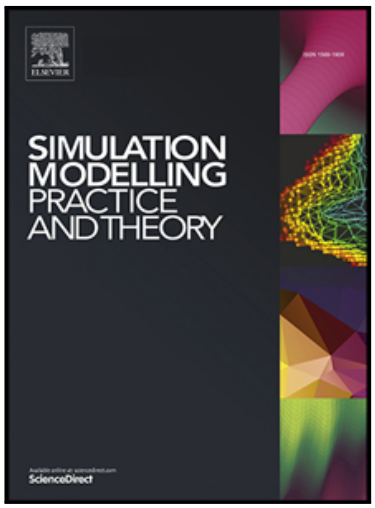

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Calibration and Validation of a Simulation-based Dynamic Traffic Assignment Model for a Large-Scale Congested Network

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Abstract

Deployment of a simulation-based dynamic traffic assignment (DTA) model requires calibration of a large number of demand and supply input parameters. In this paper, we present a data-intensive framework for deployment, calibration, and validation of a simulation-based DTA model of Melbourne, Australia as a large-scale congested network. The model consists of 55,719 links and 24,502 nodes and simulates almost 2.1 million commuters in a 4-hour morning peak period. We propose a machine learning based technique to classify and calibrate the traffic flow fundamental diagrams against empirical data obtained from a large number of freeway loop detectors across the network. An optimization framework for estimating the time-dependent origin-destination (TDOD) demand is also presented. To enhance the quality of the TDOD demand estimation, we apply a departure time profiling technique to account for the spatial differences between OD pairs. The paper also demonstrates the impact of adaptive driving on the quality of the DTA calibration. A comparison between the simulated and observed link volumes over 1,250 locations across the entire network shows that the calibration procedure generates an approximately 30% improvement in the root mean square error (RMSE). The impact of pedestrians and cyclists on the vehicular traffic is also implicitly considered in the central business district (CBD) area to improve underestimation of the simulated travel times. Validation results suggest that the calibrated DTA model successfully replicates traffic patterns in the network and support the future applications of the model for various transportation operations and planning purposes.

Keywords: dynamic traffic assignment; time-dependent origin-destination demand; bi-level optimization; traffic flow fundamental diagrams; large-scale congested network