Dabeen Lee

Contact Information

Industrial and Systems Engineering
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Positions

- **Korea Advanced Institute of Science & Technology (KAIST)**, South Korea
  Assistant Professor, Department of Industrial and Systems Engineering 07/2022 -
- **Institute for Basic Science (IBS)**, South Korea
  Research fellow, Discrete Math Group (military service) 06/2019 - 06/2022
- **IBM T.J. Watson Research Center**, Yorktown, NY, USA
  Research intern, Mathematical Sciences Department 07/2017 - 09/2017

Research Interests

I am interested in designing **algorithms** and **mathematical programming** frameworks for **broad areas of optimization** spanning continuous, discrete, combinatorial, integer, convex, online, stochastic, robust, and distributionally robust optimization. Currently, I am working on the **seamless integration of machine learning and optimization** with applications in data-driven decision-making under uncertainty. My latest research projects are on online reinforcement learning theory, stochastic optimization under decision-dependent distributions, first-order methods for constrained optimization, and distributionally robust optimization frameworks.

Education

- **Carnegie Mellon University**, Pittsburgh, PA, USA
  Ph.D. in Algorithms, Combinatorics and Optimization (ACO), 08/2014 - 05/2019
  - Concentration: Operations Research and Optimization
  - Advisor: Prof. Gérard P. Cornuéjols
- **POSTECH**, Pohang, South Korea
  B.S. in Industrial and Management Engineering, 03/2010 - 06/2014
- **The University of Waterloo**, Waterloo, ON, Canada
  Exchange Program in the Department of Combinatorics and Optimization, 09/2012 - 12/2012
- **Gyeonggi Science High School**, Suwon, South Korea 03/2008 - 02/2010

Honors and Awards

- **Best Teaching Award**, the Department of Industrial and Systems Engineering, KAIST, 2023.
- **Young Scientist Fellowship**, the Institute for Basic Science (IBS), 2021-2022.
- **Second-place** in the **INFORMS Optimization Society Student Paper Prize** competition, 2019
- **Gerald L. Thompson Doctoral Dissertation Award**, the Tepper School of Business, Carnegie Mellon University for the best doctoral dissertation in management science, 2019.
- **Henry J. Gailliot Presidential Fellowship**, Carnegie Mellon University, 2016-2017.
- **Egon Balas Award**, the Tepper School of Business, Carnegie Mellon University for the best student paper in the area of operations research, 2016.
- **William Larimer Mellon Fellowship**, the Tepper School of Business, Carnegie Mellon University, 2014-2018.

Research Grants

- Artificial Intelligence-Based End-to-End Framework for Black-Box Combinatorial Optimization (PI, Young Researcher Grant, National Research Foundation (NRF), Korea) 2024 - 2027
- Deep Learning Foundation Model for Combinatorial Optimization and Its Applications to Various Industrial Problems (Co-PI, Basic Research Lab Grant, National Research Foundation (NRF), Korea) 2024 - 2027
- Intelligent National Defense Swarm System ITRC (Co-PI, Institute for Information & communication Technology Planning & evaluation (IITP), Korea) 2024 - 2031
- Optimal Test Mode Register Set (TMRS) Combination Search (PI, Samsung Electronics DRAM) 2023 - 2024

Submitted Papers

1. Improved regret bound for safe reinforcement learning via tighter cost pessimism and reward optimism, with Kihyun Yu, Duksang Lee, and William Overman.
2. Parameter-free algorithms for performative regret minimization under decision-dependent distributions, with Sungwoo Park, Junyeop Kwon, Byeongnoh Kim, Suhyun Chae, and Jeeyong Lee.
   Reject and resubmit by the **Journal of Machine Learning Research**.
3. Projection-free online convex optimization with stochastic constraints, with Duksang Lee and Nam Ho-Nguyen.
4. Non-smooth, Hölder-smooth, and robust submodular maximization, with Duksang Lee and Nam Ho-Nguyen.
5. Scheduling jobs with stochastic holding costs, with Milan Vojnovic.
   Conference version: **NeurIPS 2021** 34 (2021) 19375–19384.

Publications

1. Reinforcement learning for infinite-horizon average-reward linear MDPs via approximation by discounted-reward MDPs, with Kihyuk Hong, Woojin Chae, Yufan Zhang, and Ambuj Tewari.
   AISTATS 2025, to appear.

