

Nikola Marković, Ph.D.

✉ nikola.markovic@utah.edu [in](#) Profile
🌐 <https://transanalytics.civil.utah.edu/>

Employment History

- 2018 – ···· **Assistant Professor**, University of Utah, Civil & Environmental Engineering.
- 2015 – 2018 **Faculty Assistant**. University of Maryland, Center for Advanced Transportation Technology (CATT).
- 2013 – 2015 **Postdoctoral Research Associate**. University of Maryland, Civil & Environmental Engineering.

Education

- 2013 **Ph.D. University of Maryland, USA** in Civil & Environmental Engineering.
Thesis title: *Evasive flow capture*.
- 2010 **M.Sc. University of Maryland, USA** in Civil & Environmental Engineering.
Thesis title: *Scheduling under uncertainty for a single-hub intermodal system*.
- 2009 **Dipl.-Ing. University of Belgrade, Serbia** in Traffic & Transportation Engineering.
Thesis title: *A Petri net simulation model of the Batajnica railway station*.

Research Interests

- Operations Research.** I focus on developing and applying operations research models to enhance transportation system efficiency, particularly in facility location, vehicle routing, and resource allocation. My research has earned two major awards: the 2022 TSL Best Paper Award and the 2015 Glover-Klingman Prize. Additionally, my ride-sharing algorithms are used by multiple transportation companies serving seniors and individuals with disabilities, while the Utah Department of Transportation employs route optimization methods developed by my student for their snowplow trucks.
- Data Science.** I am interested in applying machine learning and data visualization techniques to inform decision-making and automate relevant processes. I have worked extensively with millions of GPS trajectories, using them to estimate statewide traffic patterns and network performance. In collaboration with Abbas Rashidi, the students we co-advise developed computer vision systems to automatically collect aircraft operations data at Utah airports, rank roadside safety along rural roads in Utah, and extract traffic queue information along freeway on-ramps in Utah.

Research Publications

Journal Articles Under Review

- 1 S. Chen, M. H. [Rahman](#), N. **Marković**, M. I. Y. Siddiqui, M. Mohebbi, and Y. Sun, “Empowering WMATA’s MetroAccess service with nested decomposition and service type integration,” in *INFORMS Journal on Applied Analytics*, Submitted.
- 2 M. [Farhadmanesh](#), A. Rashidi, A. [Kumar Subedi](#), and N. **Marković**, “A computer vision-based standalone system for automated operational data collection at non-towered airports,” in *IEEE Access*, Submitted.
- 3 M. [Farhadmanesh](#), A. Rashidi, P. Schonfeld, J. Rakas, and N. **Marković**, “Aircraft surface movement and operation monitoring systems in general aviation and commercial airports: A state-of-the-art review,” in *Iranian Journal of Science and Technology*, Submitted.

- 4 A. Mashhadi Hassandokht, A. Rashidi, M. Hamedi, and N. **Marković**, “Hourly traffic volume estimation in construction work zones with a custom regularized model and VAE augmentation,” in *Transportation Research Part C: Emerging Technologies*, Submitted.
- 5 A. Mashhadi Hassandokht, A. Rashidi, J. Medina, and N. **Marković**, “A hybrid framework for predicting crash severity in work zones using knowledge distillation and conditional gans,” in *Journal of Computing in Civil Engineering*, In revision.
- 6 M. H. Rahman, Y. Chen, S. Chen, *et al.*, “Achieving transit accessibility gains through flexible bus routing and advance online reservation for a low-demand route,” in *Transportation Science*, In revision.
- 7 S. Tiwari, A. Rashidi, and N. **Marković**, “Estimation and prediction of queue states at metered ramps: A hybrid approach utilizing computer vision and queuing theory,” in *Journal of Intelligent Transportation Systems*, Submitted.
- 8 J. Wang, W. Xie, I. O. Ryzhov, N. **Marković**, and G. Ou, “D-optimal orienteering for post-earthquake reconnaissance planning,” in *Operations Research*, In revision.

