 멀티 라벨 차선 검출 딥러닝 알고리즘

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Multi-Label Lane Detection Algorithm for Autonomous Vehicle Using Deep Learning

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Key Words : Lane detection(차선 검출), Autonomous vehicle(자율 주행), Deep learning(딥러닝), Perception(인지)

ABSTRACT

This paper represents multi-label lane detection for autonomous vehicle using deep learning. The proposed algorithm can detect two types of lanes, such as center lane and normal lane. The algorithm uses a convolution neural network with an encoder-decoder architecture to extract features from input images and produce a multi-label heatmap for predicting lane's label. The algorithm has the potential to detect more diverse types of lanes in that it can expand the number of labels by extend heatmap's dimension. The proposed algorithm was tested on a OpenLane dataset and achieved 85 FPS in end-to-end inference time. The results demonstrate the effectiveness and efficiency of the proposed algorithm for multi-label lane detection in autonomous vehicles.

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