2. Learning infinite-horizon average-reward linear mixture MDPs of bounded span, with Woojin Chae, Kihyuk Hong, Yufan Zhang, and Ambuj Tewari.
   AISTATS 2025, to appear.
3. Infinite-horizon reinforcement learning with multinomial logistic function approximation, with Jaehyun Park and Junyeop Kwon.
   AISTATS 2025, to appear.
4. Stochastic-constrained stochastic optimization with Markovian data, with Yeongjong Kim.
   Journal of Machine Learning Research, to appear.
5. A Projection-free method for solving convex bilevel optimization problems, with Khanh-Hung Giang-Tran and Nam Ho-Nguyen.
   Mathematical Programming, published online.
   Finalist in the INFORMS Undergraduate Operations Research Prize, 2024
6. From coordinate subspaces over finite fields to ideal multipartite uniform clutters, with Ahmad Abdi.
   Mathematical Programming, published online.
7. Conic mixed-binary sets: convex hull characterizations and applications, with Fatma Kılınç-Karzan, Simge Küçükyavuz, and Soroosh Shafieezadeh-Abadeh.
   Operations Research, published online.
8. Strong formulations for distributionally robust chance-constrained programs with left-hand side uncertainty under Wasserstein ambiguity, with Nam Ho-Nguyen, Fatma Kılınç-Karzan and Simge Küçükyavuz.
   INFORMS Journal on Optimization 5(2) (2023) 211-232.
9. Test score algorithms for budgeted stochastic utility maximization, with Milan Vojnovic and Se-Young Yun.
   INFORMS Journal on Optimization 5(1) (2023) 27-67.
10. Distributionally robust chance-constrained programs with right-hand side uncertainty under Wasserstein ambiguity, with Nam Ho-Nguyen, Fatma Kılınç-Karzan, and Simge Küçükyavuz.
    Mathematical Programming 196 (2022) 641–672.
11. Joint chance-constrained programs and the intersection of mixing sets through a submodularity lens, with Fatma Kılınç-Karzan and Simge Küçükyavuz.
    Mathematical Programming 195 (2022) 283–326.
12. On a generalization of the Chvátal-Gomory closure, with Sanjeeb Dash and Oktay Günlük.
    Mathematical Programming 192 (2022) 149–175.
    Conference version: **IPCO 2020**, LNCS 12125 (2020) 117-129.
13. Idealness of k-wise intersecting families, with Ahmad Abdi, Gérard Cornuéjols, and Tony Huynh.
    Mathematical Programming 192 (2022) 29–50.
    Conference version: **IPCO 2020**, LNCS 12125 (2020) 1-12.
14. Generalized Chvátal-Gomory closures for integer programs with bounds on variables, with Sanjeeb Dash and Oktay Günlük.
    Mathematical Programming 190 (2021) 393–425.
15. Resistant sets in the unit hypercube, with Ahmad Abdi and Gérard Cornuéjols.
    Mathematics of Operations Research 46 (2021) 82–114.
16. Intersecting restrictions in clutters, with Ahmad Abdi and Gérard Cornuéjols.

Combinatorica 40 (2020) 605–623.

17. Cuboids, a class of clutters, with Ahmad Abdi, Gérard Cornuéjols, and Natália Guričanová.
    Journal of Combinatorial Theory B 142 (2020) 144–209.
18. On the rational polytopes with Chvátal rank 1, with Gérard Cornuéjols and Yanjun Li.
    Mathematical Programming 179 (2020) 21-46.
19. Identically self-blocking clutters, with Ahmad Abdi and Gérard Cornuéjols.
    IPCO 2019, LNCS 11480 (2019) 1-12.
20. On the NP-hardness of deciding emptiness of the split closure of a rational polytope in the 0,1 hypercube.
    Discrete Optimization 32 (2019) 11-18.
21. Deltas, extended odd holes and their blockers, with Ahmad Abdi.
    Journal of Combinatorial Theory B 136 (2019) 193-203.
22. On some polytopes contained in the 0,1 hypercube that have a small Chvátal rank, with Gérard Cornuéjols.
    Mathematical Programming 172 (2018) 467-503.
    Conference version: **IPCO 2016**, LNCS 9682 (2016) 300-311.
    Second-place in the INFORMS Optimization Society Student Paper Prize Competition, 2019

