Nicholas D. Kullman

Ph.D. Student
Operations Research, Scheduling & Transportation Team   314-724-6359
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Education

Ph.D., University of Tours, Tours, France, May 2020
Computer Science, emphasis in Operations Research
Dissertation: *Dynamic Decision Making Under Uncertainty in Vehicle Routing & Logistics*
Advisors: Jorge E. Mendoza, Justin C. Goodson, and Jean-Charles Billaut

M.S., University of Washington, Seattle, WA, December 2016
Quantitative Ecology and Resource Management
Thesis: *Measuring Conflict Among Objective Functions in Multi-objective Optimization*
Committee: Sándor F. Tóth (chair), David E. Butman, Zelda B. Zabinsky

B.S., University of Missouri, Columbia, MO, May 2011
Physics, minor in Mathematics
Phi Beta Kappa; Summa Cum Laude; Departmental Honors; 3.98/4.0 GPA

Research & Teaching Experience

Doctoral Researcher (September 2016 - Present)
University of Tours, Department of Computer Science
- Formulate, build, and solve quantitative mathematical models representing dynamic transportation and logistics systems under uncertainty, especially in the context of electric vehicles
- Design and implement optimization solution methods, including exact solutions using Gurobi commercial solver, heuristic-based dynamic policies, and dynamic agents trained via deep reinforcement learning with artificial neural networks
- Create computer simulations to assess decision-making of dynamic policies and agents
- Develop and maintain Java and Python codebases on GitHub

Intern Co-Advisor & Visiting Doctoral Researcher (Spring 2019)
HEC Montréal, Centre Interuniversitaire de Recherche sur les Réseaux d'Entreprise, la Logistique et le Transport (CIRRELT)
- Hire, advise, and manage masters student intern investigating the adaptation of classical transportation problem models for machine-learning-based solutions

Visiting Doctoral Researcher (Fall 2018)
HEC Montréal, Centre Interuniversitaire de Recherche sur les Réseaux d'Entreprise, la Logistique et le Transport (CIRRELT)
- Formulate stochastic dynamic programming models in autonomous vehicle fleet operations
- Implement solution methods leveraging machine learning algorithms
- Model and solve mathematical program representing static, deterministic variants of dynamic, stochastic problem

Graduate Research Assistant (September 2013 - December 2016)
University of Washington, Quantitative Ecology and Resource Management
- Build linear and nonlinear mathematical optimization models to identify efficient forestry operations in the context of climate change
- Develop solver for multi-objective optimization problems using CPLEX and Java
- Study quantification of conflict among competing solutions and objectives in multi-objective optimization
- Design interactive web-based visualization of optimization solutions using JavaScript (D3)

Research Intern (January 2016 - September 2016)
University of Tours, Department of Computer Science
- Improve routing of electric vehicles in logistics operations under uncertainty through development of exact and heuristic optimization methods
- Formulate stochastic dynamic program to model Markov decision process
- Develop and maintain Java codebase

Graduate Teaching Assistant (Spring 2016)
University of Washington, Quantitative Ecology and Resource Management
- *Optimization Techniques for Natural Resources*: Develop material for, teach, and grade labs for solving optimization problems in natural resource management
- *Forest Management & Economics*: Provide problem-solving assistance to students, hold office hours, grade homework and exams

Undergraduate Research Assistant (September 2008 - May 2011)
University of Missouri, Department of Physics
- Prepare lab environment, assist in experiments in condensed matter physics (alternative fuel storage) and optics (digital holography)

Undergraduate Teaching Assistant (August 2009 - December 2010)
University of Missouri, Department of Physics
- *College Physics I & II*: Lead problem solving and discussion sections

Research Experience for Undergraduates (REU) Research Assistant (Summer 2010)
University of California-Davis, Department of Physics
- Analyze stellar imagery and perform differential photometry in search of exoplanets

Honors & Awards

- Eiffel Excellence Scholarship (2018)
- SPFFA Dufrenoy Fellowship (2018)
- CNRS GdR RO Doctoral Travel Grant (2017)
- Hall Ammerer Fellowship (2013)
- Phi Beta Kappa (2011)
- Bright Flight Scholar (2007, 2008, 2009, 2010)
- Curators Scholar (2007, 2008, 2009, 2010)
- E W & Dr. Kenneth Mares Scholarship (2010)
- Helen Barrett Mathematics Scholarship (2008, 2009, 2010)
- Paul E. Basye Physics Scholarship (2010)
- Phyllis Ann Heyssel Scholarship (2010)
- Ralph K & Maxine J Hibbs Scholarship (2010)
- Class Valedictorian (2007)