Journal Articles

- 1 S. Chen, M. H. Rahman, N. **Marković**, M. I. Y. Siddiqui, M. Mohebbi, and Y. Sun, “Schedule negotiations with ADA paratransit riders under value of time uncertainty,” *Transportation Research Part B: Methodological*,
- 2 Y. Wang, Y. Chen, I. O. Ryzhov, X. C. Liu, and N. **Marković**, “Resource allocation in an uncertain environment: Application to snowplowing operations in Utah,” *Transportation Science*,
- 3 Y. Wang, A. Cheraghi, G. Ou, and N. **Marković**, “Post-earthquake building damage assessment: A multi-period inspection routing approach for Gaussian process regression,” *Transportation Research Part E: Logistics and Transportation Reviews*,
- 4 A. Cheraghi, Y. Wang, N. **Marković**, and G. Ou, “Efficient post-earthquake reconnaissance planning using adaptive batch-mode active learning,” *Advanced Engineering Informatics*, vol. 60, p. 102 414, 2024.
- 5 M. V. B. Farias, Y. Wang, A. Rashidi, and N. **Marković**, “Optimization of microphone placement for audio-based modeling of construction jobsites,” *KSCE Journal of Civil Engineering*, pp. 1–13, 2024.
- 6 A. Mashhadi Hassandokht, A. Rashidi, and N. **Marković**, “A GAN-augmented CNN approach for automated roadside safety assessment of rural roadways,” *Journal of Computing in Civil Engineering*, vol. 38, no. 2, p. 04 023 043, 2024.
- 7 Y. Wang, Y. Chen, I. O. Ryzhov, X. C. Liu, and N. **Marković**, “Improving snowplowing operations in Utah through optimization and visualization,” *INFORMS Journal on Applied Analytics*, 2024.
- 8 B. Azin, X. T. Yang, N. **Marković**, and C. Xiong, “An incentivized scheme for electric vehicle charging demand management,” *Transportation Research Part C: Emerging Technologies*, vol. 155, p. 104 288, 2023.
- 9 M. Farhadmanesh, N. **Marković**, and A. Rashidi, “Automated video-based air traffic surveillance system for counting general aviation aircraft operations at non-towered airports,” *Transportation Research Record*, vol. 2677, no. 3, pp. 250–273, 2023.
- 10 M. H. Rahman, S. Chen, Y. Sun, M. I. Y. Siddiqui, M. Mohebbi, and N. **Marković**, “Integrating dial-a-ride with transportation network companies for cost efficiency: A Maryland case study,” *Transportation Research Part E: Logistics and Transportation Review*, vol. 175, p. 103 140, 2023.
- 11 Y. Chen, N. **Marković**, I. O. Ryzhov, and P. Schonfeld, “Data-driven robust resource allocation with monotonic cost functions,” *Operations Research*, vol. 70, no. 1, pp. 73–94, 2022.
- 12 M. Farhadmanesh, A. Rashidi, and N. **Marković**, “General aviation aircraft identification at non-towered airports using a two-step computer vision-based approach,” *IEEE Access*, vol. 10, pp. 48 778–48 791, 2022.

