Monika Filipovska

Ph.D. Candidate

Northwestern University Transportation Center
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EDUCATION

Northwestern University, Evanston IL

Ph.D. Candidate in Civil and Environmental Engineering — Expected 2021
Transportation Systems Analysis and Planning
Dissertation: *Travel Time Reliability in Stochastic Dynamic Networks: Modeling, Path Finding and Routing*
Dissertation Advisor: Hani S. Mahmassani
Committee: David Morton, Marco Nie (Northwestern University), Jiwon Kim (University of Queensland), Ali Zockaie (Michigan State University)

M.S. in Civil and Environmental Engineering — 2019

New York University Abu Dhabi, Abu Dhabi, UAE

B.S. in Engineering (Urban Systems), Mathematics — 2017
Thesis: *A Gauss-Markov random field approach for microscopic traffic estimation*
Thesis Advisor: Saif E. Jabari

RESEARCH INTERESTS

Dynamic Stochastic Transportation Network Modeling and Optimization
Applications of Emerging Vehicle and Infrastructure Technologies
Traffic Flow Modeling and Simulation
Predictive Analytics for Real-Time Traffic Operations: Intelligent Transportation Systems
Big Data, Machine Learning and Artificial Intelligence: Applications for Traffic Management

PUBLICATIONS

Peer-Reviewed Journal Articles

J1 **Filipovska**, M. and Mahmassani, H. S. (2020) 'Traffic Flow Breakdown Prediction using Machine Learning Approaches', *Transportation Research Record*.

J2 **Filipovska**, M., Mahmassani, H. S. and Mittal, A. (2019) 'Prediction and Mitigation of Flow Breakdown Occurrence for Weather Affected Networks: Case Study of Chicago, Illinois', *Transportation Research Record*, 2673(11), pp. 628–639.

J3 **Filipovska**, M., Mahmassani, H. S. and Mittal, A. 'Estimation of Path Travel Time Distributions in Stochastic Time-Varying Networks with Correlations', *Transportation Research Record*. (*accepted*)

J4* **Filipovska**, M. and Mahmassani, H. S. 'Reliable Trajectory-Adaptive Routing Strategies in Stochastic, Time-Varying Networks with Generalized Correlations', *Transportation Research Part C: Emerging Technologies* (under 1st revision)

J5** **Filipovska**, M. and Mahmassani, H. S. 'Characterization and Modeling of Stochastic Dynamic Transportation Networks with Spatio-Temporal Dependencies', *Transportation Science.* (under 1st review)

Manuscripts in Preparation

M1 **Filipovska**, M. and Mahmassani, H. S. 'Modeling and Estimation of Path Travel Time Distributions in Stochastic Dynamic Networks with Spatio-Temporal Dependencies', *Transportation Research Part B: Methodological* (forthcoming submission)

M2 **Filipovska**, M. and Mahmassani, H. S. 'Information-Adaptive Routing Problems in Stochastic Dynamic Networks with Spatio-Temporal Dependencies', *European Journal of Operations Research* (forthcoming submission)

M3 Di, X., Mahmassani, H. S., **Filipovska**, M., Lava, J. A., Smith, S., Fan, Y., Genc, S., Bose, P., Kueh, D., and Qin, Z. (order of authors to be confirmed) 'The Promise of Machine Learning in Transportation Science: Old and New, Opportunities and Challenges', *Preprint to be submitted to Elsevier* (forthcoming submission)

Peer-Reviewed Technical Reports

T1 Mahmassani, H. S. and **Filipovska**, M. (2020) Estimation of Travel Time Distributions Along User-Defined Travel Paths: Application Guide. U.S. Department of Transportation, Federal Highway Administration. FHWA-HOP-20-### (under revision)

T2 Mahmassani, H. S. and **Filipovska**, M. (2020) Estimation of Travel Time Distributions Along User-Defined Travel Paths: GIS Platform User Guide. U.S. Department of Transportation, Federal Highway Administration. FHWA-HOP-20-067

Peer-Reviewed Conference Contributions and Proceedings

P1 **Filipovska**, M., Mahmassani, H. S. A Priori and Adaptive Reliable Routing in Stochastic Dynamic Networks with Correlations. International Symposium on Transportation Data and Modeling (ISTDM 2021) (accepted 2020, postponed to 2021 due to COVID-19).

