algorithms

Editorial

Special Issue "Neural Network for Traffic Forecasting"

Weiwei Jiang

School of Information and Communication Engineering, Beijing University of Posts and Telecommunications, Beijing 100876, China; jww@bupt.edu.cn

Traffic forecasting is an important research topic in intelligent transportation systems and smart cities. Various approaches have been proposed for solving this challenging problem with both complex spatial and temporal dependencies. More recently, neural networks have been proven to have a strong learning ability and are promising for a wide range of applications. This Special Issue aims to collect the state-of-the-art results of applying neural networks for traffic forecasting. A collection of five papers are accepted and included in this Special Issue, covering the latest methods such as Artificial Neural Networks (ANN), Physics-Informed Neural Networks (PINNs), spatio-temporal attention-boosted autoencoder and Deep Reinforcement Learning (DRL). These papers should be inspiring for researchers from the relevant fields.

The first paper is presented by Y. Zhao and J. Dong-O'Brien [1]. Previous traffic breakdown prediction models fail to consider on-ramp traffic flow. To fill this research gap, an ANN-based algorithm is developed in [1], which considers temporal and spatial correlations of the traffic conditions from the location of interest, the ramp, and the upstream and downstream segments. The numerical results demonstrate that the prediction of the probability of a traffic breakdown occurrence on freeway segments with merging traffic is improved in [1] with an accuracy of 96%.

The second paper is presented by D. Gatarić, N. Ruškić, B. Aleksić, et al. [2]. Road traffic accidents are difficult to predict because of a variety of subjective and objective factors and ANNs are adopted in [2] to solve this challenging problem. Two ANN models are presented to predict traffic accidents on common roads in the Republic of Serbia and the Republic of Srpska (Bosnia and Herzegovina). They consider various factors including road length, terrain type, road width, average daily traffic volume, and speed limit. The proposed two ANN models achieve the highest values of r^2 of 0.986, 0.988, and 0.977, and 0.990, 0.969, and 0.990, accordingly, for training, testing and validation cycles.

The third paper is presented by M. Usama, R. Ma, J. Hart, et al. [3]. Traditional model-driven and data-driven methods for traffic state estimation (TSE) are not satisfactory and a PINN framework is proposed to combine the advantages of both approaches and mitigate their limitations in [3]. The proposed framework obtains high-quality TSEs for a traffic network based on a small amount of observational speed data and outperforms existing solutions.

The fourth paper is presented by S. Fiorini, M. Ciavotta, and A. Maurino [4]. Because of the complex and nonlinear spatial and temporal dependencies hidden in urban mobility patterns, it is still challenging to predict the number of incoming and outgoing vehicles for different city areas. Spatio-temporal neural networks are proposed for solving this challenging problem in [4]. Specifically, a novel autoencoder architecture is proposed, which combines time-distributed convolutions, cascade hierarchical units and two distinct attention mechanisms. The proposed model effectively captures and exploits complex spatial and temporal patterns in mobility data and is proven effective for short-term flow prediction.

The fifth paper is presented by P. Karthikeyan, W. Chen, and P. Hsiung [5]. DRL-inspired autonomous intersection management is introduced in [5] to improve traffic

check for updates

Citation: Jiang, W. Special Issue "Neural Network for Traffic Forecasting". *Algorithms* **2023**, *16*, 421. https://doi.org/10.3390/a16090421

Received: 2 August 2023
Accepted: 1 September 2023
Published: 2 September 2023

environment efficiency and safety. The priority assignment model, the intersection-control model learning, and the safe brake control are used in the proposed scheme as three main modules. Using a simulation of urban mobility tools, the proposed approach is proven to be effective for intersection management.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Zhao, Y.; Dong-O'Brien, J. Prediction of Freeway Traffic Breakdown Using Artificial Neural Networks. *Algorithms* **2023**, *16*, 298. [CrossRef]
2. Gatarić, D.; Ruškić, N.; Aleksić, B.; Đurić, T.; Pezo, L.; Lončar, B.; Pezo, M. Predicting Road Traffic Accidents—Artificial Neural Network Approach. *Algorithms* **2023**, *16*, 257. [CrossRef]
3. Usama, M.; Ma, R.; Hart, J.; Wojcik, M. Physics-Informed Neural Networks (PINNs)-Based Traffic State Estimation: An Application to Traffic Network. *Algorithms* **2022**, *15*, 447. [CrossRef]
4. Fiorini, S.; Ciavotta, M.; Maurino, A. Listening to the city, attentively: A spatio-temporal attention-boosted autoencoder for the short-term flow prediction problem. *Algorithms* **2022**, *15*, 376. [CrossRef]
5. Karthikeyan, P.; Chen, W.L.; Hsiung, P.A. Autonomous Intersection Management by Using Reinforcement Learning. *Algorithms* **2022**, *15*, 326. [CrossRef]