- 13 M. Sheibani, Y. Wang, G. Ou, and N. **Marković**, “Efficient structural reconnaissance surveying for regional postseismic damage inference with optimal inspection scheduling,” *Journal of Engineering Mechanics*, vol. 148, no. 2, p. 04 021 156, 2022.
- 14 B. Azin, X. T. Yang, N. **Marković**, and M. Liu, “Infrastructure enabled and electrified automation: Charging facility planning for cleaner smart mobility,” *Transportation Research Part D: Transport and Environment*, vol. 101, p. 103 079, 2021.
- 15 A. Mashhadi Hassandokht, M. Farhadmanesh, A. Rashidi, and N. **Marković**, “Review of methods for estimating construction work zone capacity,” *Transportation Research Record*, vol. 2675, no. 9, pp. 382–397, 2021.
- 16 Z. Vander Laan, M. Franz, and N. **Marković**, “Scalable framework for enhancing raw GPS trajectory data: Application to trip analytics for transportation planning,” *Journal of Big Data Analytics in Transportation*, vol. 3, no. 2, pp. 119–139, 2021.
- 17 S. Dabiri, N. **Marković**, K. Heaslip, and C. K. Reddy, “A deep convolutional neural network based approach for vehicle classification using large-scale GPS trajectory data,” *Transportation Research Part C: Emerging Technologies*, vol. 116, p. 102 644, 2020.
- 18 S. Miller, Z. Vander Laan, and N. **Marković**, “Scaling GPS trajectories to match point traffic counts: A convex programming approach and Utah case study,” *Transportation Research Part E: Logistics and Transportation Review*, vol. 143, p. 102 105, 2020.
- 19 Z. Yi, X. C. Liu, N. **Marković**, and J. Phillips, “Inferencing hourly traffic volume using data-driven machine learning and graph theory,” *Computers, Environment and Urban Systems*, vol. 85, p. 101 548, 2020.
- 20 M. Kim, N. **Marković**, and E. Kim, “A vertical railroad alignment design with construction and operating costs,” *Journal of Transportation Engineering, Part A: Systems*, vol. 145, no. 10, p. 04 019 043, 2019.
- 21 N. **Marković**, M. E. Kim, E. Kim, and S. Milinković, “A threshold policy for dispatching vehicles in demand-responsive transit systems,” *Promet-Traffic&Transportation*, vol. 31, no. 4, pp. 387–395, 2019.
- 22 N. **Marković**, P. Sekula, Z. Vander Laan, G. Andrienko, and N. Andrienko, “Applications of trajectory data from the perspective of a road transportation agency: Literature review and Maryland case study,” *IEEE Transactions on Intelligent Transportation Systems*, pp. 1–12, 2018.
- 23 P. Sekula, N. **Marković**, Z. Vander Laan, and K. F. Sadabadi, “Estimating historical hourly traffic volumes via machine learning and vehicle probe data: A Maryland case study,” *Transportation Research Part C: Emerging Technologies*, vol. 97, pp. 147–158, 2018.
- 24 N. **Marković**, I. O. Ryzhov, and P. Schonfeld, “Evasive flow capture: A multi-period stochastic facility location problem with independent demand,” *European Journal of Operational Research*, vol. 257, no. 2, pp. 687–703, 2017.
- 25 N. **Marković**, M. E. Kim, and P. Schonfeld, “Statistical and machine learning approach for planning dial-a-ride systems,” *Transportation Research Part A: Policy and Practice*, vol. 89, pp. 41–55, 2016.
- 26 N. **Marković**, S. Milinković, K. S. Tikhonov, and P. Schonfeld, “Analyzing passenger train arrival delays with support vector regression,” *Transportation Research Part C: Emerging Technologies*, vol. 56, pp. 251–262, 2015.
- 27 N. **Marković**, R. Nair, P. Schonfeld, E. Miller-Hooks, and M. Mohebbi, “Optimizing dial-a-ride services in Maryland: Benefits of computerized routing and scheduling,” *Transportation Research Part C: Emerging Technologies*, vol. 55, pp. 156–165, 2015.
- 28 N. **Marković**, I. O. Ryzhov, and P. Schonfeld, “Evasive flow capture: Optimal location of weigh-in-motion systems, tollbooths, and security checkpoints,” *Networks*, vol. 65, no. 1, pp. 22–42, 2015.
- 29 N. **Marković**, Ž. Drobnjak, and P. Schonfeld, “Dispatching trucks for drayage operations,” *Transportation Research Part E: Logistics and Transportation Review*, vol. 70, pp. 99–111, 2014.

