Algorithms for Public Transport Networks

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Summary: develop new algorithms for very fast journey computation in public transport networks.

Context: With the development of assisted navigation in cars, efficient algorithmic techniques were recently invented to enable very fast shortest path computation in road networks such as Contraction Hierarchies [1] and Hub Labeling [2]. The latter technique is the fastest known and can answer distance queries on continental scale in few microseconds. It consists in selecting a set of hubs for each node in the network (possibly different hub sets for each one) with the following covering property: any source and destination have a common hub on a shortest path from one to another. Surprisingly, it appears that very small hub sets (in the order of one hundred nodes per hub set) can be computed in road networks and to some extent in public transport networks [3, 4]. However, the situation is more complex in public transport networks especially when considering multiple criteria (e.g. considering time of arrival and walking distance) and several modes of transportation (e.g. combining bicycle with bus) or when integrating real time information.

Long term goal: enhance algorithmic techniques for journey computation in public transport networks and more generally multimodal networks combining several modes of transportation.

Short term goal: tackle public transport with unlimited walk. Existing public transport algorithms only consider very short transfers (in terms of walking time). With unlimited walk [5], query time grows above 1s. Alleviating this limitation while maintaining fast queries is a real challenge.

Progress on that side would be an algorithmic breakthrough for multimodal transportation.

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Contact: Laurent Viennot
IRIF, Btiment Sophie Germain, Universit Paris Diderot
8 place Aurlie Nemours, Paris 13me.
Laurent.Viennot@inria.fr

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