Harshal D. Kaushik, Ph.D.

Data Scientist – Operations Research

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harshaldkaushik

Results-driven Operations Research Data Scientist with over six years of experience. Expertise in leveraging advanced analytics and machine learning algorithms to solve real-world business challenges. Proficient in applying optimization techniques to effectively solve complex problems and drive data-informed decision-making. Notable career highlights include recognition as an exemplary doctoral student and the achievement of a distinguished graduate fellowship.

Professional Experience

Data Scientist – Operations Research July 2022 – Aug 2023
Bayer Crop Science, St Louis, MO (Contract)

- Fine-tuned the OR model within the breeding pipeline (to schedule the planting population of 25-30K within a 171K sq. feet greenhouse area). Substantial increase in the adoption rate from 65-70% to 75%.
- Enhanced the efficiency of weekly workflow schedules in the trait delivery pipeline by incorporating capacity management, calendarized forecasts, and resource balancing.
- Contributed to the development of new features in the existing OR models, leveraging CPLEX, Python.
- Effectively conveyed project updates to stakeholders, ensuring a clear depiction of the current status.

Postdoctoral Associate Oct 2021 – July 2022
Department of Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA

- Experienced in building efficient machine learning algorithms and estimating their complexity.
- Provided guidance and mentorship to Ph.D. students in their doctoral thesis pursuits.
- Engaged as a speaker and organizer at prestigious conferences, including INFORMS, ACC, and AAAI.

Operations Research Intern May 2019 – Aug 2019
Schneider: Transportation, Freight Shipping & Logistics, Green Bay, WI

- Engaged in solving a strategic *network pricing* problem (MIP) for the entire US network.
- Developed a novel algorithm by combining CPLEX solver with an iterative gradient descent scheme.
- The proposed solution anticipated to deliver substantial cost savings (estimated revenue gains $0.6M).

Graduate Research Assistant Jan 2017 – Oct 2021
School of Industrial Engineering & Management, Oklahoma State University, Stillwater, OK

- Designed algorithms (along with the rate analysis) for large-scale ill-posed optimization problems.
- Investigated the effectiveness of equilibria in noncooperative Nash games.
- Developed block-coordinate gradient-based algorithms for finite sum distributed optimization problem (addressing the high-dimensionality in support vector machines (SVM)).

Project Associate June 2015 – Nov 2016
Indian Institute of Technology (IIT) Madras, Chennai, TN, India

- Design optimization of Savonius wind turbine. Employed importance sampling for estimating failure probabilities and approximating cumulative distribution functions within a probit space.
- Conducted trajectory optimization and stability analysis of UAVs intended for surveillance application.

Education

Ph.D. in Operations Research 2017 – 2021
School of Industrial Engineering and Management, Oklahoma State University
Dissertation: On Distributed Optimization Problems with Variational Inequality Constraints: Algorithms, Complexity Analysis, and Applications.

M.Tech. in Applied Mechanics 2013 – 2015
Indian Institute of Technology (IIT), Madras, India.

B.E. in Mechanical Engineering 2008 – 2012
University of Pune, India.

Programming Skills

- **Operations Research:** CPLEX, Gurobi, IBM OPL.
- **Data Analysis:** SQL, R, Java, Python (NumPy, Pandas, Matplotlib, SciKit-Learn).
- **AWS cloud:** EC2 server, S3 bucket
- **Domino** Dashboard; **Github**

Awards and Scholarships

- Roy and Virginia Dorrough Distinguished Graduate Fellowship (awarded by the Graduate College, Oklahoma State University). 2020 – 2021
- Robberson Summer Research and Creative Activity Grant (awarded by the Graduate College, Oklahoma State University). 2021
- IEM Doctoral Student Award (awarded by the School of Industrial Engineering and Management, Oklahoma State University for exemplary performance in the graduate program). 2020
- Nominated for INFORMS Doctoral Student Colloquium, INFORMS, Annual Meeting. 2021
- Member of an honor society for Industrial and Systems Engineering students: Alpha Pi Mu. 2018 – Present
- Member of the Society for Industrial and Applied Mathematics (SIAM). 2020 – Present
- Member of the Institute of Operations Research and Management Science (INFORMS). 2018 – Present

Select Publications

[1] H. D. Kaushik, S. Samadi, and F. Yousefian, "An incremental gradient method for optimization problems with variational inequality constraints", *IEEE Transactions on Automatic Control*, April 2023. arXiv: 2105.14205 [math.OC].

[2] H. D. Kaushik and F. Yousefian, "A method with convergence rates for optimization problems with variational inequality constraints", *SIAM Journal on Optimization*, vol. 31, no. 3, pp. 2171–2198, 2021. [Link].

[3] M. Jin, V. Khattar, H. D. Kaushik, B. Sel, and R. Jia, "On solution functions of optimization: Universal approximation and covering number bounds", *accepted at the 36th AAAI Conference on Artificial Intelligence (AAAI-23), January 2023.*

[4] A. Al-Tawaha, H. D. Kaushik, and M. Jin, "Decision focused learning for inverse noncooperative games: Generalization bounds and convergence analysis", acceptted for *IFAC World Congress*, March 2023. arXiv: 2203.12653 [math.OC].

Grant Proposals

1. H. D. Kaushik, "Mathematical models for distributed optimization problems subject to variational inequality constraints", *Graduate College Robberson Summer Research and Creative Activity Grant, CEAT Oklahoma State University, May 2021* (awarded).

2. Ming Jin, Zuyi Li, Zoltan Nagy, and H. D. Kaushik, "Trustworthy reinforcement learning for smart communities to combat climate change", *Digital Transformation and AI for Energy and Climate Security (C3.ai DTI), December 2021* (submitted).

Conference Presentations and Guest Lectures

- "Decision-focused utility learning", **INFORMS Annual Meeting 2022**, Indianapolis, IN (Oct. 16$^{\text{th}}$, 2022).
- Guest Lecture for an Advanced Machine Learning Course, **ECE 5424 - Virginia Tech** (April 21$^{\text{st}}$, 2022).
- "Decision-focused Utility Learning", Poster presentation at the **CPES-PEC Conference, Virginia Tech** (April 14$^{\text{th}}$, 2022).
- "Distributed optimization problems with variational inequality constraints: algorithms, complexity analysis, and applications", **2021 INFORMS Annual Meeting** (Oct 24$^{\text{th}}$, 2021).
- "An incremental gradient method for large-scale distributed nonlinearly constrained optimization", **ACC 2021** (May 25$^{\text{th}}$, 2021).
- "An incremental gradient method for large-scale distributed nonlinearly constrained optimization", **INFORMS Annual Meeting 2020** (Nov. 13$^{\text{th}}$, 2020).
- "First-order methods for optimization over the solution set of variational inequality problems", **INFORMS Annual Meeting 2019**, Seattle, WA (Oct. 22$^{\text{nd}}$, 2019).
- "A randomized block coordinate iterative regularized subgradient method for high-dimensional ill-posed convex optimization", **2019 American Control Conference**, Philadelphia, PA (Jul. 11$^{\text{th}}$, 2019).
- "A first order method for high-dimensional ill-posed optimization problems", **INFORMS Annual Meeting 2018**, Phoenix, AZ (Nov. 5$^{\text{th}}$, 2018).
- "Utilization of wind shear for powering unmanned aerial vehicles in surveillance application: A numerical optimization study", **Fifth International Conference on Advances in Energy Research, ICAER 2015**, Mumbai, India (Dec. 16$^{\text{th}}$, 2015).

Academic Service and Leadership Activities

- Session Chair for **2023 INFORMS Annual Meeting**: Predictive Analytics and Game Theoretic Techniques for Smart Network Grids.
- Session Chair for **2022 INFORMS Annual Meeting**: Trustworthy Reinforcement Learning for Energy Systems.
- Session Chair for **2022 INFORMS Annual Meeting**: Predictive Analytics for Game Theory.
- Session Chair for **2021 INFORMS Annual Meeting**: Algorithms for Hierarchical and Distributed Optimization.
- Reviewer for the **IEEE Transactions on Automatic Control (TAC)**: 2022, 2023.
- Reviewer for the **IEEE Conference on Decision and Control (CDC)**: 2021, 2022, 2023.
- Reviewer for the **C3.ai Digital Transformation Institute (C3DTI) (Third call for proposals)**: 2022.

Doctoral Coursework (Operations Research)

• Distributed & Parallel Optimization • Stochastic Processes • Network Optimization • Convex Optimization • Integer & Combinatorial Optimization • Nonlinear Programming • Optimization Under Uncertainty