- 30 N. **Marković**, S. Milinković, P. Schonfeld, and Ž. Drobñjak, "Planning dial-a-ride services: Statistical and meta-modeling approach," *Transportation Research Record: Journal of the Transportation Research Board*, no. 2352, pp. 120–127, 2013.
- 31 N. **Marković** and P. Schonfeld, "Scheduling for a single-terminal intermodal system recovery with Poisson arrivals," *Strojñski vestnik-Journal of Mechanical Engineering*, 2012.
- 32 N. **Marković** and P. Schonfeld, "Scheduling under uncertainty for single-hub intermodal freight system," *Transportation Research Record*, vol. 2238, no. 1, pp. 24–31, 2011.

Conference Proceedings

- 1 A. Mashhadi Hassandokht, A. Rashidi, J. Medina, and N. **Marković**, "Comparing performance of different machine learning methods for predicting severity of construction work zone crashes," in *Computing in Civil Engineering 2023*, 2023, pp. 434–442.
- 2 S. Tiwari, A. Rashidi, and N. **Marković**, "Implementing convolution neural network (CNN) based approach for traffic queue length and delay estimation at highway ramps," in *Computing in Civil Engineering 2023*, 2023, pp. 257–264.
- 3 M. Farhadmanesh, A. Rashidi, and N. **Marković**, "An image processing method for light aircraft tail number detection in general aviation airports," in *Transportation Research Board 92nd Annual Meeting*, 2022.
- 4 M. Farhadmanesh, A. Rashidi, and N. **Marković**, "Implementing haar cascade classifiers for automated rapid detection of light aircraft at local airports," in *Computing in Civil Engineering 2021*, 2021, pp. 17–25.
- 5 A. Mashhadi Hassandokht, M. Farhadmanesh, A. Rashidi, and N. **Marković**, "State-of-the-art methods in estimating freeway work zones capacity: A literature review," in *Transportation Research Board 100th Annual Meeting*, 2021.
- 6 N. **Marković**, R. Nair, P. Schonfeld, E. Miller-Hooks, and M. Mohebbi, "Optimizing dial-a-ride services in Maryland," in *Transportation Research Board 93rd Annual Meeting*, 2014.
- 7 N. Bešinović, N. **Marković**, and P. Schonfeld, "Optimal allocation of truck inspection stations based on *k*-shortest paths," in *Transportation Research Board 92nd Annual Meeting*, 2013.
- 8 J. Perovanović, J. Jaswal, N. **Marković**, and E. Hoffman, "Nuclear envelope laminopathies: Evidence for developmentally inappropriate chromatin-nuclear envelope interactions," in *Epigenetics & Chromatin*, vol. 6, BioMed Central, 2013, P65.
- 9 N. Bešinović, N. **Marković**, and P. Schonfeld, "Location of truck inspection stations based on stochastic flows," in *Transportation Research Board 91st Annual Meeting*, 2012.
- 10 N. **Marković**, N. Bešinović, and P. Schonfeld, "Simulation-based optimization of recovery for multiterminal freight transportation system," in *Transportation Research Board 91st Annual Meeting*, 2012.
- 11 N. **Marković**, Ž. Drobñjak, and P. Schonfeld, "Nonstationary Markov chain framework for optimizing dedicated check-in service," in *Transportation Research Board 91st Annual Meeting*, 2012.

Funding

Federal: \$1,564,000

\$385,000 ■ **Federal Transit Authority:** Paratransit Forward Study, focusing on paratransit, vehicle routing, and optimization. Period: 2022 – 2024. PI: Cathy Liu, Co-PIs: Andy Hong, Nikola Marković.

Funding (continued)

- \$495,000 ■ **National Science Foundation:** Collaborative Research: Resource-constrained optimal learning for post-seismic regional building damage inference, focusing on optimal learning, vehicle routing, and disaster relief. Period: 2021 – 2025. PIs: Nikola Marković & Ilya O. Ryzhov, co-PI: Gaby Ou.
- \$659,000 ■ **National Science Foundation:** HBCU-EiR: Interoperable Transportation Service Roaming System for Transportation Disadvantaged Populations, focusing on dial-a-ride, resource allocation, and autonomous vehicles. Period: 2021 – 2025. PIs: Yanshuo Sun, co-PIs: Celeste Chavis & Nikola Marković.
- \$25,000 ■ **Airport Cooperative Research Program:** Automated Independent Video-based Air Traffic Surveillance System (AIVATS), focusing on computer vision, deep learning, and automation. Period: 2021 – 2022. PI: Abbas Rashidi, co-PI: Nikola Marković.

