The restricted stochastic user equilibrium with threshold model: Large-scale application and parameter testing

This paper presents the application and calibration of the recently proposed Restricted Stochastic User Equilibrium with Threshold model (RSUET) to a large-scale case-study. The RSUET model avoids the limitations of the well-known Stochastic User Equilibrium model (SUE) and the Deterministic User Equilibrium model (DUE), by combining the strengths of the Boundedly Rational User Equilibrium model and the Restricted Stochastic User Equilibrium model (RSUE). Thereby, the RSUET model reaches an equilibrated solution in which the flow is distributed according to Random Utility Theory among a consistently equilibrated set of paths which all are within a threshold relative to the cost on the cheapest path and which do not leave any attractive paths unused. Several variants of a generic RSUET solution algorithm are tested and calibrated on a large-scale case network with 18,708 arcs and about 20 million OD-pairs, and comparisons are performed with respect to a previously proposed RSUE model as well as an existing link-based mixed Multinomial Probit (MNP) SUE model. The results show that the RSUET has very attractive computation times for large-scale applications and demonstrate that the threshold addition to the RSUE model improves the behavioural realism, especially for high congestion cases. Also, fast and well-behaved convergence to equilibrated solutions among non-universal choice sets is observed across different congestion levels, choice model scale parameters, and algorithm step sizes. Clearly, the results highlight that the RSUET outperforms the MNP SUE in terms of convergence, calculation time and behavioural realism. The choice set composition is validated by using 16,618 observed route choices collected by GPS devices in the same network and observing their reproduction within the equilibrated choice sets generated by the RSUET model. Relevantly, the RSUET model is very successful in reproducing observed link.

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