

Dagstuhl Seminar

Dynamic Traffic Models in Transportation Science July 7-12

Monday, July 8

9.00 – 10.00	Introduction Talks (1- minute talks)
10.00 – 10.30	Coffee break
10.30 – 11.45	<p>Review Talk – Hong K. Lo</p> <p>Titel: Dynamic Traffic Assignment: An Incomplete Review</p> <p>Abstract: Traffic Assignment, which predicts the traffic loading on a transportation network, is central to transportation planning and operations. With the advent of real-time information and control, autonomous vehicles, dynamic traffic assignment (DTA) becomes all the more important, for both offline planning and real-time operations. I started my career working on DTA and the related topic dynamic traffic control in the 90's, and then on and off I continued for the last few decades. When I felt the problem got too hard and I could not contribute, I stopped. However, when I read new studies or new approaches to tackle the problem, I felt revived and continued. Hence, this review represents my personal DTA journey, which is incomplete and perhaps biased. It covers travel choice principles expressed as Variational Inequality Problem (VIP), Non-linear Complementarity Problem (NCP), mathematical programming, dynamical systems, touches upon deterministic and stochastic dynamics, attraction domains, stability issues, and equilibrium versus non-equilibrium approaches. As for traffic modeling, this review mainly contrasts static and dynamic traffic models, point-queue versus spatial-queue approaches, and their implications on the modeling results. This review ends with a discussion of how to extend DTA for bi-level large-scale applications via machine learning techniques, our ongoing work.</p>
12.00 – 13.00	Lunch
13.00 – 15.45	Break
15.45 – 17.00	<p>Review Talk – Chiwei Yan</p> <p>Titel: Ride-hailing / Ridesharing Operations</p> <p>Abstract: In this review talk, I will explore the primary operational challenges faced by ride-hailing and ridesharing platforms, with a bias toward pricing strategies. I will begin by examining ride-hailing services for solo rides and walk through the fundamentals of a simple surge pricing model. Despite being practiced for over a decade, a universally accepted surge pricing algorithm has yet to emerge in either academic literature or practical application. I will talk about a strawman proposal and initiate a discussion on what the future directions could be. Next, I will discuss my recent work on pricing shared</p>

	rides, allowing multiple riders into the same vehicle. A new challenge arises in this context where the cost of a ride is uncertain beforehand. Contrary to the popular upfront pricing strategies, I argue that platforms should implement a two-tiered pricing policy where prices depend on matching outcomes, demonstrating that this approach results in a win-win-win situation for riders, platforms, and the environment. If time permits, I will conclude with a brief discussion on complementary work involving strategic agents.
17.00 – 18.00	Open Problem Session
18.00	Dinner

Tuesday, July 9

9.00 – 10.15	<p>Review Talk – Neil Olver</p> <p>Titel: Combinatorial explorations in the Vickrey bottleneck model</p> <p>Abstract: The Vickrey bottleneck model is a simple, yet relevant, model of congestion in dynamic traffic networks. I will survey our current theoretical understanding of the behaviour of equilibria in traffic networks under this model. A focus will be on the very combinatorial structure of the model, and how this gives insight into some of its fundamental properties.</p> <p>Beyond the most basic setting, there are many orthogonal directions in which the model can be modified or extended to capture more aspects of real-world traffic. I will discuss some interesting questions that arise amongst the many possible combinations of these variations, with an emphasis on those motivated by the perspective of transportation economics.</p>
10.15 – 10.45	Coffee break
10.45 – 12.00	<p>Contributed talks</p> <ul style="list-style-type: none"> • Katharina Eickhoff <i>Some open problems in freight train scheduling</i> • Andres Fielbaum <i>Optimising public transport networks that integrate on-demand mobility</i> • Gunnar Flötteröd <i>Strategic freight transport models with both cooperative and competitive behavior</i>
12.00 – 13.00	Lunch
13.00 – 15.30	Break
15.30 – 16.00	Continuation of Neil's talk
16.15 – 17.30	<p>Review Talk – Terry L. Friesz</p> <p>Titel: <i>The History and Likely Future of Dynamic User Equilibrium</i></p> <p>Abstract: In this presentation we review what has been learned about fixed and elastic demand user equilibrium in a dynamic setting over the last decade. We also discuss the challenges posed by extensions to consider mixed autonomous vehicle (AV) and human-driven vehicle (HDV) flow. We make conjectures about algorithmic innovations and the role of digital twins.</p>
17.30 – 18.00	Open Problem Session and Discussion
18.00	Dinner

Wednesday, July 10

9.00 – 10.15	Contributed talks <ul style="list-style-type: none">• Theresa Ziemke <i>Oscillating long-term behavior of user equilibria in dynamic traffic models with spillback</i>• Gaurav Malik <i>A Game-theoretical Model of Road Pricing with Endogenized Multi-modal User-equilibrium</i>• Martin Strehler/ Daniel Schmand <i>On the Price of Anarchy in Packet Routing Games with FIFO</i>
10.15 – 10.45	Coffee break
10.45 – 12.00	Contributed talks <ul style="list-style-type: none">• Lukas Graf <i>A Decomposition Theorem for Dynamic Flows</i>• Tobias Harks <i>Tolls for Dynamic Equilibrium Flows</i>• Ravi Seshadri <i>Congestion tolling: dollars vs tokens</i>
12.00 – 13.00	Lunch
13.00 – 17.30	Social Event Hike
18.00	Dinner on the hike at <i>Zum Schloßberg</i>

Thursday, July 11

9.00 – 10.15	Contributed talks <ul style="list-style-type: none">• Takamasa Iryo <i>Establishing cooperation in an evolutionary environment: towards an efficient sharing of transport resources in communities</i>• Song Gao <i>A Recursive Logit Model for Vacant Ride-Sourcing Vehicle Routing Behavior</i>• Koki Satsukawa <i>Game-theoretic analysis of user behaviour in reserving transport services</i>
10.15 – 10.45	Coffee break
10.45 – 12.00	Contributed talks <ul style="list-style-type: none">• Marc Schröder <i>Tolls for Nash Flows over Time</i>• Roberto Cominetti /Nico Stier-Moses /Marco Scarsini /Marc Schröder <i>Convergence of Large Atomic Congestion Games</i>• Roberto Cominetti /Nico Stier-Moses /Marco Scarsini /Marc Schröder <i>Ordinary and prophet planning under uncertainty in Bernoulli congestion games</i>
12.00 – 13.00	Lunch
13.00 – 13.10	Group Photo
13.10 – 16.00	Break
16.00 – 16.50	Contributed talks <ul style="list-style-type: none">• Svenja Griesbach <i>Optimizing Throughput and Makespan of Queuing Systems by Information Design</i>• Max Klimm <i>Information Design for Congestion Games with Unknown Demand</i>
17.00 – 18.00	Open Problem Session and Discussion
18.00	Dinner

Friday, July 12

9.00 – 10.15	Contributed talks <ul style="list-style-type: none">• Jannik Matuschke <i>Controlling and Identifying Solutions in Combinatorial Optimization</i>• Saif Jabari <i>On cyberattacks in traffic</i>
10.15 – 10.45	Coffee break
10.45 – 11.45	Final Discussion
12.00 – 13.00	Lunch and Departure