Invited Presentations at Academic Institutions

- *Business Analytics Seminar*, The University of Sydney Business School, Sydney, Australia, February 2025, "Function approximation frameworks for infinite-horizon reinforcement learning".
- *Winter Lecture Series*, The Center for Algorithm and Optimization (CALOP), POSTECH, Pohang, South Korea, January 2025, "Introduction to modern combinatorial optimization: mathematical programming, algorithms, and machine learning".
- *Applied Mathematics Seminar*, Department of Mathematical Sciences, Seoul National University, Seoul, South Korea, August 2024, "Recent progress on improving regret bounds for reinforcement learning in Markov decision processes".
- *Summer Undergraduate Research Seminar*, VIASM, Hanoi, Vietman, June 2024, "Reinforcement learning for infinite-horizon average-reward MDPs with multinomial logistic function approximation".
- *IBS Discrete Math Seminar*, IBS, Daejeon, South Korea, August 2023, "From coordinate subspaces over finite fields to ideal multipartite uniform clutters".
- *Mathematical Sciences Colloquium*, Department of Mathematical Sciences, KAIST, Daejeon, South Korea, October 2022, "Nonsmooth and Hölder-smooth submodular optimization".
- *Neuro-Symbolic AI Seminar*, IBM Research, Yorktown, NY, May 2022, "Solving distributionally robust optimization under Wasserstein ambiguity".
- *SME Seminar*, Department of Systems Management Engineering, Sungkyunkwan University, Suwon, South Korea, September 2021, "Recent progress on chance-constrained optimization".
- *IBS Discrete Math Seminar*, IBS, Daejeon, South Korea, September 2021, "Mixing sets, submodularity, and chance-constrained optimization".
- *Business Analytics Seminar*, The University of Sydney Business School, Sydney, Australia (online), August 2021, "Data-driven decision making for combinatorial optimization".

- *ISysE Seminar*, Department of Industrial and Systems Engineering, KAIST, Daejeon, South Korea, July 2021, "Modern discrete optimization: algorithms and learning frameworks".
- *ISysE Seminar*, Department of Industrial and Systems Engineering, KAIST, Daejeon, South Korea, April 2021, "Data-driven chance-constrained optimization under Wasserstein ambiguity".
- *BK Colloquium*, Department of Mathematical Sciences, Seoul National University, Seoul, South Korea, April 2021, "Data-driven chance-constrained optimization under Wasserstein ambiguity".
- *Special Seminar*, Department of Applied Mathematics and Statistics, Johns Hopkins University, Baltimore, MD, USA (online), January 2021, "Data-driven optimization: test score algorithms and distributionally robust approach".
- *Séminaire virtuel de théorie des graphes et combinatoire en Rhône-Alpes et Auvergne*, France (online), December 2020, "Multipartite clutters and the $\tau = 2$ conjecture".
- *CS Colloquium*, Department of Computer Science, SUNY Korea, Incheon, South Korea (online), October 2020, "Test score based algorithms for budgeted stochastic submodular maximization".
- *IME Special Seminar*, Department of Industrial and Management Engineering, POSTECH, Pohang, South Korea, July 2020, "Distributionally robust chance-constrained programs under Wasserstein ambiguity".
- *IBS Discrete Math Seminar*, IBS, Daejeon, South Korea, March 2020, "On a generalization of the Chvátal-Gomory closure".
- *Frontiers in Industrial & Systems Engineering, 2019 Winter ISysE Symposium*, Department of Industrial and Systems Engineering, KAIST, Daejeon, South Korea, December 2019, "Linear programs with probabilistic constraints and binary mixing sets".
- *IBS/KAIST Joint Discrete Math Seminar*, IBS, Daejeon, South Korea, July 2019, "Integrality of set covering polyhedra and clutter minors".
- *Operations Research Seminar*, IBM Research, Yorktown, NY, June 2019, "Chvátal-Gomory cuts, rank, closure, and their generalizations for integer programming".
- *ISysE Seminar*, Department of Industrial and Systems Engineering, KAIST, Daejeon, South Korea, December 2018, "Complexity of integer programming: geometric and combinatorial perspectives".
- *Operations Research Seminar*, IBM Research, Yorktown, NY, July 2018, "Integrality of set covering polyhedra and clutter minors".
- *Optimization Seminar*, Department of Combinatorics and Optimization, University of Waterloo, Waterloo, ON, Canada, March 2017, "On the rational polytopes with Chvátal rank 1".