Lectures & Presentations

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1. "Atari-fying The Vehicle Routing Problem With Stochastic Service Requests." INFORMS TSL Conference, Arlington, VA. May 2020.
2. "Applications of Machine Learning in Logistics." Invited lecture for masters course *Planning & Control of Logistics Systems*, HEC Montréal, Quebec, Canada. November 2019.
3. "ATARI-ing the Vehicle Routing Problem with Stochastic Requests." INFORMS Annual Meeting 2019, Seattle, WA. October 2019.
   Video of presentation: https://www.youtube.com/watch?v=XOGq82idV6k
4. "Control of Autonomous Electric Fleets for Ridehail Systems." INFORMS Annual Meeting 2019, Seattle, WA. October 2019.
   Video of presentation: https://www.youtube.com/watch?v=RWrHb1GjLqY

5. "Control of Autonomous Electric Fleets for Ridehail Systems." TSL Workshop 2019, Vienna, Austria. July 2019.
6. "Control of Autonomous Electric Fleets for Ridehail Systems." EURO Working Group on Vehicle Routing and Logistics (VeRoLog) 2019, Seville, Spain. June 2019.
7. "Control of Autonomous Electric Fleets for Ridehail Systems." Workshop on logistics of autonomous vessels, Bergen, Norway. May 2019.
8. "Control of Autonomous Electric Fleets for Ridehail Systems." Optimization Days 2019, HEC Montréal, Quebec, Canada. May 2019.
9. "Measuring Conflict behind Competing Objective Functions in Multi-objective Mathematical Programming." CLAIO, Lima , Peru. September 2018.
10. "Dynamic Electric Vehicle Routing with Mid-route Recharging and Uncertain Availability." Odysseus, Cagliari, Italy. June 2018.
11. "Electric Vehicle Routing with Uncertain Charging Station Availability & Dynamic Decision-Making." University of Brescia, Brescia, Italy. December 2017.
12. "Dynamic Electric Vehicle Routing with Uncertain Availability: Heuristics and Lower Bounds." University of Tours, Tours, France. October 2017.
13. "Quantifying the Conflict among Competing Forest Ecosystem Services under Alternative Climate Scenarios." Symposium on Systems Analysis in Forest Resources, Suquamish, WA. August 2017.
14. "Dynamic Electric Vehicle Routing with Uncertain Availability: Heuristics and Lower Bounds." INFORMS Transportation Science and Logistics Society Conference, Chicago, IL. July 2017.
15. "An Update on VRP-REP: the Vehicle Routing Problem Repository." Sixth Annual Workshop of the EURO Working Group on Vehicle Routing and Logistics Optimization, Amsterdam, Netherlands. July 2017.
16. "Electric Vehicle Routing with Mid-route Recharging and Uncertain Charging Station Availability." INFORMS Annual Meeting, Nashville, TN. November 2016.
17. "Quantifying Conflict Between Competing Forest Ecosystem Services Under Alternative Climate Scenarios." INFORMS Annual Meeting, Nashville, TN. November 2016.
18. "Impacts of climate change on conflict among forest ecosystem services." Precision Forestry Cooperative Annual Board Meeting, Seattle, WA. October 2016.
19. "Measuring conflict: Computing the hypervolume of a pareto frontier." Invited lecture for graduate course *Optimization Techniques for Natural Resources*, University of Washington, Seattle, WA. May 2016.
20. "Modeling Non-Timber Objectives in Harvest Scheduling with Linear Programming." Lecture for Forest Management & Economics, University of Washington, Seattle, WA. May 2016.
21. "Multi-Objective Optimization and the Impacts of Climate Change on the Joint Provision of Forest Ecosystem Services." INFORMS Annual Meeting, Philadelphia, PA. November 2015.
22. "Analysis of Hydrogen Adsorption in Engineered Carbon Nanospaces." American Physical Society, 2009 APS March Meeting, Pittsburgh, PA. March 2009.

