Calibration of Agent Based Transport Simulations with Multi-Fidelity Bayesian Optimization

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Abstract

MATsim is a flexible agent based transport simulator. Its flexibility derives from the high number of parameters that control the behavior of its simulations. For these simulations to be representative of what is observed in reality, these parameters require to be calibrated by hand. This process can be tedious and time consuming. In this work, we propose an automatic calibration procedure for MATsim based on batch multi-fidelity Bayesian optimization (MF-BO). We cast the calibration problem as an optimization problem, where we minimize the mismatch of aggregate measures of traffic events, such as travel time distribution, between the output of MATsim and real world observations. This optimization problem is non-convex and does not have an analytical form. Furthermore, the evaluation of its objective function is computationally expensive. Bayesian Optimization is a black-box, sample efficient, global optimization algorithm that is well suited for this kind of problems. Moreover, it can be adapted to parallel evaluations and it naturally accommodates different levels of approximation of the objective function, which can easily be obtained from MATsim and can speed up the optimization. We demonstrate the effectiveness of MF-BO for the calibration of MAStim on both small (Sioux Falls) and large scale (Zurich) scenarios.