알고리즘 II

Attention이 적용된 LSTM-Autoencoder 알고리즘을 사용한 차량 주행 패턴 시각화

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Visualization of Vehicle Driving Patterns Using the LSTM-Autoencoder Algorithm with Attention Applied

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Key Words : Attention mechanism(어텐션 메커니즘), Autoencoder(자동부호기), LSTM(장단기 메모리), Deep learning (딥러닝)

ABSTRACT

Recently, the analysis of vehicle driving data has garnered attention as a primary research topic aimed at optimizing the driving style of drivers and enhancing the performance of vehicles. The objective of this study is to collect operational data from drivers, including steering angle, wheel speed, accelerator pedal, and brake, and to cluster driving segments based on their characteristics using deep learning. For this purpose, we adopted a methodology that combines the LSTM-Autoencoder model, which comprehends the features of time-series data while focusing on crucial aspects to compress and restore the data, with the Attention mechanism. We cluster the driving segments and visually represent each segment in various colors. Experimental results from the proposed methodology demonstrated that the input and output values matched at a rate of over 96%, allowing for the clustering of driving segments based on their distinguishing characteristics. This offers invaluable insights for improving drivers' driving habits and optimizing vehicle assistance systems, expected to contribute significantly to the advancement of research.

후기

2023년 한국교통대학교의 지원을 받아 수행하였음.

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동적 물체 분할을 통한 3D 물체 탐지 개선 연구

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Improvement of 3D Object Detection Performance Through Moving Object Segmentation

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Key Words : Moving Object Segmentation(동적 물체 분할), 3D object Detection(3차원 물체 탐지), Autonomous Driving(자율주행), Pointcloud(점 군집)

ABSTRACT

Accurate 3D object detection in autonomous driving plays an important role in downstream tasks, such as multi-object tracking and path planning, which are essential for the safe and efficient operation of autonomous vehicles. In this paper, we propose a method to increase the performance of 3D object detection using moving object segmentation. Our method begins by acquiring point-wise moving labels through a moving object segmentation process and then they are subsequently integrated into the LiDAR point cloud data, effectively enhancing the detection capabilities of model. We evaluated our method using KITTI-road datasets and achieved better performance notably in terms of AOS (Average Orientation Similarity), which serves as a key metric for assessing the accuracy of 3D object detection. Our findings demonstrate that our proposed method not only contributes to advancing detecting performance of any lidar-only 3D object detection method but also holds significant promise for enhancing the overall perception capabilities of autonomous driving systems.

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트랜스포머 기반 종단간 국소적 고정밀 지도 생성 모델

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Transformer-Based End-to-End Local High-Definition Map Generation Model

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Key Words : Autonomous driving(자율 주행), HD map(고화질 지도), End-to-end model(종단간 모델), Transformer (트랜스포머), Bird's eye view(버드아이뷰)

ABSTRACT

The traditional method of creating HD maps required a significant amount of manpower and resources. It involved collecting point cloud data, generating maps using SLAM(Simultaneous Localization and Mapping) technology, and manually adding additional annotations. Therefore, our goal is to predict local maps using the images from surrounding cameras, offering a more cost-effective approach. The proposed end-to-end model utilizes a Transformer as the backbone network to extract important features. The model generates Bird's Eye View(BEV) features, which project the extracted features into the 3D space of the vehicle coordinate system. Based on these BEV features, the position of map elements can be detected and classified. As a result, the proposed model achieves 50.1 mean average precision(mAP). It can effectively function as a local map even in areas where no annotations exist in HD maps.

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거리 기반 적응형 임계값을 통한 3D 객체 검출의 견고성 향상

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Enhancing 3D Object Detection Robustness via Distance-Driven Adaptive Thresholds

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Key Words : Autonomous driving Perception(자율주행 인지), 3D Object detection(3차원 객체 탐지), Bird Eye's View (버드 아이즈 뷰), Adaptive threshold(적응형 임계값), Post-processing(후처리)

ABSTRACT

Robust 3D Object detection in diverse scenarios is a core challenge for autonomous driving system in urban environment. To address this challenge, The Bird Eye's View (BEV) representations utilizing LiDAR, Camera, Radar sensors have been widely adopted and have improved the performance of 3D BEV model. However real-world urban scenarios often lead to numerous false positives due to unexpected situations, presenting challenges in developing a robust BEV model. This paper presents a post-processing algorithm that adapts object detection thresholds based on the distance from the ego-vehicle within 3D BEV representations. The existing perception algorithm usually employ a single threshold value in post-processing, but BEV (Bird's Eye View) models, based on sensor characteristics such as sensor resolution and range, as well as training data, exhibit superior performance in detecting nearby objects while demonstrating suboptimal performance for distant objects. The proposed algorithm addresses this issue by employing adaptive thresholds guided by Recall/Precision and F1 score, effectively minimizing false negatives and reducing false positives in the BEV model. The results demonstrate performance improvements in the BEV model across various scenarios, including not only typical urban road conditions but also situations involving fog and rain.

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자율주행차량 탑승자 이질감 최소화를 위한 주행 성향 학습 기반 제어

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Data Driven Control of Automated Driving Vehiclefor Enhanced Human Acceptance

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Key Words : Autonomous Driving(자율주행), LSTM Autoencoder(LSTM 오토 인코더), Spectral Clustering(그래프 기반 군집화 기법), Human Acceptability(인간 수용성), Driving Comfort(승차감)

ABSTRACT

This paper presents a methodology for developing personalized human driver models (AI-Agents) that reflect individual drivers' driving patterns, aiming to improve human acceptability compared to rule-based algorithms. We propose data-driven control logic based on the individual driving data developed to enhance the acceptability of autonomous vehicles and address the limitation of rule-based algorithms in accommodating diverse driving patterns. In order to collect manual driving data reflecting individual patterns in urban environment, a test scenario including a vulnerable ride comfort situation was selected. A LSTM Autoencoder has been implemented to extract feature for visualizing driving patterns, and the extracted feature vectors are clustered through spectral clustering. It has been shown that the proposed algorithm can categorize driving behavior precisely and reflect individual drivers' driving pattern distinctly by defining each behavior state. Using regression analysis, the fitting function of Longitudinal Acceleration for each cluster is derived. The control logic has been implemented by integrating Longitudinal MPC (Model Predictive Control), which applies the upper and lower bounds of the fitting function, and lateral control that considered individual driver-specific paths. This approach enabled the implementation of the AI-Agents customized for individual drivers. As a result of comparing the AI-Agent with manual driving data, we confirmed that the AI-Agent exhibits driving behavior more similar to real drivers than conventional rule-based autonomous driving systems. AI-Agent based on data-driven control has been evaluated for ride comfort at an urban test road and received assessments indicating that the AI-Agent algorithms demonstrated improvements exceeding 82.5% compared to the conventional rule-based approach. To make driver models adaptable in various environments, the future challenge lies in implementing and validating them in diverse virtual settings.

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