P2 **Filipovska**, M., Mahmassani, H. S. and Mittal, A. (2021) 'Estimation of Path Travel Time Distributions in Stochastic Time-Varying Networks with Correlations', The 100th Annual Meeting of the Transportation Research Board, Washington, DC.

P3 **Filipovska**, M., Mahmassani, H. S. Computation and Estimation of Path Travel Time Variability with Sparse Vehicle Trajectory Data. International Symposium on Transportation Data and Modeling (ISTDM 2021)

P4 **Filipovska**, M., Mahmassani, H. S. (2020). Reliable Least-Time Path Estimation and Computation in Stochastic Time-Varying Vetworks with Spatio-Temporal Depencencies. 2020 23rd International Conference on Intelligent Transportation Systems (ITSC). (virtual)

P5 **Filipovska**, M. and Mahmassani, H. S. (2020). Traffic Flow Breakdown Prediction using Machine Learning Approaches. The 99th Annual Meeting of the Transportation Research Board, Washington, DC.

P6 **Filipovska**, M., Mahmassani, H. S. (2020). Reliable Least-Time Path Estimation and Computation in Stochastic Time-Varying Vetworks with Spatio-Temporal Depencencies. The 99th Annual Meeting of the Transportation Research Board, Washington, DC.

P7 **Filipovska**, M., Mahmassani, H. S., & Mittal, A. (2019). Prediction and Mitigation of Flow Breakdown Occurrence for Weather Affected Networks: Case Study of Chicago, Illinois. The 98th Annual Meeting of the Transportation Research Board, Washington, DC.

P8 Jabari, S. E., Zheng, F., Liu, H., & **Filipovska**, M. (2018). Stochastic Lagrangian modeling of traffic dynamics. The 97th Annual Meeting of the Transportation Research Board, Washington, DC (No. 18-04170).

Other Conference Contributions, Presentations, Invited Talks

O1 **Filipovska**, M., Mahmassani, H. S., Du, L., (2021). Next Generation Transportation Networks: Emerging Technologies, Data Analytics, and Perspectives. *Proposed Workshop*, 2021 24th International Conference on Intelligent Transportation Systems (ITSC). (under review)

O2 **Filipovska**, M., Mahmassani, H. S. (2020). Performance Assessment of Machine Learning Methods for Traffic Flow Breakdown Prediction. *Invited Talk*, Machine Learning in Science and Engineering Virtual Conference: Transportation Track, Data Science Institute, Columbia University

O3 **Filipovska**, M. (2020). Travel Time Reliability Modeling and Optimization in Stochastic Dynamic Networks. Seminar, Mathematical Challenges and Opportunities for Autonomous Vehicles Program, Institute for Pure and Applied Mathematics, University of California, Los Angeles (UCLA) (virtual due to COVID-19)

O4 **Filipovska**, M., Mahmassani, H. S. (2019). Leveraging Connected and Autonomous Vehicles for Flow Breakdown Prediction and Mitigation. Workshop on Autonomous Vehicles, Institute for Pure and Applied Mathematics, University of California, Los Angeles (UCLA)

RESEARCH EXPERIENCE

Travel Time Reliability in Stochastic Dynamic Networks: Modeling, Path Finding and Routing, Northwestern University Transportation Center — Jun. 2020 - Present

Dissertation Research

Methods for characterization of stochastic dynamic networks, developing approaches for modeling path travel time distributions with spatio-temporal dependencies, algorithms, and heuristics for a priori and adaptive path finding under uncertainty, routing guidance for improved travel time reliability

Estimation of Travel Time Distributions Along User-Defined Travel Paths, U.S. Department of Transportation, Federal Highway Association — 2018 – 20

Lead Graduate Student Researcher

Developing methods and models for the estimation of travel time distributions in large-scale urban networks using numerical integration, simulation, and data-driven methods.

Implementation of Analysis, Modeling and Simulation Tools for Road Weather Connected Vehicle Applications, U.S. Department of Transportation, Federal Highway Association — 2019

Graduate Student Researcher

Application of analysis, simulation and modeling tools for traffic and demand management strategies, mobility applications, weather-related maintenance strategies using connected vehicle data.

Integrated Modeling for Road Condition Prediction, U.S. Department of Transportation, Federal Highway Association — 2018 – 19

Graduate Student Researcher

Developed and tested models for traffic speed estimation and prediction using time-series analysis approaches.

