Abhishek Umrawal

✍ 3054 ECE Building, Mail Code: 702 | 306 N. Wright St., Urbana, IL 61801

☎ (315) 504-5658 ✉ aumrawal@illinois.edu ☞ abhishekumrawal.github.io

Research Summary

My research studies algorithmic decision-making in networked and platform-based systems. I focus on how incentives, data, and AI shape user behavior, system outcomes, and operational performance. Methodologically, I develop algorithmic and data-driven models combining operations research, machine learning, and economics to study diffusion, targeting, resource allocation, and strategic behavior.

- **Networked Systems and Algorithmic Decision-Making:** I study influence dynamics, incentive design, and sequential decision-making in networked and platform-based environments. I develop learning and optimization methods for allocating resources and shaping behavior when decisions interact through complex systems, with an emphasis on scalable algorithms and performance guarantees.
  Journal pipeline: Management Science (2); Information Systems Research (1); Operations Research (1).
- **AI Systems and Strategic Behavior:** I study the safety, control, and trustworthiness of modern AI systems, with an emphasis on controllable text generation and strategic behavior in large language models. I develop causal and game-theoretic approaches to understand and influence AI behavior, including manipulation, intent-hiding, and interactions between AI systems and users.
  Journal pipeline: INFORMS Journal on Computing (1).

Overall, my work bridges AI, optimization, and networked systems to understand and design algorithmic decision-making at scale.

Education and Training

- **Purdue University** Aug. 2023
  College of Engineering
  Doctor of Philosophy, Industrial Engineering (Operations Research)
  Dissertation: Machine Learning Algorithms for Influence Maximization on Social Networks
  Advisors: Vaneet Aggarwal and Christopher Quinn
  Honors: Bilsland Dissertation Fellow (2022); Trailblazers in Engineering Fellow (2021)
- **Purdue University** May 2021
  Mitch E. Daniels, Jr. School of Business
  Master of Science, Economics

  Department of Statistics and Data Science
  Master of Science, Statistics

Academic Appointments

- **University of Illinois Urbana-Champaign, Urbana, IL** Aug. 2023 – Present
  Teaching Assistant Professor, Department of Electrical and Computer Engineering
  - ▷ *Affiliations:* Coordinated Science Lab, National Center for Supercomputing Applications, Grad College
  - ▷ *Honors:* Stanley H. Pierce Award (2026); Engineering Council Outstanding Advisor Award (2026)
- **University of Maryland, Baltimore County, Baltimore, MD** Aug. 2022 – June 2023
  Visiting Lecturer, Department of Computer Science and Electrical Engineering

Research Papers

Google Scholar (scholar.google.co.in/citations?user=ezM7mtQAAAAJ&hl=en): Citations 411; h-index 11

Journal Papers

J4. **Maximizing the Spread of Influence through a Social Network Using Partial Incentives** with Eliot Robson, Vaneet Aggarwal, and Christopher Quinn, in *Journal of Artificial Intelligence Research (JAIR)*, 2026.

- Earlier version in *IEEE Conference on Decision and Control (CDC)*, 2023.

J3. **A Community-Aware Framework for Social Influence Maximization** with Christopher Quinn and Vaneet Aggarwal, in *IEEE Transactions on Emerging Topics in Computational Intelligence (T-ETCI)*, 2023.

- Earlier versions in:
  - ▷ *ACM SIGMETRICS Performance Evaluation Review (PER)*, 2022.
  - ▷ *AAAI Workshop on Graphs and Other Complex Structures for Learning and Reasoning (GCLR)*, 2022.

J2. **Stochastic Top-k Subset Bandits with Linear Space and Non-Linear Feedback with Applications to Social Influence Maximization** with Mridul Agarwal, Vaneet Aggarwal, and Christopher Quinn, in *ACM/IMS Transactions on Data Science (TDS)*, 2022.

- Earlier version in *Algorithmic Learning Theory (ALT)*, 2021.

J1. **FlexPool: A Distributed Model-Free Deep Reinforcement Learning Algorithm for Shared Passengers and Goods Delivery** with Kaushik Manchella and Vaneet Aggarwal, in *IEEE Transactions on Intelligent Transportation Systems (T-ITS)*, 2021.

- Earlier version in *ACM Computer Science in Cars Symposium (CSCS)*, 2020.

Journal Manuscripts

JR5. **Optimizing Marketing Budgets for Social Influence: A Generalized Fractional Incentives Framework** with Akhil Bhimaraju, Eliot Robson, and Lav Varshney. *In preparation for Management Science*.

- Earlier version in *ACM International Conference on Information and Knowledge Management (CIKM)*, 2024.

JR4. **How Social Reinforcement Shapes Word-of-Mouth: A Conviction-Based Model for Marketing Diffusion and Network Targeting** with Curt Stutsman, Camille Woods, and Eliot Robson. *In preparation for Management Science*.

- Earlier version in *International AAAI Conference on Web and Social Media (ICWSM)*, 2026.

JR3. **Regulating Attention in Digital Platforms via Dynamic Taxation and Strategic Learning** with Eliot Robson, Alex Zheng, Elaine Ly, and Lav Varshney. *In preparation for Information Systems Research*.

