Rahul Swamy, Ph.D.

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Google Scholar: https://scholar.google.com/citations?user=skboI2kAAAAJ&hl=en

Education

- Ph.D. in Industrial Engineering, University of Illinois at Urbana-Champaign, GPA: 3.95/4   2016 – 2023
  Thesis: *Optimization approaches for political districting and graph partitioning*
  Advisor: Dr. Sheldon H. Jacobson, Founder Professor in Computer Science
- M.S. in Operations Research, State University of New York (SUNY) at Buffalo, GPA: 3.89/4   2014 – 2016
  Thesis: *Hurricane evacuation planning using public transportation*
  Advisor: Dr. Rajan Batta, SUNY Distinguished Professor, Associate Dean for Faculty Affairs and Recognition
- B.Tech. in Engineering Physics, Indian Institute of Technology Madras   2009 – 2013

Professional and Research Experience

- **Senior Data Scientist,** Walmart Centroid   Oct 2023 - present
- **Academic Programs Data Science Intern**, Gurobi Optimization, Remote   June 2022 – Aug 2023
- **Research/Teaching Assistant**, University of Illinois at Urbana-Champaign, Urbana, IL   Jan 2016 – May 2022
- **Data Science Fellow**, Atlanta Data Science for Social Good, Atlanta, GA   June - August 2015
- **Optimization Analyst**, KPMG India, Business Consulting, Mumbai, India   June 2013 – May 2014

Published Articles in Q1 Journals

- **Swamy, R.,** Kang, J.E., Batta, R. and Chung, Y., 2017. "Hurricane Evacuation Planning Using Public Transportation." *Socio-Economic Planning Sciences.* (108 citations)
- **Swamy, R.,** King, D.M. and Jacobson, S.H., 2023. "Multi-Objective Optimization for Politically Fair Districting: A Scalable Multilevel Approach." *Operations Research*. (29 citations)
  - Two INFORMS best paper awards (Finalist and First Place)
- Ludden I.G., **Swamy, R.,** King, D.M. and Jacobson, S.H., 2022. "A bisection protocol for political redistricting." *INFORMS Journal on Optimization*. (7 citations)
- Dobbs, K., **Swamy, R.,** King, D.M., Ludden I.G., and Jacobson, S.H., 2023. "An Optimization Case Study in Analyzing Missouri Redistricting." *INFORMS Journal on Applied Analytics*. (5 citations)
  - Results presented to the Missouri House and Senate Independent Bi-Partisan Redistricting Commissions
- **Swamy, R.,** King, D.M., Ludden, I., Dobbs, K., and Jacobson, S.H., 2024. "A practical optimization framework for political redistricting: A case study in Arizona." *Socio-Economic Planning Sciences*.
- **Swamy, R.** and Murray, T., 2020. "Computing Equilibrium in Network Utility-Sharing and Discrete Election Games." *Journal of Combinatorial Optimization.* (1 citation)

Awards and Honors

- Semifinalist, INFORMS Innovative Applications in Analytics Award 2021.
- First Place (out of 51 submissions), INFORMS Service Science Best Paper Award 2019.

- Fellow, Mavis Future Faculty Fellows (MF3) Program, The Grainger College of Engineering, UIUC 2019.
- Finalist (4 out of 39 submissions), INFORMS Public Sector Operations Research Best Paper Award 2018.
- First Place (out of 30 posters), Poster Competition Award 2018, INFORMS Annual Meeting, Phoenix, AZ
- Recipient, UIUC ISE Graduate Service Awards for the years 2016-2017 and 2017-18 for student leadership.
- Recipient, SUNY Buffalo Thomas-Drury Industrial Engineering Scholarship 2014 -15 given to one deserving unfunded Master's student per year in Industrial Engineering.
- Ranked in the top 99.7% percentile in the Indian Institute of Technology Joint Entrance Exam 2009 based on aptitude in Physics, Mathematics and Chemistry.

Conference Proceedings

- **Swamy, R.**, Murray, T. and Garg, J., 2018. "Network Cost-Sharing Games: Equilibrium Computation and Applications to Election Modeling." *Combinatorial Optimization and Applications*. 722–738.
- **Swamy, R.,** King, D.M. and Jacobson, S.H. 2018. "Multilevel Optimization Framework for Geographical Districting Problems." *XXIV EURO Working Group on Locational Analysis Meeting*. 14, 127-128.