Invited Presentations at Conferences and Workshops

- *Mixed Integer Programming International Workshop 2024*, IIT Bombay, Mumbai, India, December 2024, "Combinatorial Black-Box Optimization".
- *1st Korean AI Theory Community Workshop: Bandits*, Seoul, Korea, June 2024, "Reinforcement learning for infinite-horizon average-reward MDPs with multinomial logistic function approximation".
- *INFORMS Annual Meeting* (*INFORMS 2023*), Pheonix, AZ, October 2023, "Projection-free online convex optimization with stochastic constraints".

- *Optimization and Machine Learning Workshop*, UNIST, South Korea, August 2023, "Online optimization for constrained reinforcement learning".
- *SIAM Conference on Optimization* (*OP23*), Seattle, WA, June 2023, "Scheduling jobs with stochastic holding costs".
- *20th Mixed Integer Programming Workshop*, University of Southern Califorrnia, Los Angeles, CA, May 2023, "Nonsmooth and Hölder-smooth submodular optimization".
- *Gurobi Days Korea*, Seoul, South Korea,, March 2023, "Mathematical optimization in modern business analytics".
- *Korea-Taiwan-Vietnam Joint Seminar in Combinatorics and Analysis*, virtual, March 2023, "Nonsmooth and Hölder-smooth submodular optimization".
- *35th Conference on Neural Information Processing Systems* (*NeurIPS 2021*) (virtual), December 2021, "Scheduling jobs with stochastic holding costs".
- *INFORMS Annual Meeting* (*INFORMS 2021*), Aneheim, CA, October 2021, "Conic mixed-binary sets: convex hull characterizations and applications".
- *22nd Conference of the International Federation of Operational Research Societies* (*IFORS 2021*) (virtual), August 2021, "Joint chance-constrained programs and the intersection of mixing sets through a submodularity lens".
- *SIAM Conference on Optimization* (*OP21*) (virtual), July 2021, "Conic mixed-binary sets: convex hull characterizations and applications".
- *INFORMS Annual Meeting* (*INFORMS 2020*) (virtual), November 2020, "Improved formulations for distributionally robust chance-constrained programs under Wasserstein ambiguity".
- 21*st Conference on Integer Programming and Combinatorial Optimization* (*IPCO 2020*), London, UK (online), June 2020, "On a generalization of the Chvátal-Gomory closure".
- *KSIAM Annual Meeting*, Yeosu, South Korea, November 2019, "Joint chance-constrained programs and the intersection of mixing sets through a submodularity lens".
- *INFORMS Annual Meeting* (*INFORMS 2019*), Seattle, WA, October 2019, "Joint chance-constrained programs and the intersection of mixing sets through a submodularity lens".
- *Award Seminar, INFORMS Annual Meeting* (*INFORMS 2019*), Seattle, WA, October 2019, "On some polytopes contained in the 0,1 hypercube that have a small Chvátal rank".
- *2019 Combinatorics Workshop* (*Korea*), Incheon, South Korea, August 2019, "On the Chvátal rank for integer programming".
- 9*th Cargese Workshop on Combinatorial Optimization*, Corsica, France, October 2018, "Primal and dual integrality of set covering linear programs".
- *International Symposium on Mathematical Programming* (*ISMP*), Bordeaux, France, July 2018, "Deltas, extended odd holes, and their blockers".
- (*Poster*) *Mixed Integer Programming* (*MIP*) *Workshop*, Clemson University, SC, June 2018, "Generalized Chvátal-Gomory closures for integer programs with bounds on variables".
- *INFORMS Optimization Society Conference*, Denver, CO, March 2018, "Generalized Chvátal-Gomory closures for integer programs with bounds on variables".
- 22*nd Aussois Combinatorial Optimization Workshop*, Aussois, France, January 2018, "Generalized Chvátal-Gomory closures for integer programs with bounds on variables".

