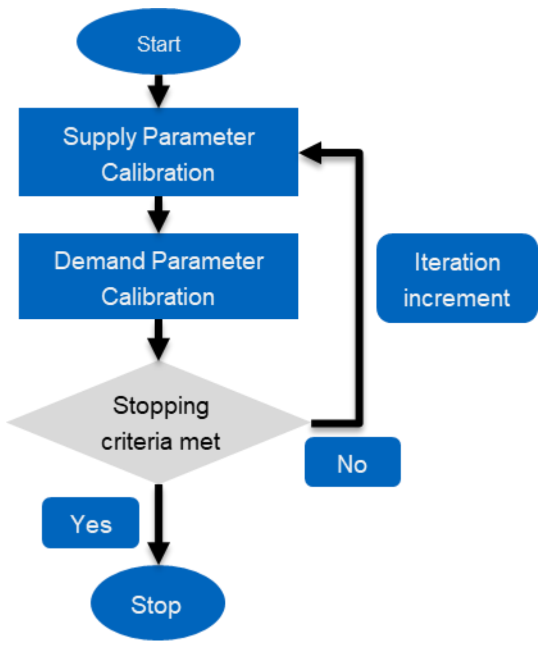
Demand Generation and Calibration for Microscopic Traffic Simulation using OD Matrices

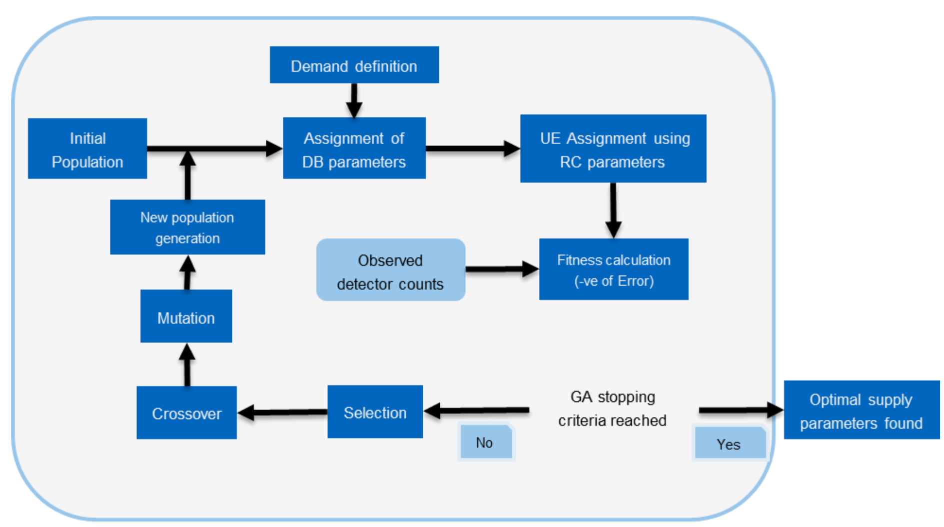
Master's Thesis of Md. Manjurur Rahman

Mentoring:
Dr.-Ing. Lisa Kessler
M.Sc. Natalie Sautter



Traffic simulation models play a crucial role in transportation planning and decision-making. However, a simulation model, in its default state, will often produce outputs that vary from the observed data. This error in the simulation output may often be attributed to the imprecise definition of the traffic demand scenario used for the simulation or the unrealistic assumptions made in forms of simulation parameters to simplify parts of the complex simulation model. In this master thesis, an extensive literature review has been conducted to discover the different calibration approaches presented in the recent years that attempted at reducing the error in simulation output by either calibrating the demand definition or the simulation parameters or jointly calibrating both. The literature review also focussed on the different ways the simulation error was represented in the calibration approaches. At the end, a sequential joined demand-supply approach has been proposed that reduces the combined simulation error.

On the supply side of the calibration framework, a metaheuristic evolutionary optimization algorithm i.e., Genetic Algorithm has been used to calibrate the traffic dynamic parameters (driver behaviour and route choice parameters) of the simulation model. GA is quite capable in solving nonlinear and stochastic optimization problems and has been proven to be quite effective in past methodologies of traffic model calibration (Ma & Abdulhai, 2002), (Kim & Rilett, 2007). One of the advantages of GA is the possibility to distribute its computational workload into multiple processors, thus significantly reducing the calibration time. The simulation model is generated on microscopic level, which can be achieved by employing a microscopic traffic simulator (e.g., SUMO. VISSIM, AIMSUN etc.).



The OD matrix estimation framework is based on the Information minimization model developed by Van Zuylen and Willumsen (1980). Further improvements and enhancements on the IM model done by Wang (2008), Wang and Friedrich (2009), and Pohlmann (2011) are also implemented in the OD estimation approach.