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Section Transportation and Future Mobility



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Section Information

Over the past years, Transportation has expanded and is used in an ever-growing number of application areas. The “Transportation and Future Mobility” Section is open to receiving high-quality submissions on new technologies, processes, methods, materials, systems, and applications in the field of transportation.

Section Editor-in-Chief

Prof. Dr. David Fernández-Llorca

Subject Areas

The main topics of the Section include but not limited to:

- Intelligent Transportation Systems
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- Decision and Control Systems
- Simulation and Digital Twins
- Internet of Things
- Intelligent Mobility
- Big Data in Future Mobility
- Industry 4.0 in Future Mobility

Content Highlights



Smart City for Sustainable Development: Applied Processes from SUMP to MaaS at European Level

Authors: Francesco Russo and Corrado Rindone

Abstract: Urban areas constitute one of the main issues of sustainability as defined by the United Nations with the Sustainable Development Goals (SDGs). The recent smart city concept represents a way for achieving the urban sustainability goals. The European Commission (EC) bases the smart city concept on three pillars: energy, transport and Information and Communication Technologies (ICT). The main objective of the paper is to investigate the European smart city process, by focusing on urban mobility and their interconnections with the other two pillars. The methodological approach of territorial planning is used by identifying the plan dimensions and then analyzing the processes at master and sectorial level. The applied processes are verified with a review of the European documents that constitute the rules for defining and implementing the smart city concept. European guidelines indicate the SUMP as the integrated master plan that contributes to reach the convergence among energy, transport and ICT processes. By focusing on people mobility sector, European cities are implementing the Mobility as a Service (MaaS) plan at the sectorial level. This implies the necessity to enhance the knowledge of mobility phenomenon, in relation to emerging ICT and their impact on energy consumptions...

<https://doi.org/10.3390/app13031773>



A Long-Term Traffic Flow Prediction Model Based on Variational Mode Decomposition and Auto-Correlation Mechanism

Authors: Kaixin Guo, Xin Yu, Gaoxiang Liu and Shaohu Tang

Abstract: Traffic flow forecasting, as an integral part of intelligent transportation systems, plays a critical part in traffic planning. Previous studies have primarily focused on short-term traffic flow prediction, paying insufficient attention to long-term prediction. In this study, we propose a hybrid model that utilizes variational mode decomposition (VMD) and the auto-correlation mechanism for long-term prediction. In view of the periodic and stochastic characteristics of traffic flow, VMD is able to decompose the data into intrinsic mode functions with different frequencies, which in turn helps the model extract the internal features of the data and better capture the changes of traffic flow data in the cycle. Additionally, we improve the residual structure by adding a convolutional layer to propose a correction module and use it together with the auto-correlation mechanism to jointly build an encoder and decoder to extract features from different data components (intrinsic mode functions) and fuse the extracted features for output. To meet the requirements of long-term forecasting, we set the traffic flow forecast length to 4 levels: 96, 192, 336, and 720...

<https://doi.org/10.3390/app13127139>



Cooperative Decision-Making for Mixed Traffic at an Unsignalized Intersection Based on Multi-Agent Reinforcement Learning

Authors: Huanbiao Zhuang, Chaofan Lei, Yuanhang Chen and Xiaojun Tan

Abstract: Despite rapid advances in vehicle intelligence and connectivity, there is still a significant period in mixed traffic where connected, automated vehicles and human-driven vehicles coexist. The behavioral uncertainty of human-driven vehicles makes decision-making a challenging task in an unsignalized intersection scenario. In this paper, a decentralized multi-agent proximal policy optimization (MAPPO) based on an attention representations algorithm (Attn-MAPPO) was developed to make joint decisions at an intersection to avoid collisions and cross the intersection effectively. To implement this framework, by exploiting the shared information, the system was modeled as a model-free, fully cooperative, multi-agent system. The vehicle employed an attention module to extract the most valuable information from its neighbors. Based on the observation and traffic rules, a joint policy was identified to work more cooperatively based on the trajectory prediction of all the vehicles. To facilitate the collaboration between the vehicles, a weighted reward assignment scheme was proposed to focus more on the vehicles approaching intersections. The results presented the advantages of the Attn-MAPPO framework and validated the effectiveness of the designed reward function...

<https://doi.org/10.3390/app13085018>



An Efficient Feature Augmentation and LSTM-Based Method to Predict Maritime Traffic Conditions

Authors: Eunky Lee, Junaid Khan, Woo-Ju Son and Kyungsup Kim

Abstract: The recent emergence of futuristic ships is the result of advances in information and communication technology, big data, and artificial intelligence. They are generally autonomous, which has the potential to significantly improve safety and drastically reduce operating costs. However, the commercialization of Maritime Autonomous Surface Ships requires the development of appropriate technologies, including intelligent navigation systems, which involves the identification of the current maritime traffic conditions and the prediction of future maritime traffic conditions. This study aims to develop an algorithm that predicts future maritime traffic conditions using historical data, with the goal of enhancing the performance of autonomous ships. Using several datasets, we trained and validated an artificial intelligence model using long short-term memory and evaluated the performance by considering several features such as the maritime traffic volume, maritime traffic congestion fluctuation range, fluctuation rate, etc. The algorithm was able to identify features for predicting maritime traffic conditions...

<https://doi.org/10.3390/app13042556>



Solutions to the Problem of Freight Transport Flows in Urban Logistics

Authors: Nijolė Batarlienė and Darius Bazaras

Abstract: The operation of a city's logistics system is associated with many problematic issues, for example, intense pollution and negative impacts on the environment, uneven intensity of traffic flows, and other problems. This article focuses on heavy transport because it causes disruptions in the supply system and affects timely customer service. Optimization processes are associated with route selection, deployment of logistics centers, and the need for cargo consolidation–de-consolidation, which leads to the possibility of using the PPP (public–private partnership) method in practice. A unique aspect of this research is related to the problems of the first and last mile and the use of elements of the “sharing economy”. Therefore, this article aims to analyze the problematic challenges of the first and last mile and the role and significance of heavy transport in urban logistics. For that purpose, in addition to an analysis of scientific sources, an expert survey was conducted and responses related to the questions on optimizing heavy traffic flows in city logistics were analyzed...

<https://doi.org/10.3390/app13074214>

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Guest Editor: Prof. Dr. Suchao Xie



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Guest Editors: Dr. Roland Jachimowski and Dr. Michał Kłodawski



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