- Earlier version in *ACM Workshop on Cognitive Security for Human–AI Systems (CogSec)*, 2026.

JR2. **Adaptive Exploration and Exploitation for Sequential Decision-Making under Uncertain and Weakly Separated Rewards** with Advaith Anand. *In preparation for Operations Research*.

- Earlier version in *NeurIPS Workshop on Mathematical Foundations and Operational Integration of Machine Learning for Uncertainty-Aware Decision-Making (ML×OR)*, 2026.

JR1. **A Game-Theoretic Analysis of Attacks on Large Language Models via Compositional Skills** with Xinbo Wu, Huan Zhang, and Lav Varshney. *In preparation for INFORMS Journal on Computing*.

- Earlier version in *International Conference on Machine Learning (ICML)*, 2026.

Conference Proceedings (Peer-Reviewed)

Note: *Peer-reviewed conference publications, including ICML, ICWSM, SIGMETRICS, CIKM, ALT, and CDC, that are earlier versions of journal papers or manuscripts are listed with the entries above and are not repeated here.*

C5. **CyNetDiff: A Python Library for Accelerated Implementation of Network Diffusion Models** with Eliot Robson and Dhemath Reddy, in *International Conference on Very Large Data Bases (VLDB)*, 2024.

C4. **Leveraging Causal Graphs for Blocking in Randomized Experiments** in *Conference on Causal Learning and Reasoning (CLeaR)*, 2023.

- Earlier version in *NeurIPS Workshop on Causal Inference Challenges in Sequential Decision Making (CSDNeurIPS)*, 2021.

C3. **An Explore-then-Commit Algorithm for Submodular Maximization under Full-Bandit Feedback** with Guanyu Nie, Mridul Agarwal, Vaneet Aggarwal, and Christopher Quinn, in *Conference on Uncertainty in AI (UAI)*, 2022.

C2. **DART: Adaptive Accept Reject Algorithm for Non-Linear Combinatorial Bandits** with Mridul Agarwal, Vaneet Aggarwal, and Christopher Quinn, in *AAAI Conference on AI (AAAI)*, 2021.

C1. **DeepFreight: A Model-Free Deep-Reinforcement-Learning-Based Algorithm for Multi-Transfer Freight Delivery** with Jiayu Chen, Tian Lan, and Vaneet Aggarwal, in *International Conference on Automated Planning and Scheduling (ICAPS)*, 2021.

Additional Working Papers

W4. **Efficient Influencer Selection across Interconnected Communities** with Eliot Robson.

W3. **Efficient Sequential Influencer Selection under Limited Feedback** with Advaith Anand.

W2. **Causal Steering of LLMs via Latent Vector Manipulation** with Yingbing Huang and Deming Chen.

W1. **Causal Analysis of Mixture-of-Experts Systems** with Huiting Zhou, Yunze Xiao, and Zixin Mao.

Education and Teaching Publications

E2. **Low Effort, High Grades? Benchmarking LLMs on Engineering Assignments** with Yuxuan Chen, Siegfried Egg, Abdussalam Alawini, Mariana Silva, Max Fowler, and Melkior Ornik, in *ASEE Annual Conference and Exposition*, 2026.

E1. **Understanding the Impact of Ungraded Assignments on Student Learning in Introductory Computing** with Yehya Sleiman Tellawi, in *ASEE Annual Conference and Exposition*, 2026.

- Earlier version in *ACM Technical Symposium on Computer Science Education (SIGCSE)*, 2026.

Open-Source Software

S1. **CyNetDiff: A Python Library for Accelerated Implementation of Network Diffusion Models**

Developed and maintained a scalable open-source library for network diffusion modeling, distributed via PyPI (`pip install cynetdiff`), with an associated publication in the *International Conference on Very Large Data Bases (VLDB)*, 2024.

Grants and Funding

- **Artificially Successful? Investigating Generative AI's Ability to Solve Course Assignments** 2025–2027
  Strategic Instructional Innovation Program (SIIP); *Role: Co-PI; Amount: $36,800 (Year 1), $30,000 (Year 2)*
- **SIIP and Share: Podcasts to Connect the Engineers of The Grainger College of Engineering** 2026–2027
  Strategic Instructional Innovation Program (SIIP); *Role: Co-PI; Amount: $30,000 (Year 2)*
- **Developing Reference Sheets for Undergraduate Probability and Algorithms** 2025–2026
  Strategic Instructional Innovation Program (SIIP); *Role: PI; Amount: $7,000*
- **Studying How Ungraded Assignments Affect Learning in Introductory Computing** 2024-2026
  Grants for Advancement of Teaching in Engineering (GATE); *Role: PI; Amount: $8,000*

