Haoming Shen

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Research Interests

Methodologies	**Stochastic Optimization and Integer Programming**
Applications	**Power and Transportation Systems**

Education

2018–Present	**Ph.D. in Industrial and Operations Engineering**, *University of Michigan*, Ann Arbor, MI, USA
2021–Present	**M.S. in Applied Mathematics**, *University of Michigan*, Ann Arbor, MI, USA
2016–2018	**M.S. in Electrical and Computer Engineering**, *University of Michigan*, Ann Arbor, MI, USA Specialized in Signal Processing and Machine Learning
2012–2016	**B.E. in Electrical Engineering**, *Xi'an Jiaotong University*, Xi'an, Shannxi, China

Preprints

2022	**Shen, H.** and Jiang, R., 2022. Wasserstein Two-Sided Chance Constraints with An Application to Optimal Power Flow. arXiv:2204.00191.
2021	**Shen, H.** and Jiang, R., 2021. Convex Chance-Constrained Programs with Wasserstein Ambiguity. arXiv:2111.02486. Major Revision at Operations Research.

Publications

2022	**Shen, H.** and Jiang, R., 2022. Chance-Constrained Set Covering with Wasserstein Ambiguity. Mathematical Programming, pp.1-54.
2020	Chen, X., Huang, X., Cai, Y., **Shen, H.** and Lu, J., 2020. Intra-day Forecast of Ground Horizontal Irradiance Using Long Short-term Memory Network (LSTM). Journal of the Meteorological Society of Japan. Ser. II.
2018	Heimann, M., **Shen, H.**, Safavi, T. and Koutra, D., 2018, October. REGAL: Representation learning-based graph alignment. In Proceedings of the 27th ACM international conference on information and knowledge management (pp. 117-126).
2017	Jin, D., Leventidis, A., **Shen, H.**, Zhang, R., Wu, J. and Koutra, D., 2017, September. PERSEUS-HUB: Interactive and collective exploration of large-scale graphs. In Informatics (Vol. 4, No. 3, p. 22).

Research Projects

2020-2021	**A Data-Driven Approach towards Strategic Planning of Charging Stations**

Developed a data-driven distributionally robust chance-constrained model for the strategic planning of charging stations for battery electric buses (BEBs), where the uncertainty in energy consumption and dwell time of BEBs are explicitly considered.

- ○ Derived mixed-integer second-order conic reformulation for the problem.
- ○ Designed an efficient algorithm based on separation and low-rank approximation.
- ○ Extensive experiments on a real-world bus system demonstrated the effectiveness of the proposed models and algorithms.

2018-2019	**Projection Cuts for Two-Stage Stochastic Mixed-Integer Programs**

Proposed a new type of valid inequality, called projection cuts, for Benders decomposition to significantly reduce the Benders feasibility cuts and accelerate computation.

- ○ Motivated by Principal Component Analysis (PCA), projection cuts are constructed from the minor components of the positive cone generated by the recourse matrix.
- ○ Designed a two-phase variant of Benders decomposition with projection cuts to strengthen the initial relaxation.
- ○ Demonstrated its effectiveness on an extensive numerical study based on stochastic unit commitment, multi-commodity network design, and stochastic production routing problems.

Presentations and Posters

2022	**Shen, H.**, Jiang, R., Convex Chance-Constrained Programs with Wasserstein Ambiguity, International Conference on Continuous Optimization (ICCOPT).
2022	**Shen, H.**, Jiang, R., Convex Chance-Constrained Programs with Wasserstein Ambiguity, INFORMS Optimization Society (IOS) Conference.
2022	**Shen, H.**, Jiang, R., Chance-Constrained Set Covering with Wasserstein Ambiguity, INFORMS Computing Society (ICS) Conference.
2021	**Shen, H.**, Jiang, R., Chance-Constrained Set Covering with Wasserstein Ambiguity, INFORMS Annual Meeting.
2021	**Shen, H.**, Jiang, R., Chance-Constrained Set Covering with Wasserstein Ambiguity, Mixed Integer Programming Workshop.
2020	**Shen, H.**, Jiang, R., Distributionally Robust Chance-Constrained Set Covering, INFORMS Annual Meeting.
2019	**Shen, H.**, Jiang, R., Benders Decomposition with Projection Cuts, INFORMS Annual Meeting.

Awards

2022	Rackham Graduate Student Travel Grant, University of Michigan
2019-2021	Rackham Graduate Student Research Assistantship, University of Michigan
2019-2020	Rackham Graduate Student Instructor, University of Michigan
2019	Rackham Graduate Student Travel Grant, University of Michigan
2018	Engineering Graduate Fellowship, University of Michigan

Related Courses

Optimization	Linear Programming, Convex Optimization, Integer Programming, Dynamic Programming, Stochastic and Robust Optimization.
Mathematics	Real Analysis, Functional Analysis, Probability Theory, Stochastic Processes, Intro to Topology.
Computer Science	Machine Learning, Reinforcement Learning, Computational Complexity Theory, Foundations of AI, Foundations of Computer Vision, Computational Data Science, Database Management Systems.

Teaching Experience

Fall 2020	**Graduate Student Instructor**, IOE 310, Intro to Optimization Methods
Winter 2020	**Graduate Student Instructor**, IOE 310, Intro to Optimization Methods
Fall 2019	**Graduate Student Instructor**, IOE 611, Nonlinear Programming

Professional Skills

Languages	Python, Julia, LaTeX, Shell Script, MATLAB, Mathematica, C++, C, Java, R, SQL.
Packages	Gurobi, MOSEK, Pyomo, PySpark, Networkx, scikit-learn, Tensorflow.