ERC Scale-FreeBack Seminar program

Ioannis Paschalidis, September 4th 2017 (Gipsa Lab DAUTO)

11h00 – 12h00 Ioannis Paschalidis talk “Inverse Equilibrium Problems and Price-of-Anarchy Estimation in Transportation Networks” – Salle des Séminaires B208, DAUTO

Abstract: Equilibrium modeling is common in a variety of fields such as game theory, transportation science, and systems biology. The inputs for these models, however, are often difficult to estimate, while their outputs, i.e., the equilibria they are meant to describe, are often directly observable. By combining ideas from inverse optimization with the theory of variational inequalities, we develop an efficient, data-driven technique for estimating the parameters of these models from observed equilibria. A distinguishing feature of our approach is that it supports both parametric and nonparametric estimation by leveraging ideas from statistical learning.
We apply this general framework to transportation networks. Using real traffic data from the Boston area, we estimate origin-destination flow demand matrices and the per-road cost (congestion) functions drivers implicitly use for route selection. Given this information, one can formulate and solve a system-optimum problem to identify socially optimal flows for the transportation network. The ratio of total latency under a user-optimal policy versus a system-optimal policy is the so-called Price-of-Anarchy (POA), quantifying the efficiency loss of selfish actions compared to socially optimal ones. We find that POA can be quite substantial, sometimes exceeding 2, suggesting that there is scope for control actions to steer the equilibrium to a socially optimal one. We will discuss what some of these actions may be and how to prioritize interventions.

Ioannis Paschalidis is a Professor of Electrical and Computer Engineering, Systems Engineering, and Biomedical Engineering at Boston University. He is the Director of the Center for Information and Systems Engineering (CISE). He obtained a Diploma (1991) from the National Technical University of Athens, Greece, and an M.S. (1993) and a Ph.D. (1996) from the Massachusetts Institute of Technology (MIT), all in Electrical Engineering and Computer Science. He has been at Boston University since 1996. His current research interests lie in the fields of systems and control, networks, optimization, operations research, computational biology, and medical informatics.

Prof. Paschalidis' work has been recognized with a CAREER award (2000) from the National Science Foundation, the second prize in the 1997 George E. Nicholson paper competition by INFORMS, the best student paper award at the 9th Intl. Symposium of Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt 2011) won by one of his Ph.D. students for a joint paper, an IBM/IEEE Smarter Planet Challenge Award, and a finalist best paper award at the IEEE International Conference on Robotics and Automation (ICRA). His work on protein docking (with his collaborators) has been recognized for best performance in modeling selected protein-protein complexes against 64 other predictor groups (2009 Protein Interaction Evaluation Meeting). His recent work on health informatics won an IEEE Computer Society Crowd Sourcing Prize. He was an invited

Scale-FreeBack has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement N° 694209).

participant at the 2002 Frontiers of Engineering Symposium organized by the National Academy of Engineering, and at the 2014 National Academies Keck Futures Initiative (NAFKI) Conference. Prof. Paschalidis is a Fellow of the IEEE and the Editor-in-Chief of the IEEE Transactions on Control of Network Systems.

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