Multimodal Route Selection via Carbon Emission Measures

Shally Jain
Freie Universität Berlin

People use public transport every day but are often unaware of how much their journey contributes to the overall carbon footprint and indirectly to greenhouse gas emissions and towards climate change. In this paper, we evaluate multi-modal public transport options by using their carbon emissions and, thus, enrich the user experience when they are selecting a route between an origin and a destination. The multi-modal public transportation modeling is more complex than mono-modal public transportation because there are multiple modes, each with varying schedules and speeds, which often also depend on uncertainty factors such as overall traffic congestion and passenger occupancy. Within this challenging modeling, we propose to use the carbon emissions of travel options in the design of algorithms for selecting the best route option. As the public transportation network can contain many locations, we choose genetic programming as a method for achieving this task. In our paper, we implement two natural genetic algorithms that select routes with a minimum carbon footprint. Firstly, we investigate an algorithm that initially minimizes the travel time and then, among those routes, minimizes carbon footprint. Secondly, we investigate an algorithm that initially minimizes the carbon footprint and then, among those routes, minimizes travel time. Finally, we evaluate and compare the performance of these algorithms. Our initial results suggest that minimizing carbon footprint results in a longer travel time and minimizing travel time results in a longer carbon footprint. The algorithms are scalable on networks with up to 1000 locations (e.g. Smart City Mobility Bamberg). In the future, we will try to scale them to even more locations.