Non-Federal: \$622,000

- \$60,000 ■ **Utah Department of Transportation:** Enhancing accessibility for individuals with limited mobility: Leveraging AI and cycling data for an inclusive active transportation network, focusing on computer vision and deep learning. Period: 2024 – 2025. PI: Nikola Marković, co-PI: Abbas Rashidi.
- \$102,000 ■ **Utah Department of Transportation:** Measuring the impact of roadside features on road-departure crashes and prioritizing safety improvement projects, focusing on safety, data science, and statistical learning. Period: 2023 – 2024. PI: Nikola Marković, co-PI: Abbas Rashidi.
- \$50,000 ■ **Utah Department of Transportation:** Construction work zone safety: spatio-temporal analysis of construction work zone crashes, focusing on safety, data science, and statistical learning. Period: 2022 – 2023. PI: Nikola Marković, co-PI: Abbas Rashidi.
- \$108,000 ■ **Utah Department of Transportation:** Intelligent queue length estimation on ramps using computer vision and machine learning algorithms, focusing on computer vision, deep learning, and automation. *Period:* 2022 – 2023. PI: Abbas Rashidi, co-PI: Nikola Marković.
- \$25,000 ■ **University of Utah Seed Grant:** Reading aircraft tail numbers at Utah airports, focusing on computer vision, deep learning, and automation. Period: 2021 – 2022. PI: Nikola Marković.
- \$82,000 ■ **Utah Department of Transportation:** Automated safety assessment of rural roadways, focusing on computer vision, deep learning, and automation. Period: 2021 – 2022. PI: Abbas Rashidi, co-PI: Nikola Marković.
- \$90,000 ■ **Utah Department of Transportation:** Development of a snowplow routing software for Utah, focusing on vehicle routing and software development. Period: 2020 – 2021. PI: Nikola Marković, co-PI: Cathy Liu.
- \$63,000 ■ **Utah Department of Transportation:** Automated detection of airplanes at Utah airports, focusing on computer vision, deep learning, and automation. Period: 2020 – 2021. PI: Abbas Rashidi, co-PI: Nikola Marković.
- \$40,000 ■ **National Institute for Transportation and Communities:** Visual exploration of Utah GPS trajectory data, focusing on machine learning, data visualization, and big data (12 GB). Period: 2018 – 2019. PI: Nikola Marković.

Graduate Students Advised

PhD Students

- 2022 ■ **Mohammad Farhadmanesh.** Vision-based modeling of airport operations with multiple aircraft type traffic for activity recognition and identification. Co-advised with Abbas Rashidi.
- 2024 ■ **Yinhu Wang.** Fleet management optimization for infrastructure system recovery. Dissertation defense: https://youtu.be/OHzfUMF0U_Q

Graduate Students Advised (continued)

- 2025 **Ali Mashhadi Hassandokht.** Application of data science in mobility and safety analysis of construction work zones. Expected graduation. Co-advised with Abbas Rashidi.
- 2027 **Md. Hishamur Rahman.** Novel models for improving efficiency of transit systems. Expected graduation.
- 2027 **Madhu Mausam Thapa.** Essays on optimization of transit systems. Expected graduation.

MS Students

- 2023 **Sushant Tiwari.** Computer vision-based system for monitoring traffic states at freeway on-ramps. Co-advised with Abbas Rashidi.
- 2024 **Abhishek Kumar Subedi.** Assessing the impact of roadside safety measures on road departure crashes. Expected graduation. Co-advised with Abbas Rashidi.

