Abstract

With improvements in computing power and the widespread use of sensor technology, highly accurate and high frequency traffic flow data is now readily available. Traffic flow data can be modeled for various applications, but handling these data requires large-scale storage and high-speed computing power. Therefore, this dissertation focuses on *Mesoscopic Modeling* for large-scale traffic flow data to efficiently obtain useful information. A mesoscopic model in traffic flow is a network model in which continuous values are discretized by replacing the main points in the traffic flow as nodes and the movement information with statistical values. Furthermore, when combined with space partition and trajectory clustering, the data can be abstracted to a level that does not miss important traffic flow information while significantly reducing the data size.

Since the modeling process requires time and effort, this method applies process mining techniques to streamline the process of creating mesoscopic models. Process mining is a technique for analyzing event logs output by a system to discover, verify, and improve process models. Applied to modeling, it enables event sequence analysis, state transition analysis, feature extraction of traffic flow, filtering of unnecessary data, and extraction of statistical information, thereby significantly reducing the modeling effort. Furthermore, process mining can be used for conformance checks to ensure that the model is operating correctly according to the design.

The mesoscopic model constructed by this method enables high-speed simulations because the amount of data is greatly reduced while retaining important information. Therefore, the mesoscopic model is very useful and beneficial in the planning phase of traffic measures, when the current traffic flow is to be grasped quickly, or when a large number of simulations with finely varied conditions are to be performed.

***Keywords*:** Traffic flow simulation, Mesoscopic model, Object Petri nets, Process Mining, Trajectory clustering