Articles Under Review and Technical Reports

- **Swamy, R.,** King, D.M. and Jacobson, S.H. 2024. "Highly Connected Graph Partitioning: Exact Formulation and A Cutting Planes Approach." ArXiv:2406.08329. Under review at *Naval Research Logistics*.
- Walteros, J. and **Swamy, R.** 2017. "United States Department of Transportation: Locating Portable Stations to Support the Operation of Bike Sharing Systems." *U.S. Department of Transportation*, National Transportation Library.
- Ludden I., **Swamy, R.,** King, D.M. and Jacobson, S.H. 2019. "Political Redistricting and O.R.: A Map for the Future." *Operations Research and Management Science (ORMS) Today*.

Conference Presentations

- **Swamy, R,** King, D.M., and Jacobson, S.H. "Optimization models for fair political redistricting," Modeling and Optimization: Theory and Applications (MOPTA) 2023, Bethlehem, PA.
- **Swamy, R** and Yurchisin, J. "Where Data Meets Decisions: An Overview of Gurobi's Jupyter Notebook Data Science Example Library," INFORMS Business Analytics Conference 2023, Aurora, CO.
- **Swamy, R** and Yurchisin, J. "Where Optimization Meets Prediction: Novel Use-cases from Gurobi Optimization for Data Scientists," INFORMS Annual Meeting 2022, Indianapolis, IN.
- Dobbs, K., **Swamy, R.,** Ludden, I.G., King, D.M., and Jacobson, S.H. "Practical Redistricting for Missouri Using Recombination," INFORMS Annual Meeting 2021, Anaheim, CA.
- **Swamy, R. (session chair),** King, D.M., and Jacobson, S.H. "Approximation Algorithms For Political Redistricting: Theory And Practice," INFORMS Annual Meeting 2020, virtual.
- **Swamy, R,** King, D.M., and Jacobson, S.H. "Political Districting with Fairness Objectives: An Optimization-Based Multilevel Approach," INFORMS Computing Society 2019, Knoxville, TN.
- **Swamy, R,** King, D.M., and Jacobson, S.H. "Multi-objective Optimization for Political Districting: A Scalable Multilevel Approach," **First Place**, **Best Service Science Paper Session**. INFORMS Annual Meeting 2019, Seattle, WA.
- **Swamy, R,** King, D.M., and Jacobson, S.H. "Transparency Vs Fairness in Political Redistricting," INFORMS Annual Meeting 2019, Seattle, WA.
- Nikolaev, A., **Swamy, R.**, and Semenov, A. "Social Media Mining: Techniques and Applications," INFORMS Annual Meeting 2019, Seattle, WA.

- Ludden I., **Swamy, R.,** King, D.M. and Jacobson, S.H. "A Bisection Protocol for Political Redistricting," INFORMS Annual Meeting 2019, Seattle, WA.
- **Swamy, R.,** King, D.M. and Jacobson, S.H. "Political Districting with Fairness Objectives: An Optimization-Based Framework," **First Place**, **Poster Competition**, INFORMS Annual Meeting 2018, Phoenix, AZ.
- **Swamy, R.,** King, D.M. and Jacobson, S.H. "Political Districting with Fairness Objectives: An Optimization-Based Framework," **Honorary Mention**, **Public Sector Operations Research Best Paper Award**, INFORMS Annual Meeting 2018, Phoenix, AZ.
- **Swamy, R.**, Murray, T., and Garg, J. "Network Cost-Sharing Games: Equilibrium Computation and Applications to Election Modeling," Combinatorial Optimization and Applications: 12th International Conference, COCOA 2018, Atlanta, GA.
- **Swamy, R.,** King, D.M. and Jacobson, S.H. "Multilevel Optimization Framework for Geographical Districting Problems," XXIV EURO Working Group on Locational Analysis Meeting 2018, Edinburgh, United Kingdom.
- **Swamy, R.,** King, D.M. and Jacobson, S.H. "Multilevel Geo-graph Framework For The Political Districting Problem," INFORMS Annual Meeting 2017, Houston, TX.
- **Swamy, R.** and Walteros, J. "Bike Rebalancing Problem with Portable Stations," INFORMS Annual Meeting 2016, Nashville, TN.
- **Swamy, R.** and Walteros, J. "Managing the Daily Operations of a Bike Sharing System with Mobile Stations," IIE Annual Conference and Expo 2016, Anaheim, CA.
- **Swamy, R.** and Walteros, J. "Optimizing the Operations of a Bike Sharing System with Mobile Stations," Transportation Science and Logistics Workshop on Recent Advances in Urban Transportation through Optimization and Analytics 2016, Atlanta, GA.
- **Swamy, R.**, Kang, J.E., and Batta, R. "Hurricane Evacuation Planning using Public Transportation," INFORMS Annual Meeting 2015, Philadelphia, PA.
- **Swamy, R.**, Kang, J.E., and Batta, R. "Hurricane Evacuation Planning using Public Transportation," Health and Humanitarian Logistics Conference 2015, Johannesburg, South Africa.