Teaching

Graduate courses

- 6530 **Quantitative Methods.** I have designed a graduate-level course integrating operations research, machine learning, and data visualization techniques, covering over 15 network models applied to the Utah state highway network. Students complete weekly assignments involving Matlab and GAMS programming sets. Hybrid modules introduce machine learning applications to transportation data, complemented by Stanford's online Machine Learning course. At the semester's start, students undergo a Coursera's five-week Introduction to Programming with Matlab, ensuring proficiency for subsequent coursework.
- 6945 **Deep Learning Certificate Capstone Project.** I served as one of the four instructors for the University of Utah Deep Learning Certificate Capstone Project. Throughout the capstone project, students tackled various image processing tasks pertinent to transportation, such as utilizing dash-cam footage to identify work zone cones and pavement cracks. Weekly meetings were held to review student progress and address any inquiries.

Undergraduate courses

- 2310 **Probability & Statistics.** I teach a sophomore Probability in Statistics course, where the curriculum is split into two main sections. The first part of the course focuses on Probability Theory, utilizing resources from an online MIT MOOC, "Introduction to Probability," and its corresponding textbook. During this phase, students engage in various activities: (a) watching MIT video lectures, (b) taking quizzes on Canvas, (c) attending class for concept summaries and numerical examples, and (d) solving homework problems graded automatically on Canvas. The second part of the course covers statistics and computer labs. Additionally, students have the opportunity to enroll in two online courses, "R Programming A-Z: R For Data Science With Real Exercises!" and Duke's "Statistics with R Specialization," to further enhance their learning experience in statistics and R programming.
- 3520 **Transportation Engineering.** I teach a junior-level class in Transportation Engineering. This course introduces essential concepts and fundamental knowledge in transportation engineering, encompassing transportation planning and travel demand forecast methods, traffic flow principles, level of service analysis, intelligent transportation systems, traffic signal control, vehicle dynamics, geometric design, linear programming, and transportation systems management. Additionally, students learn basic Python programming, which is applied to solving traveling salesman and vehicle routing problems.

Teaching (continued)

- 3515 **Civil Engineering Materials.** I instructed a junior-level class in Civil Engineering Materials, which covers the fundamental behavior and properties of various civil engineering materials. Topics include an introduction to mechanical behavior of materials, characteristics of metals, characteristics of wood, evaluation of aggregates, design of Portland cement concrete and asphalt concrete, and an introduction to materials testing. I have developed all the video lectures from scratch and automated the homework grading in Canvas. For a sample video lecture, please refer to [THIS LINK](#).

Awards

Research

- 2022 **Winner, INFORMS Transportation Science and Logistics (TSL) Best Paper Award** for the article: "Data-driven robust resource allocation with monotonic cost functions" published in *Operations Research*.
- 2015 **Winner, Glover-Klingman Prize** for the best paper published in *Networks*. The awarded article is titled: "Evasive flow capture: Optimal location of weigh-in-motion systems, tollbooths, and safety checkpoints."
- 2021 **Winner (tied first place), Airport Management and Planning Design Challenge** category of the Airport Cooperative Research Program (ACRP) University Design Competition for Addressing Airport Needs.

Teaching

- Probability and Statistics.** Ranked among the top 15% instructors in the College of Engineering for teaching Probability and Statistics in Spring 2022 and 2023, based on student evaluations.
- Transportation Engineering.** Ranked among the top 15% instructors in the College of Engineering for teaching Transportation Engineering in Fall 2022, based on student evaluations.
- Nominated** twice for the Early Career Teaching Award in 2021 and 2023.

Professional Activities

- | | |
|----------------|--|
| Vice president | Special Interest Group on Intelligent Transportation Systems (ITS), Transportation Science and Logistics (TSL) Society, INFORMS |
| Co-chair | 2024 INFORMS RAS Student Paper Competition, Railway Applications Section (RAS) of INFORMS |
| Member | Institute for Operations Research and Management Science (INFORMS)
Transportation Research Boards (TRB) |
| Reviewer | Numerous journals |