Publications

Published in Refereed Journals

1. "SieveSifter: A Web-based Tool for Visualizing the Sieve Analyses of HIV-1 Vaccine Efficacy Trials," with Andrew Fiore-Gartland, Allan deCamp, Graham Clenaghan, Wayne Yang, Craig Magaret, Paul Edlefsen,and Peter Gilbert. *Bioinformatics*. 2017.

Submitted & Works In Progress

1. "frvcpy: An Open-Source Solver for the Fixed Route Vehicle Charging Problem," with Aurelien Froger, Jorge Mendoza, and Justin Goodson. http://goodson.slu.edu/papers/frvcpy.pdf
2. "Dynamic Ridehailing with Electric Vehicles," with Martin Cousineau, Justin Goodson, and Jorge Mendoza. https://hal.archives-ouvertes.fr/hal-02463422
3. "Atari-fying the Vehicle Routing Problem with Stochastic Service Requests," with Jorge Mendoza, Martin Cousineau, and Justin Goodson. https://arxiv.org/abs/1911.05922
4. "Electric Vehicle Routing with Public Charging Stations," with Justin Goodson and Jorge Mendoza. https://hal.archives-ouvertes.fr/hal-01928730
5. "Measuring Conflict Among Objective Functions in Multi-objective Optimization," with Sándor Tóth.

Patents

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1. "Adaptive convolution method in long term evolution networks," with Rajveen Narendran, Sreekar Marupaduga, and Andrew Wurtenberger. U.S. Patent 9,844,063. December 2017.
2. "Communications-Tower Antenna Mount," with Andrew Wurtenberger. U.S. Patent 9,698,465. July 2017.
3. "Controllable Transformer Tap to Dynamically Adjust Power Distribution Levels in Wireless Networks," with Sreekar Marupaduga, Eugene Mitchell Jr., and Andrew Wurtenberger. U.S. Patent 9,635,617. April 2017.
4. "Communications-Tower Antenna Mount," with Andrew Wurtenberger. U.S. Patent 9,608,306. March 2017.
5. "Methods, Systems, and Computer Readable Media for Selecting Wireless Channel Bandwidth Based on Data-usage Tendency of User Equipment," with Rajveen Narendran, Sreekar Marupaduga, and Andrew Wurtenberger. U.S. Patent 9,544,902. January 2017.

6. "Optimization of Neighbor Information Transfer in a Long Term Evolution Network," with Sreekar Marupaduga and Andrew Wurtenberger. U.S. Patent 9,462,518. October 2016.
7. "Utilization of Relay Nodes with Beamformed Communications," with Sreekar Marupaduga. U.S. Patent 9,445,389. September 2016.
8. "Staged Signal Modification," with Eugene Mitchell Jr. and Sreekar Marupaduga. U.S. Patent 9,397,935. July 2016.
9. "Dynamically Adjusting Power Settings Based on a Gain Mapping File," with Andrew Wurtenberger, Joshua Koenig, Sreekar Marupaduga, and Patrick Schmidt. U.S. Patent 9,319,991. April 2016.
10. "Adaptive Convolution Method in Long Term Evolution Networks," with Sreekar Marupaduga, Rajveen Narendran, and Andrew Wurtenberger. U.S. Patent 9,301,159. March 2016.
11. "Systems and Methods for Dynamically Adjusting Drop-timer Thresholds Based on Loading," with Sreekar Marupaduga and Andrew Wurtenberger. U.S. Patent 9,288,711. March 2016.
12. "Dynamic Adjustment of the Number of Uplink Grants per Random Access Response Message," with Sreekar Marupaduga and Andrew Wurtenberger. U.S. Patent 9,144,079. September 2015.
13. "Dynamic Adjustment of Preambles for a Random Access Channel," with Sreekar Marupaduga and Andrew Wurtenberger. U.S. Patent 9,137,827. September 2015.
14. "Roaming Control System and Method for a Roaming Wireless Communication Device," with Sreekar Marupaduga. U.S. Patent 9,107,038. August 2015.
15. "Provision of Relay Operation Information to a Wireless Communication Network," with Sreekar Marupaduga and Andrew Wurtenberger. U.S. Patent 9,094,814. July 2015.
16. "Dynamic Assignment of MIMO Modes for a Wireless Communication Device," with Sreekar Marupaduga, Muralidhar Malreddy, and Andrew Wurtenberger. U.S. Patent 9,065,498. June 2015.
17. "Method and System of Activating a Global Beam in a Coverage Area," with Sreekar Marupaduga, Andrew Wurtenberger, and Matt Masters. U.S. Patent 9,042,323. May 2015.
18. "Optimizing Voice Services," with Sreekar Marupaduga. U.S. Patent 9,019,820. April 2015.
19. "System and Method for Avoiding the Transmission of Unsupported Messages," with Sreekar Marupaduga and Andrew Wurtenberger. U.S. Patent 9,019,987. April 2015.
20. "Dynamic Qrxlevmin and Sintrasearch Values to Optimize Intra-and Inter-Frequency Handovers in LTE," with Sreekar Marupaduga, Rajveen Narendran, and Andrew Wurtenberger. U.S. Patent 9,020,509. April 2015.
21. "Adaptive CoMP Schemes in LTE Networks Based on Battery Life," with Sreekar Marupaduga, Rajveen Narendran, and Andrew Wurtenberger. U.S. Patent 8,989,125. March 2015.
22. "Methods, Systems, and Computer Readable Media for Dynamic Toggling of Synchronization Signaling to Provide Access Control and Free Up Resources," with Sreekar Marupaduga, Andrew Wurtenberger, and Rajveen Narendran. U.S. Patent 8,965,391. February 2015.
23. "Dynamic Gain Adjustment via Mechanical Transducers Involving Active Combiners in Wireless Networks," with Sreekar Marupaduga, Eugene Mitchell Jr., and Andrew Wurtenberger. U.S. Patent 8,942,755. January 2015.

