How to Estimate, Take Into Account, and Improve Travel Time Reliability in Transportation Networks

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Abstract

Many urban areas suffer from traffic congestion. Intuitively, it may seem that a road expansion (e.g., the opening of a new road) should always improve the traffic conditions. However, in reality, a new road can actually worsen traffic congestion. It is therefore extremely important that before we start a road expansion project, we first predict the effect of this project on traffic congestion.

Traditional approach to this prediction is based on the assumption that for any time of the day, we know the exact amount of traffic that needs to go from each *o*rigin city zone A to every other *d*estination city zone B (these values form an *OD-matrix*), and that we know the exact capacity of each road segment. Under this assumption, known efficient algorithms produce the equilibrium traffic flows; see, e.g., [3].

In reality, the road capacity may unpredictably change due to weather conditions, accidents, etc. Drivers take this uncertainty into account when planning their trips: e.g., if a driver does not want to be late, he or she may follow a slower route but with a guaranteed arrival time instead of a (on average) faster but unpredictable one. We must therefore take this uncertainty into account in traffic simulations. In addition, the predictions of the future OD-matrix come with (interval) uncertainty. We thus need to make sure that the designed project is good not only under the nominal OD values, but under all possible OD values as well. In this talk, we describe algorithms that take this uncertainty into account [1].

It turns out that the convergence of the corresponding fixed point iterations cannot be proven by using the traditional convergence results, we need to use advanced techniques which come from the logical analysis of the traditional convergence proofs [2].
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References

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