Determining the Most Harmful Roads in Search for System Optimal Routing

Abstract:
Recent advances in Intelligent Transportation Systems (ITS), navigation tools and personal smart devices can be used to relieve congestion and thus improve traffic performance. Transportation networks, however, are seen as complex networks and therefore present a control challenge. In this paper we demonstrate that using an information dissemination technique and providing minimal but the right context to the population can steer the system into a more efficient operational state. As every commuter chooses the most optimal route from his/her own perspective, traffic distribution on the road network becomes heterogeneous, resulting in a small number of roads, which are largely overpopulated, while others remain underutilized [1]. In order to achieve a more homogeneous road utilization and thus reduce congestion levels, we propose a simple routing control strategy of informing drivers to avoid certain roads, which are chosen based on simulated outcomes of their closing. We demonstrate that the full removal of certain road segments from the network can redistribute traffic in a socially beneficial way, leading to an increase in transit performance on a city level. By considering a real road network and realistic traffic patterns we are able to validate our approach on a city scale. We identify the most harmful roads and quantify their negative effect on the system. Furthermore, since completely removing roads can be considered a rather extreme measure, we introduce the concept of soft closing. Instead of informing the whole population to avoid a certain road, we inform only a portion of the drivers, further improving the network utilization. We use the city of Singapore as a case study for our traffic assignment model which we calibrate and validate using both survey
and GPS tracking devices data. By identifying and soft closing one road segment from the entire Singaporean road network (240,000 segments) we can reduce the average travel time of all 300,000 daily commuters by 6%, equating to 8,000 saved man hours.

Stichworte:
soft closing of roads, information control, complex systems, transportation, optimal routing

Jahr:
2016

Occurences:
· Einrichtungen > Fakultäten > Fakultät für Informatik > Technische Berichte > 2016

Entries: