# Kartikey Sharma

*Curriculum Vitae*

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## Research Interests

Optimization under uncertainty, Machine Learning, Interpretability, Transportation, Healthcare

## Education

2014 - 2020 **PhD**, *IEMS, Northwestern University, Evanston*, Advisor: Omid Nohadani.
Title: Optimization under Variable Uncertainty

2014 - 2015 **MS**, *IEMS, Northwestern University, Evanston*, *GPA – 3.9*.

2009 - 2014 **MBA**, *Indian Institute of Technology, Roorkee*, *GPA: 9.1/10*.

2009 - 2014 **B.Tech**, *Indian Institute of Technology, Roorkee*, *GPA – 9.1/10*.

## Experience

2020 - 2024 **Postdoctoral Researcher and Research Area Lead**, Zuse Institute Berlin, Advisor: Sebastian Pokutta.

Conducted research, advised and taught students and managed a research thrust:

- *Research*: I collaborated on several research projects inside and outside the institute on optimization, machine learning, interpretability, etc.
- *Teaching and Advising*: I developed and taught a course at TU Berlin on optimization under uncertainty. I worked with several Bachelor's and Master's students on their thesis.
- *Research Area Lead*: I evaluated new applications and organized seminars and workshops on relevant research topics.

2015 - 2020 **Research Assistant**, Northwestern University, IL.

Developed robust optimization models for variable uncertainties:

- *Decision Dependent Uncertainty*: Uncertainty sets can depend on decisions made within the problem. I evaluated the complexity of such problems and provided a family of models which improve the computational performance. These models are applicable to transportation, power distribution, etc.
- *Connected Uncertainty*: The Uncertainty model in a period can depend on uncertainty realizations from previous periods. I provided reformulations for general robust and distributionally robust problems and evaluated their performance for knapsack and portfolio management problems.
- *Connected Classifier*: I extended the Minimax Probability Machine model to streaming data such that the classifier can adapt to new observations. This has direct applications in credit fraud detection, wind speed detection, etc.

2018 **Summer Research Scientist Intern**, Amazon, Seattle, WA.

Developed optimal shipment flow models in the Supply Chain and Optimization Department. Developed a novel optimization model along with a parameter estimation procedure. Delivered evaluations of the final model through simulations of historical data.

2013 **Summer Intern**, Deutsche Bank, Mumbai.

At the Custodial Services Department, worked on processes involved in foreign investment into India. Prepared a Key Operating Procedures manual for the bank's Account Documentation Team.

## Awards

George Nemhauser Best Paper Award, 2018, by the IEMS department of Northwestern University

Graduate fellowship by Northwestern's Graduate School, 2019

## Journal Publications

[1] Nohadani, O., Sharma, K. *Optimization under Decision Dependent Uncertainty*. **SIAM Journal on Optimization**, 28(2), 1773-1795, 2018

[2] Nohadani, O., Sharma, K. *Optimization under Connected Uncertainty*. **INFORMS Journal on Optimization**, 2022

[3] Kossen, T., Hirzel, M. A., Madai, V. I., Boenisch, F., Hennemuth, A., Hildebrand, K., Pokutta, S., Sharma, K., Hilbert, A., Sobesky, J., Galinovic, I., Khalil, A. A., Fiebach, J. B., and Frey, D. (2021). *Towards sharing brain images: Differentially private TOF-MRA images with segmentation labels using generative adversarial networks*. **Frontiers in Artificial Intelligence**, 5, 2022

[4] Aigner, K., Bärmann, A., Braun, K, Liers, F., Pokutta, S., Schneider, O., Sharma, K., Tschuppik, S. *Data-driven Distributionally Robust Optimization Over Time*. **INFORMS Journal on Optimization**, 2023

[5] Kruser, J., Sharma, K., Holl, J., and Nohadani, O. *Identifying Patterns of Medical Intervention in Acute Respiratory Failure: A Retrospective Observational Study*. **Critical Care Explorations**, 2023

[6] Kaur, R., Sharma, K., and Khanna, A. *Detecting earnings management in India: A sector-wise study*. **European Journal of Business and Management**, 2014

## Conference Proceedings

[1] Sharma, K., Hendrych, D., Besançon, M., and Pokutta, S. *Network Design for the Traffic Assignment Problem with Mixed-Integer Frank-Wolfe*. **Proceedings of INFORMS Optimization Society Conference**, 2024

[2] Wäldchen, S., Sharma, K., Zimmer, M., Turan, B., and Pokutta, S. *Merlin-Arthur Classifiers: Formal Interpretability with Interactive Black Boxes*. **Proceedings of International Conference on Artificial Intelligence and Statistics**, 2024

## Working Papers

[1] Göß, A., Martin, A., Pokutta, S., and Sharma, K. *Norm-induced Cuts: Optimization with Lipschitzian Black-box Functions*. Under Review

[2] Han, E., Sharma, K., Singh, K., and Nohadani, O. *Dynamic Capacity Management for Deferred Surgeries*. Under Review

[3] Goerigk, M., Hartisch, M., Merten, S., and Sharma, K. *Feature-Based Interpretable Surrogates for Optimization*. Under Review

## Presentations

INFORMS Annual Meeting 2024, Seattle

INFORMS Optimization Society Conference 2024, Houston

INFORMS Annual Meeting 2023, Phoenix

German OR Society Conference 2023, Hamburg

Optimization and Machine Learning Workshop, Waischenfeld

INFORMS Annual Meeting 2022, Indianapolis

DMV Annual Meeting 2022, Berlin

ICCOPT 2022, Bethlehem

Manufacturing Services and Operations Management Conference 2022, Munich

INFORMS Annual Meeting 2021, Anaheim

INFORMS Annual Meeting 2019, Seattle

INFORMS Annual Meeting 2018, Phoenix
ISMP 2018, Bordeaux
INFORMS Annual Meeting 2017, Houston
IFORS 2017, Quebec City
Poster, NEMFEST Workshop 2017, Atlanta
INFORMS Annual Meeting 2016, Nashville

## Teaching Experience

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| Summer 2024 | Lecturer for Optimization under Uncertainty at TU Berlin |
| Winter 2020 | Teaching Assistant for Organizational Behavior at NU |
| Spring 2019 | Teaching Assistant for Foundations of Optimization at NU |
| Winter 2018 | Teaching Assistant for Probability at NU |
| Fall 2015, 2016 | Teaching Assistant for Mathematical Programming at NU |

## Computer skills

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| Languages | Python, Julia, Java, C++ |
| Software | MATLAB, R, Gurobi, LaTeX |

## Professional Groups

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| 2022- | Postdoctoral Representative, MATH+ |
| 2016-2017 | President, Northwestern University INFORMS Chapter |
| 2015-2016 | Secretary, Northwestern University INFORMS Chapter |

## Organization and Outreach

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| 2024 | Presenting GPT-enabled interactive robot at LNdW at ZIB |
| 2024 | Member of the organizing committee of the BMS-BGSMath Junior Meeting in Berlin |
| 2023 | Member of the organizing committee of the MATH+ Thematic Einstein Semester in Berlin |

## Languages

English, Hindi

## Relevant Courses

Mathematical Statistics, Mathematical Optimization I&II (Linear and Nonlinear Optimization), Robust Optimization, Stochastic Optimization, Large Scale Optimization, Dynamic Programming, Combinatorial Optimization