Traffic State Estimation for Real-time Traffic Analysis, New York University Abu Dhabi — 2017

Postgraduate Research Assistant

AWARDS & HONORS

ILITE Graduate Scholarship Award, Institute of Transportation Engineers (ITE) - Illinois Section — 2020

ITSC Best Presentation Award, *Third prize*, 23rd IEEE Intelligent Transportation Systems Conference (ITSC) — 2020

CIRTL Scholar Certificate, Center for Integration of Research, Teaching and Learning (CIRTL) Network — 2020

Fellow and Core Participant, Mathematical Challenges and Opportunities for Autonomous Vehicles, Institute for Pure and Applied Mathematics, University of California, Los Angeles (UCLA) (remote due to COVID-19) — 2020

CIRTL Associate Certificate, Center for Integration of Research, Teaching and Learning (CIRTL) Network — 2019

Walter P. Murphy Fellow, McCormick School of Engineering, Northwestern University — 2017-18

TEACHING AND ADVISING EXPERIENCE

Co-Teaching

Civil and Environmental Engineering Systems Analysis, Department of Civil and Environmental Engineering, Northwestern University — Spring 2021
Developing and teaching 2 of 3 course modules
Co-Instructor: Pablo Durango-Cohen

Data Analytics for Transportation and Urban Infrastructure Systems, Department of Civil and Environmental Engineering, Northwestern University — Spring 2020
Taught an on-going application-focused module
Co-Instructor: Ying Chen

Teaching Assistantships

Engineering Analysis-3 Systems Dynamics, Department of Mechanical Engineering, Northwestern University — Spring 2018

Calculus I, Courant Institute of Mathematical Sciences, New York University — Spring 2016

Training and Certification

Teaching Certificate Program, Searle Center for Advancing Learning and Teaching, Northwestern University — 2020-21

Searle Teaching-As-Research (STAR), CIRTL at Northwestern — 2020
Project: *Content Relevance and Social Pedagogies: Fostering Student Motivation in a Blended Learning Environment,*
Course Context: Data Analytics for Transportation and Urban Infrastructure Applications

Introduction to Evidence-Based Undergraduate STEM Teaching, Massive Online Open Course, Center for the Integration of Research, Teaching and Learning (CIRTL) Network — 2019

PROFESSIONAL DEVELOPMENT

Mathematical Challenges and Opportunities for Autonomous Vehicles Program, *Fellow and Core Participant*, Institute of Pure and Applied Mathematics, University of California, Los Angeles (UCLA) — 2020-21

Workshop on Autonomous Vehicles, Institute of Pure and Applied Mathematics, University of California, Los Angeles (UCLA) — 2019

SERVICE

Professional Service

Journal Referee:
- Transportation Research Board Annual Meeting / Transportation Research Record
- IEEE Transactions on Intelligent Transportation Systems

Professional Activities

Student Member, IEEE Intelligent Transportation Systems Society (ITSS)
Student Member, Institute for Operations Research and the Management Sciences (INFORMS)
- Member, Transportation Science and Logistics Society (TSL) of INFORMS

Student Member, Institute of Transportation Engineers (ITE)
Member, Institute of Transportation Engineers (ITE) Councils:
- Transportation Systems Management & Operation (TSM&O) Council
- Traffic Engineering Council
- Transportation Education Council

Student Member, Transportation Research Forum (TRF)
Friend, Transportation Research Board (TRB) Standing Committees on:
- Transportation Network Modeling (AEP40)
- Traffic Flow Theory and Characteristics (ACP50)
- Intelligent Transportation Systems (ACP15)
- Statistical Methods (AED60)

Member, Women's Transportation Seminar (WTS)
- WTS International
- WTS Greater Chicago Chapter

Leadership and Institutional Service

Northwestern University Chapter of the American Society of Civil Engineers (NU-ASCE)
Northwestern University Student Chapter of the Institute for Operations Research and the Management Sciences (INFORMS)
Women in Science and Engineering Research (WISER), Northwestern University
Graduate Chapter of the Society of Women Engineers (GradSWE), Northwestern University
Undergraduate Curriculum Committee Student Representative, New York University Abu Dhabi
Engineering Division Student Representative: New York University Abu Dhabi

TECHNICAL SKILLS

Programming and Computing:
- Python, R, MATLAB, Weka in Java, STATA, Gurobi, AMPL, LaTeX

Simulation Software:
- ArcGIS, QGIS, SUMO (Simulation of Urban Mobility), Cube Dynasim, Vissim, DYNASMART-P, DYNASMART-X