



Borsa di studio attivata ai sensi di quanto disposto dal D.M. n. 1061 del 10/08/2021

Titolo del progetto: Estimation of Dynamic OD matrix through automatic differentiation and Jacobian free algorithms

La borsa sarà attivata sul seguente corso di dottorato accreditato per il XXXVII ciclo:

INFRASTRUTTURE E TRASPORTI

Responsabile scientifico: Guido Gentile

Area per la quale si presenta la richiesta: GREEN

Numero di mensilità da svolgere in azienda: 12

Numero di mensilità da svolgere all'estero: 6 presso Technical University of Denmark - DTU

Azienda: Moving Projects srl

Il Dipartimento è disponibile a cofinanziare per un importo pari a euro: 10000

Dipartimento finanziatore: DIPARTIMENTO DI INGEGNERIA CIVILE, EDILE E AMBIENTALE con delibera del 22.09.2021

Progetto di ricerca:

The availability of historical vehicle trajectories and speed measures with extensive time and space coverage deriving from Floating Car Data is continuously increasing. These data can be beneficial to identify hypercritical conditions on road networks influencing demand and link flow patterns. The aim of this research is to directly use them within the Dynamic Origin-Destination Matrix Estimation problem as an additional source of information, and even build model-free DODE methods. This research proposes then a methodology to estimate dynamic OD demand matrices using multiple data sources to guarantee reliability and computational efficiency in large-scale congested networks using an innovative method to describe the relationship between demand flows and traffic measurements. It shows how information about congestion, either obtained from the underlying Dynamic Traffic Assignment method or directly measured, can be used within the DODE problem as a data source added to link flows. A critical construct is an assignment matrix that maps the OD demand flows to the traffic observations. The method proposed in this research is based on the analytical derivation to build the linear approximation of the assignment matrix, which relaxes the assumption of constant assignment proportions and explicitly accounts for congestion effects. An analytical extension of the DODE problem to directly exploit link speed measures, providing an analytical derivation of the relationship between demand flows and link speeds in the context of the dynamic assignment. Numerical tests will be presented on a simple as well as on real network to show the effects of the new linearization approach on DODE quality. The key innovation will be the usage of derivative free optimization algorithms that avoid the computation of Jacobians whose dimensions are extremely large. This will be done with two novel methods: one uses automatic differentiation, the other one uses a novel numerical approach.

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