Teaching Experience

- **University of Illinois Urbana–Champaign** (Instructor) Fall 2023 – Present
  - ▷ Financial Computing, Statistics for Finance, Algorithms & Models of Computation, Probability, Data Science & Engineering, Introductory Computing, Systems & Programming
- **University of Maryland, Baltimore County** (Instructor) Fall 2022 – Spring 2023
  - ▷ Artificial Intelligence, Machine Learning, Automata Theory, Software Engineering
- **Purdue University** (Graduate Instructor/Teaching Assistant) Fall 2017 – Spring 2020
  - ▷ Optimization, Probability and Statistics, Economic Decisions in Engineering, Calculus
- **Johns Hopkins University** (Instructor) Summer 2019
  - ▷ Game Theory, Economics
- **University of Delhi** (Instructor) Spring 2013 – Summer 2017
  - ▷ Econometrics, Time Series, Statistical Computing, Data Mining, Probability
- **Bridge School of Management** (Visiting Instructor) Spring 2015 – Spring 2017
  - ▷ Statistical Methods, Analytics Communication (delivered in the Predictive Business Analytics Program in collaboration with Northwestern University School of Professional Studies)

Research Advising and Mentorship

- **PhD Students (research project mentoring):** Eliot Robson (CS), Akhil Bhimaraju (ECE), Yingbing Huang (ECE), Raj Velicheti (ECE), Xinbo Wu (ECE)
- **Undergraduate Research Advisees:** Anh Phung (CS + Stat), Chris Deng (CS), Dhemath Reddy (CS), KaiZhou Yan (CS + Math), Curt Stutsman (ECE), Yehya Tellawi (ECE), Ayush Jain (CS + Philosophy), Terence Zheng (ECE), Huiting Zhou (ECE), Advaith Ananth (ECE), Camille Woods (ECE), Tian Tu (ECE)
- **Professional MS Advising:** Faculty advisor to two MS Financial Engineering teams, *Eighteen67ers* and *IlliniTraders*, competing in the Bloomberg Trading Challenge, 2026.
- **Visiting Students:** Jaime Soto (Wilbur Wright College)
- **Student Outcomes:** Mentees have progressed to MS/PhD programs and roles at leading technology companies (e.g., Google, Databricks, Stripe)

Industry Experience

- **Accenture Management Consulting** (Marketing Analyst), Gurugram, India June 2011 – Nov. 2012
  - ▷ Conducted promotional analytics, pricing strategy evaluation, and sales forecasting for clients in retail, finance, and telecom.

Selected Talks

- **Optimizing Marketing Budgets for Social Influence: A Generalized Fractional Incentives Framework**, INFORMS Annual Meeting, San Francisco, CA, 2026
- **Beyond Free Products: Influence Maximization with Partial Incentives**, Mitch Daniels School of Business, Purdue University, 2026
- **Trustworthy AI: Causal Control and Intent-Hiding Games in LLMs**, Siebel School of Computing and Data Science, University of Illinois Urbana–Champaign, 2025
- **Influence Maximization under Fractional Budget Allocation**
  - ▷ Department of Computer Science & Engineering, IIT Delhi, 2024
  - ▷ School of Computing, National University of Singapore, 2023
  - ▷ Coordinated Science Laboratory, University of Illinois Urbana–Champaign, 2023

Awards and Fellowships

- Gold Reviewer Award, International Conference on Machine Learning (ICML), 2026
- Stanley H. Pierce Award, University of Illinois Urbana-Champaign, 2026
- Engineering Council Outstanding Advisor Award, University of Illinois Urbana-Champaign, 2026
- Bilsland Dissertation Fellowship, Purdue University, 2022
- Certificate of Excellence in Research, Purdue University, 2022
- Trailblazers in Engineering Fellowship, Purdue University, 2021
- Graduate Research Mentor Award, Purdue University, 2020
- Faculty Excellence Award, Bridge School of Management, 2015
- Management Consulting Rockstar Sales Award, Accenture, 2012

Professional Service

- **Journal Reviewing:** SIAM J. Optimization, Trans. Machine Learning Research, ACM Trans. Knowledge Discovery from Data, ACM Trans. Internet Technology, IEEE Trans. Computational Social Systems, IEEE Trans. Knowledge and Data Engineering, IEEE/ACM Trans. Network Science and Engineering, IEEE/ACM Trans. Networking, IEEE Trans. Information Theory, IEEE Trans. Intelligent Transportation Systems, Transportation Research Part E, Springer Nature J. Supercomputing
- **Conference Reviewing:** ICML (2024–2026), NeurIPS (2025–2026), SIGKDD (2026), ICWSM (2026), AAAI (2022, 2026), ICLR (2024), UAI (2023–2026), CLeaR (2023), PAKDD (2022), ECML (2022), AISTATS (2020)
- **Session Chair at Conferences:** CIKM (2024)

In the News

- University of Illinois Urbana-Champaign News on Generative AI Safety Research (2026).
  Link: ece.illinois.edu/news/player-one-winner-ece-doctoral-students-theoretical-game-of-ai-attacks-places-at-llm-conference.
- University of Illinois Urbana-Champaign News on Faculty Awards for Advising and Mentorship (2026).
  Link: ece.illinois.edu/news/ece-faculty-recognized-for-advising-mentorship-and-leadership-development.
- Research on causal AI featured by Judea Pearl (2021).
  Links: twitter.com/yudapearl/status/1458102656178720770; twitter.com/yudapearl/status/1458102657730715648.