24. "Dynamic Allocation of Backhaul Bearer Services Based on Loading Conditions," with Sreekar Marupaduga, Rajveen Narendran, and Andrew Wurtenberger. U.S. Patent 8,913,494. December 2014.
25. "Enhanced Multipath Environments for MIMO Wireless Networks," with Sreekar Marupaduga. U.S. Patent 8,897,383. November 2014.
26. "Communications-Tower Antenna Mount," with Andrew Wurtenberger. U.S. Patent 8,896,497. November 2014.
27. "Wireless Communication System with Multiple Device-to-Device (D2D) Communication Configurations," with Sreekar Marupaduga and Andrew Wurtenberger. U.S. Patent 20,140,321,367. October 2014.

Activities & Service

Professional
- Create open source solver for Fixed Route Vehicle Charging Problem (FRVCP). https://pypi.org/project/frvcpy/
- Lead developer of Mapper utility, Vehicle Routing Problem Repository
- Referee, Forest Science
- Session chair, INFORMS Annual Meeting
- Member, INFORMS Transportation Science and Logistics Society

Community
- Website, app, and technical assistant, Vasculitis Foundation
- Visualization developer, Fred Hutch Cancer Research Center (2016)
- Member, Uptown Alliance Transportation Committee (2014)

University of Washington
- Senator, Graduate and Professional Student Senate (2016)
- Student-faculty liaison for hiring of quantitative wildlife faculty member, School of Environmental and Forest Sciences (2015)

University of Missouri
- Co-founder and President, University of Missouri Math Club
- Member, University of Missouri Physics Club
- Member, Sigma Pi Sigma Honors Physics Fraternity

Visualizations

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1. VRP-REP Mapper: Web-based mapping utility for vehicle routing problem instances. https://vrp-rep.github.io/mapper/
2. SieveSifter: Web-based interactive explorer of vaccine efficacy. http://sieve.fredhutch.org/viz
3. MOOViz: Web-based visualization for multi-objective optimization results. https://nkullman.github.io/mooViz/

Industry Experience

Telecom Design Engineer (June 2011 - August 2013)
Sprint Corporation, Radiofrequency Extension & Antenna Development Team
- Design and lead experiments for telecom equipment; analyze and deliver results
- Analyze and report on potential threats from intermodulation distortion

Geospatial Intelligence Analyst (June 2009 - August 2009)
National Geospatial-Intelligence Agency (NGA)
- Derive novel method for computing mean metric error of orthorectified images
- Analyze and reduce stereo- and mono-layer satellite imagery