Harshal D. Kaushik

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Employment

Postdoctoral Associate Fall 2021 – Present
Bradley Department of Electrical and Computer Engineering, Virginia Tech.
Research Project: Decision focused learning for optimization problems with variational inequality constraints (utility learning and incentive design in a game theoretic framework).

Education

Ph.D. in Industrial Engineering and Management 2017 – 2021
Oklahoma State University
Advisor: Dr. Farzad Yousefian
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.

Awards and Scholarships

- Robberson Summer Research and Creative Activity Grant. 2021
- Roy and Virginia Dorrough Distinguished Graduate Fellowship. 2020 – 2021
- 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
- Member of an honor society for Industrial and Systems Engineering students: Alpha Pi Mu. 2018 – Present
- M.Tech. scholarship from the Ministry of Human Resource and Development, Government of India. 2013 – 2015

Research Interest

- Multi-agent distributed optimization
- Reinforcement learning theory
- Large-scale optimization
- Nonlinear programming
- Applications: noncooperative Nash games, Stackelberg games, traffic equilibrium problems, and image processing.

Publications

[1] H. D. Kaushik, A. S. Al-Tawaha, and M. Jin, "Rate guarantees of implicit gradient schemes for utility learning and incentive design in stackelberg games", *manuscript under preparation.*

[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] H. D. Kaushik and F. Yousefian, "Distributed optimization for problems with variational inequality constraints", submitted to *IEEE Transactions on Automatic Control*, May 2021. arXiv: 2105.14205 [math.OC].

[4] V. Khattar, Q. Wani, H. D. Kaushik, Z. Chang, and M. Jin, "Zeroth-order implicit reinforcement learning for sequential decision making in distributed control systems", *manuscript under preparation.*

[5] P. Ramu and H. D. Kaushik, "A log-third order polynomial normal transformation approach for high-reliability estimation with scarce samples", *International Journal of Reliability and Safety*, vol. 14, no. 1, pp. 14–38, 2020. [Link].

[6] F. Yousefian, J. Yevale, and H. D. Kaushik, "Distributed randomized block stochastic gradient tracking method", submitted for *2022 American Control Confernce (ACC)*, Oct. 2021. arXiv: 2110.06575 [math.OC].

[7] H. D. Kaushik and F. Yousefian, "An incremental gradient method for large-scale distributed nonlinearly constrained optimization", in *2021 American Control Conference (ACC)*, 2021, pp. 953–958. [Link].

[8] H. D. Kaushik and F. Yousefian, "A randomized block coordinate iterative regularized subgradient method for high-dimensional ill-posed convex optimization", in *2019 American Control Conference (ACC)*, Philadelphia, PA, USA, 2019, pp. 3420–3425. [Link].

[9] H. D. Kaushik, R. Mohan, and K. A. Prakash, "Utilization of wind shear for powering unmanned aerial vehicles in surveillance application: A numerical optimization study", in 5^{th} *International Conference on Advances in Energy Research, ICAER 2015*, Mumbai, India, Energy Procedia, vol. 90, 2016, pp. 349–359. [Link].

Conference Presentations

- "Distributed optimization problems with variational inequality constraints: algorithms, complexity analysis, and applications", **2021 INFORMS Annual Meeting** (Oct 24^{th}, 2021).
- "An incremental gradient method for large-scale distributed nonlinearly constrained optimization", **ACC 2021** (May 25^{th}, 2021).
- "An incremental gradient method for large-scale distributed nonlinearly constrained optimization", **INFORMS Annual Meeting 2020** (Nov. 13^{th}, 2020).
- "First-order methods for optimization over the solution set of variational inequality problems", **INFORMS Annual Meeting 2019**, Seattle, WA (Oct. 22^{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^{th}, 2019).
- "A first order method for high-dimensional ill-posed optimization problems", **INFORMS Annual Meeting 2018**, Phoenix, AZ (Nov. 5^{th}, 2018).
- "Utilization of wind shear for powering unmanned aerial vehicles in surveillance application: A numerical optimization study", **5th International Conference on Advances in Energy Research, ICAER 2015**, Mumbai, India (Dec. 16^{th}, 2015).

Academic Service

- Session Chair for **2021 INFORMS Annual Meeting**: Algorithms for Hierarchical and Distributed Optimization.
- Reviewer for the **60$^{\text{th}}$ IEEE conference on decision and control (CDC)**, 2021.

Teaching Experience

- TA for **Engineering and Economic Analysis** (IEM 3503): Spring 2019, 2020. Fall 2017, 2018.
- TA for **Production Planning and Control Systems** (IEM 4613): Fall 2018, 2019.
- TA for a graduate level course, **Introduction to Optimization** (IEM 5013): Fall 2019.

Coursework and Programming Skills

- **Doctoral coursework**: Distributed and Parallel Optimization (IEM 6990), Stochastic Processes (IEM 5133), Network Optimization (IEM 5063), Convex Optimization (IEM 6990), Integer and Combinatorial Optimization (IEM 6053), Nonlinear Optimization (IEM 6043), Optimization Under Uncertainty (IEM 6063).
- **Programming**: Python 3 (NumPy, SciPy, pandas), SQL, docplex, Gurobi, CVX.
- **Engineering analysis software**: CATIA v5, ANSYS Fluent, OpenFOAM.