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RESEARCH ARTICLE

An attention-based deep learning model for traffic flow prediction using spatiotemporal features towards sustainable smart city

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Summary

In the development of smart cities, the intelligent transportation system (ITS) plays a major role. The dynamic and chaotic nature of the traffic information makes the accurate forecasting of traffic flow as a challengeable one in ITS. The volume of traffic data increases dramatically. We enter the epoch of big data. Hence, a 1deep architecture is necessary to process, analyze, and inference such a large volume of data. To develop a better traffic flow forecasting model, we proposed an attention-based convolution neural network long short-term memory (CNN-LSTM), a multistep prediction model. The proposed scheme uses the spatial and time-based details of the traffic data, which are extracted using CNN and LSTM networks to improve the model accuracy. The attention-based model helps to identify the near term traffic details such as speed that is very important for predicting the future value of flow. The results show that our attention-based CNN-LSTM prediction model provides better accuracy in terms of prediction during weekdays and weekend days in the case of peak and nonpeak hours also. We used data from the largest traffic data set the California Department of Transportation (Caltrans) for our prediction work.

KEYWORDS

attention model, convolution neural network, long short-term memory, traffic flow prediction

1 | INTRODUCTION

The intelligent and smart traffic management system is essential for managing the increasing volume of vehicles and the human population in smart cities. An intelligent transportation system (ITS) enables the collection of real-time data and helps to provide timely information about the traffic situation to the users. ITS helps the users to plan and manage their travel decisions by providing real information regarding the congestion level at the roads, the expected travel time to reach their destination, road conditions such as road closure, or any accident.

The prediction of traffic flow is an important factor for the successful deployment of the transportation management system in any country. It denotes the forecasting of traffic information such as flow from the past and current data to

