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Modelling the heterogeneous traffic correlations in urban road systems using traffic-enhanced community detection approach

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Abstract:

A better characterization of the traffic influence among urban roads is crucial for traffic control and traffic forecasting. The existence of spatial heterogeneity imposes great influence on modeling the extent and degree of road traffic correlation, which is usually neglected by the traditional distance-based method. In this paper, we propose a traffic-enhanced community detection approach to spatially reveal the traffic correlation in city road networks. First, the road network is modelled as a traffic-enhanced dual graph with the closeness between two road segments determined not only by their topological connection, but also by the traffic correlation between them. Then a flow-based community detection algorithm called Infomap is utilized to identify the road segment clusters. Evaluated by Moran's I, Calinski-Harabaz Index and the traffic interpolation application, we find that compared to the distance based method and the community based method, our proposed traffic-enhanced community based method behaves better in capturing the extent of traffic relevance as both the topological structure of the road network and the traffic correlations among urban roads are considered. It can be used in more traffic related applications, such as traffic forecasting traffic control and guidance.

Keywords: urban road system, spatial heterogeneity, traffic correlation, traffic-enhanced dual graph, community detection

1 Introduction

Modeling the spatial interaction between components of urban road systems is

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