Demand Calibration of Multimodal Microscopic Traffic Simulation using Weighted Discrete SPSA - DTU Orbit (11/11/2019)

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This paper presents a stochastic approximation framework to solve a generalized problem of off-line calibration of demand for a multimodal microscopic (or mesoscopic) network simulation using aggregated sensor data. A key feature of this problem is that demand, although typically treated as a continuous variable is in fact discrete, particularly in the context of agent-based simulation. To address this, we first use a discrete version of the weighted simultaneous perturbation stochastic approximation (W-DSPSA) algorithm for minimizing a generalized least squares (GLS) objective (that measures the distance between simulated and observed measurements), defined over discrete sets. The algorithm computes the gradient at each iteration using a symmetric discrete perturbation of the calibration parameters and a multimodal weight matrix to improve the accuracy of the gradient estimate. The W-DSPSA algorithm is then applied to the large-scale calibration of multimodal origin–destination (OD) flows (including private vehicle (PVT) and public transit (PT) trips) in a microscopic network simulation model of Singapore. The results indicate that an acceptable margin of error on the vehicle loop count (VLC) and bus passenger count (BPC) are achieved at convergence with an improvement of 60%-80% in root mean squared errors. Lastly, we validate the calibration results with observed travel times on the network. Statistical comparison shows good agreements on both point-to-point travel time (PTT) and public buses’ stop-to-stop ride-time (SRT) with the field observations.

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