- (*Poster*) *Mixed Integer Programming* (*MIP*) *Workshop*, HEC Montréal, QC, Canada, June 2017, "On the rational polytopes with Chvátal rank 1".
- 21st *Aussois Combinatorial Optimization Workshop*, Aussois, France, January 2017, "On the rational polytopes with Chvátal rank 1".
- *INFORMS Annual Meeting* (*INFORMS 2016*), Nashville, TN, November 2016, "On the rational polytopes with Chvátal rank 1".
- *Modeling and Optimization: Theory and Applications* (*MOPTA*) *conference*, Bethlehem, PA, August 2016, "On some polytopes contained in the 0,1 hypercube that have a small Chvátal rank".
- 18th *Conference on Integer Programming and Combinatorial Optimization* (*IPCO 2016*), Liège, Belgium, June 2016, "On some polytopes contained in the 0,1 hypercube that have a small Chvátal rank".

Service

Conference Organization

- INFORMS 2024 Annual Meeting, session on "Optimization under non-stationary environments", Seattle, WA, USA, October 2024.
- INFORMS 2023 Annual Meeting, session on "Projection-free first-order optimization methods", Pheonix, AZ, USA, October 2023.
- SIAM Conference on Optimization (OP23), minisymposium on "Recent advances in matroid optimization", Seattle, WA, USA, June 2023.
- INFORMS 2020 Annual Meeting, session on "Recent advances in distributionally robust optimization", online, USA, November 2020.
- KISAM 2019 Annual Meeting, two special sessions on "Combinatorial and Discrete Optimization", Yeosu, South Korea, November 2019.

Reviewer

- Operations Research,
- Mathematics of Operations Research,
- Mathematical Programming, Series A and B,
- Mathematical Programming Computation,
- SIAM Journal on Optimization,
- SIAM Journal on Discrete Mathematics,
- INFORMS Journal on Optimization,
- INFORMS Journal on Computing,
- Journal of Optimization Theory and Applications,
- Optimization and Engineering,
- Optimization Methods and Software,

- Transportation Research Seriese B,
- Networks,
- Mathematical Methods of Operations Research,
- Journal of Combinatorial Theory, Series B,
- Combinatorica,
- European Journal on Combinatorics,
- IPCO (2020, 2023, 2024), ICALP 2021
- NeurIPS (2023, 2024), ICLR (2024, 2025), ICML (2024), AISTATS (2025), AAAI (2025)

Teaching

- Advanced Optimization for Data Science — Spring 2024
  Graduate School of Data Science, KAIST
- Convex Optimization — Fall 2022, 2023, 2024
  Department of Industrial Systems Engineering, KAIST
- Operations Research I: Optimization — Spring 2023, 2024
  Department of Industrial Systems Engineering, KAIST
- Integer Programming — Spring 2023, 2025
  Department of Industrial Systems Engineering, KAIST
- Topics in Integer Programming and Combinatorial Optimization — Spring 2019
  Tepper School of Business, Carnegie Mellon University

Student Advising

Postdocs

- Duksang Lee (Postdoc; now at Hyundai Motors) — 03/2023 - 09/2023

Graduate Students

- Jaehyun Park (KAIST ISysE) — 03/2023 -
- Junyeop Kwon (KAIST ISysE) — 03/2023 -
- Sungwoo Park (KAIST ISysE) — 08/2023 -
- Seoungbin Bae (KAIST ISysE) — 03/2024 -
- Kihyun Yu (KAIST ISysE) — 03/2024 -
- Junyoung Son (KAIST GSDS) — 09/2024 -
- Hoyeol Yoon (KAIST ISysE) — 03/2025 -

Interns

- Woojin Chae (Undergraduate at KAIST Math) 01/2024 -
- Yeongjong Kim (Ph.D. student at KAIST Math; now a postdoc at POSTECH CM2LA) 10/2022 - 02/2024
- Duksang Lee (Ph.D. student at KAIST Math) 10/2021 - 02/2023
- Yunbum Kook (Undergraduate at KAIST Math; now a Ph.D. student at Georgia Tech CS) 01/2021 - 07/2021
- Will Overman (Masters student at UC Irvine CS; now a Ph.D. student at Stanford GSB) 03/2021 - 08/2021