Haoran Zhu

HOMEPAGE `https://haoranzhu94.github.io/`

CONTACT INFORMATION

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RESEARCH INTERESTS

Mixed-integer optimization; Polyhedral combinatorics; Optimization in machine learning and applications.

EDUCATION

University of Wisconsin-Madison, Madison, Wisconsin USA

Ph.D. Candidate, Industrial and systems Engineering — Sep. 2016 - May. 2022 (expected)
M.S., Computer Science — Sep. 2018 - Jun. 2020

Nanjing University, Nanjing, Jiangsu China

B.Sc., Mathematics and Statistics — Sep. 2012 - Jun. 2016

ACADEMIC EXPERIENCE

Univeristy of Wisconsin-Madison, Madison, Wisconsin USA

Research Assistant — Sep. 2016 - present
Includes current Ph.D. research, Ph.D. and Masters level coursework and research projects.

Teaching Assistant — Sep. 2018 - Dec. 2018
Course: Introduction to Combinatorial Optimization
Duties at various times have included office hours and grading.

Grader — Sep. 2019 - Dec. 2019
Course: Machine Learning in Action

Grader — Sep. 2016 - Dec. 2016
Course: Applied Dynamic Systems

INDUSTRIAL EXPERIENCE

IBM Thomas. J. Watson Research Center,Yorktown, NY, USA

Research Intern — Mar. 2019 - Sep. 2019

- Proposed a general framework for using optimization method to train optimal decision tree with large-scaled data sets. Our method improves the mean out-of-sample accuracy of optimal decision tree trained from other MIP-based methods by 10-20%, and our paper got accepted into *NeurIPS 2020*.
- Implemented our framework and incorporated them into the IBM platform.

ACCEPTED PAPERS

1. *A Scalable Mixed-integer Programming Based Framework for Optimal Decision Tree*, with P. Murali, D. Phan, L. Nguyen, J. Kalagnanam.
   NeurIPS (2020)

2. *Integer Packing Sets Form a Well-quasi-ordering*, with A. Del Pia, D. Gijswijt, J. Linderoth.
   Operations Research Letter (2020)

3. *Multi-cover Inequalities for Totally-Ordered Multiple Knapsack Sets*, with A. Del Pia, J. Linderoth.
   IPCO (2021)

4. *On the Complexity of Separation From the Knapsack Polytope*, with A. Del Pia, J. Linderoth.
   IPCO (2022) .

Submitted papers

1. *Characterization of Cutting-plane Closure*,
   Discrete Optimization Major revision.
2. *On the Polyhedrality of the Chvátal-Gomory Closure*,
   Mathematical Programming under review.
3. *Multi-cover Inequalities for Totally-Ordered Multiple Knapsack Sets: Theory and Computation* with A. Del Pia, J. Linderoth.
   Mathematical Programming Minor revision.

Papers in preparation

1. *Extended Relaxation and Cutting-planes for Linear Programs with Complementarity Constraints*, with A. Del Pia, J. Linderoth.
2. *A Semidefinite Programming Approach to the Optimal Information Structure Problem in Parking Price Competition*, with Y. Wu, X. Wang.
3. *New Classes of Facets for Complementarity Knapsack Problems.*
4. *A New Family of Cutting-planes for Multiple Knapsack Sets*, with A. Del Pia, J. Linderoth.

Patent application

1. *Optimal interpretable decision trees using integer linear programming techniques.*
   United States Patent Application 20210264290.
2. *Prediction modeling in sequential flow networks.*
   United States Patent Application 20210264288.

Honors and Awards

Graduate Student Travel Grant Award	2021
Mixed-Integer Programming workshop best poster competition finalist (virtual)	2021
IPCO best poster competition finalist (Gatech)	2021
Mixed-Integer Programming workshop best poster competition finalist (MIT)	2019
Mixed Integer Programming Workshop Student Travel Award	2019
CRM/DIMACS Workshop Student Travel Award	2019
Scholarship Funded by Elite Program of Chinese Ministry of Education	2012-2016
Nanjing University: People Scholarship	2013-2015
Be recommended for admission to college without college entrance examination	2011
CMS: First Prize in Chinese High School Students Mathematics Contest	2011

Presentations

Cutting-planes for Linear Complementarily Problems.

- INFORMS Optimization Society Conference, Denver, CO — Mar. 2018
- (Poster) Mixed Integer Programming (MIP) Workshop, Clemson University, SC — Jun. 2018
- (Poster) Second Annual WID Symposium, UW-Madison, WI — Jun. 2018
- CRM/DIMACS Workshop, Université de Montréal, CA — Oct. 2019

Polyhedrality of Aggregation Closure on Packing Set.

– (Poster) Mixed Integer Programming (MIP) Workshop, MIT, MA Jul. 2019
– (Poster) Computing in Engineering Forum, UW-Madison, WI Sep. 2019

A Scalable Mixed-integer Programming Based Framework for Optimal Decision Tree.
– (Poster) IBM Intern poster session, Yorktown, NY Aug. 2019
– IBM Industry Research Technical Exchange Seminar, Yorktown, NY Aug. 2019
– INFORMS 2020 annual meeting, virtual Nov. 2020
– NeurIPS 2020 annual conference, virtual Dec. 2020

A New Cover-based Cut Generating Method for Knapsack Problems.
– (Poster) MACSER annual meeting, virtual Jan. 2021
– The 22nd Conference on IPCO, virtual May. 2021
– INFORMS 2021 annual meeting, virtual Oct. 2021

On the Polyhedrality of the Chvátal-Gomory Closure.
– (Poster) Mixed Integer Programming (MIP) Workshop, virtual May. 2021
– (Poster) The 22nd Conference on IPCO, virtual May. 2021

Professioinal Service

Conference Organizer
– INFORMS 2020 annual meeting, session chair on "Proximity Theory on IP and Topics in Discrete Optimization", virtual Nov. 2020

Reviewer
– Mathematical Programming, Series A,
– Mathematical Programming, Series B,
– Mathematical Programming Computation,
– INFORMS Journal on Computing,
– Journal of Machine Learning Research,
– Discrete Optimization,
– Discrete Applied Mathematics,
– IPCO 2020, 2021, 2022,
– ICML 2021, 2022, NeurIPS 2021, ICLR 2022.

Student Officer
– UW-Madison INFORMS student chapter 2018-2020

Graduate Coursework

Optimization
– Linear programming, Nonlinear Programming (I,II), Integer Optimization, Introduction to Optimization, Stochastic Programming, Introduction to Combinatorical Optimization, Mixed-Integer Nonlinear Optimization

Machine learning
– Machine learning, Mathematical Machine learning, Large-Scale Mchine Learning & Optimization

Technical tools

Python, C, C++, Matlab, R, SQL, CPLEX, Gurobi.

References

Available upon request