NUTC Academic Seminar Series

Northwestern University Transportation Center presents:

"Dynamic clustering and perimeter control in large-scale urban networks"

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Tech. Room L211

ABSTRACT: Traffic is a strongly time-variant process and it needs to be studied in the spatiotemporal dimension. Investigating the clustering problem over time help us reveal the hidden information during the process of congestion formation and dissolution. The primary motivation of this seminar is to study the spatiotemporal relation of congested links in large networks, observing congestion propagation from a macroscopic perspective, and finally identifying critical congestion regimes to aid the design of peripheral control strategies and improve mobility. This is not a straightforward task as transport networks despite spatial correlations in congestion are in principle heterogeneous due to road hierarchy and spatial distribution of demand. Thus, it is not always possible to treat congestion as a continuum in space. An example is directional flows towards a city center in the morning peak. The dynamic clustering framework will be capable of replicating how clusters expand or shrink in the process of congestion formation and dissolution. Moreover, it will be able to find new pockets of congestion and merge clusters with similar traffic conditions. In this framework, we will be able to chase where congestion originates and how traffic management systems affect its formation and the time it finishes. To achieve these goals, first we formulate the problem of partitioning networks to a desired number of regions as mixed integer linear optimization. Connectivity of clusters is explicitly enforced by imposing some constraints and the homogeneity of clusters is maximized in the objective function. In the 2nd part of the presentation, different perimeter control strategies are developed based on principles of control theory. The validation of the clustering methodologies and the perimeter control schemes are conducted in various and complex city structures scenarios using data from field experiments and micro-simulations.

Bio: Prof. Nikolas Geroliminis is an Associate Professor at EPFL and the head of the Urban Transport Systems Laboratory (LUTS). Before joining EPFL he was an Assistant Professor on the faculty of the Department of Civil Engineering at the University of Minnesota. He has a diploma in Civil Engineering from the National Technical University of Athens (NTUA) and an MSc and Ph.D. in civil engineering from University of California, Berkeley. He also serves as an Associate Editor in Transportation Research part C, Transportation Science and IEEE Transactions on ITS and in the editorial board of Transportation Research, part B, and of many international conferences. His research interests focus primarily on urban transportation systems, traffic flow theory and control, on-demand transport and shared mobility, Optimization and Large Scale Networks. He is a recipient of the ERC Starting Grant "METAFERW: Modeling and controlling traffic congestion and propagation in large-scale urban multimodal networks"