Application of finite Markov chains in the analysis and simulation of traffic flow

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Abstract

One of the important tasks in the theory of intelligent transporting systems (ITS) is the modeling and simulating the movement of vehicles. By an appropriate model we can understand and handle various traffic problems, e.g., unexpected disaster events. A mathematically rigorous stochastic model that can be used for traffic analysis is proposed in [1] which is based on an interplay between graph and Markov chain theories. In this model, the transition probability matrix describes the traffic's dynamic while the unique stationary distribution of the vehicles on the road network. In a forthcoming paper, we propose a new parametrization to this model by introducing the concept of two-dimensional stationary distribution which can handle the traffic's dynamic and the vehicles' distribution at the same time, and this parameter is estimated by the composite least squares method. In the talk, a case study is discussed in detail which is based on the Taxi Trajectory Prediction (TTP) dataset and road network data from the OpenStreetMap (OSM) project, both available publicly. In this real application, we have unfolded a stationary distribution on the map graph of Porto, Portugal, based on the TTP dataset.

Keywords: Road network; Traffic simulation; Discrete time Markov chain; Stationary distribution; Composite least squares estimation.

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References

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