Invited Seminars

- Swamy, R. 2023. "Optimization Meets Politics: Mathematical Models and a Practical Case Study in Political Redistricting." Analytics and Operations Management Seminar, Bucknell University.
- Swamy, R. 2020. "Optimization Modeling and Algorithms For Politically Fair Redistricting." Computer Science Seminar, Montana State University.

Media Coverage of My Work

- **Title**: New research develops a model that optimizes political fairness for political redistricting
  Date: December 5, 2022
  Author: Ashley Smith
  Publisher: Institute for Operations Research and the Management Sciences (INFORMS)
  Link: https://www.informs.org/News-Room/INFORMS-Releases/News-Releases/New-Research-Develops-a-Model-for-Political-Redistricting-that-Optimizes-Political-Fairness
  Excerpt: *"We present a model for redistricting with political fairness criteria based on fundamental fairness principles such as vote-seat proportionality (efficiency gap), partisan (a)symmetry and competitiveness,"* says **Rahul Swamy** *of the University of Illinois Urbana-Champaign and lead author of the study.*

- **Title**: New political redistricting procedure may prevent gerrymandering by forcing parties to act fairly
  Date: December 16, 2022
  Author: Michael Boyle

Publisher: University of Illinois Grainger College of Engineering
Link: https://grainger.illinois.edu/news/stories/52711
Excerpt: *Ludden and co-authors **Rahul Swamy**, Douglas King, and Sheldon Jacobson found the bisection protocol can lead to fairer maps than when one party controls the whole redistricting process. They analyze bisection using techniques from game theory, a field of mathematics concerned with evaluating decision strategies, to prove the bisection protocol has a strategic equilibrium where no player can benefit from switching strategies.*

- **Title**: Focused on Fairness: Collaborative Research Leads to Two Algorithmic Approaches to Political Redistricting
  Date: July 19, 2022
  Author: Aaron Seidlitz
  Publisher: University of Illinois Computer Science
  Link: https://cs.illinois.edu/news/focused-on-fairness-collaborative-research-leads-to-two-algorithmic-approaches%20to-political-redistricting
  Excerpt: *The paper that **Swamy** led presents "Mixed Integer Linear Programming (MILP) models for districting with political fairness criteria based on fundamental fairness principles such as vote-seat proportionality (efficiency gap), partisan (a) symmetry, and competitiveness." By creating an algorithm for mathematically fair district plans according to a variety of fairness metrics such as the efficiency gap, partisan asymmetry, and competitiveness, the group found that algorithmically-generated district plans cater to multiple stakeholders such as the voters and the political parties.*

  *"I think a key takeaway is that this is an evolving landscape," **Swamy** said. "Even our understanding of what fairness means has evolved as a society over many decades. Meanwhile, we also see that technologies are getting better and better every year. What used to be hard problems to solve are a lot easier now.*

Judging

- Prize Committee member for the 2020 Daniel H. Wagner Prize for Excellence in the Practice of Advanced Analytics and Operations Research.
- Reviewer for Q1 journals for manuscripts in the field of Operations Research.
  - *Nature*
  - *Operations Research*
  - *Socio-Economic Planning Sciences*
  - *Journal of Combinatorial Optimization*
  - *European Journal of Operations Research*

Memberships in Professional Organizations

- Institute for Operations Research and the Management Sciences (INFORMS)
- Institute of Industrial and Systems Engineers (IISE)

Leadership and Volunteering

- **Lead Editor**, INFORMS Operations Research/Management Science (OR/MS) Tomorrow (2018 – 2020)
  - Led a team of 18 students across the US and spearheaded initiatives such as monthly articles catering OR/MS practitioners, a student writing competition, enhanced outreach and recruiting
- **Science Lab Coordinator,** Champaign Juvenile Detention Center Outreach Program (2019 – 2020)

- o Led biweekly mathematics lab sessions for middle school children in the Champaign Juvenile Detention Center to encourage career development and promote non-traditional science outreach
- **Diversity Advocate**, Engineering Graduate Student Advisory Council (2018 – 2019)
  - o Revamped the council to improve the engineering graduate student life experience at UIUC
- **President**, INFORMS UIUC Student Chapter (2016 – 2018)
  - o Oversaw the creation of the chapter; organized community and networking events