Daniel Russo

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Field of Specialization

Broad Area: Algorithms that drive sequential decision making under uncertainty in fast-paced digital systems.

Keywords: Reinforcement learning; Multi-armed bandits; Recommender systems

Education

2011 - 2015 **Stanford University**, *Stanford, CA.*
PhD in Management Science and Engineering
Concentration area: Operations Research
Advisor: Benjamin Van Roy
Dissertation title: *Efficient Learning in Sequential Optimization*

2007 - 2011 **University of Michigan**, *Ann Arbor, MI.*
Bachelor of Science in Economics (*with highest honors*) and Mathematics (*with honors*)

Academic Appointments

Columbia University, Graduate School of Business, *New York, NY.*
Decision Risk & Operations Division

2022-Present Philip H. Geier Jr. Associate Professor
2021-2022 Associate Professor
2017-2021 Assistant Professor

Northwestern University, Kellogg School of Management, *Evanston, IL.*
Operations Department

2016-2017 Assistant Professor

Professional Experience

2020-Present **Spotify**, *New York, NY.*
Consultant, Staff Machine Learning Engineer.

2015-2016 **Microsoft Research**, *Cambridge, MA.*
Postdoctoral Research Scientist

2013 **oDesk (now Upwork)**, *Redwood City, CA.*
Intern - developed automated skills testing system for job market candidates

2011 **Charles River Associates**, *Boston, MA.*
Summer Analyst – Competition and Antitrust practice

Honors and Awards

2023 Full Oral presentation at machine learning conference ICML (2.2% of submissions)

2022 Frederick W. Lanchester Prize: *Awarded for a paper, a book, or a group of books or papers that represent the "best contribution to operations research and the management sciences published in English in the past five years"*

2016 First place, INFORMS 2016 Junior Faculty Interest Group (JFIG) paper competition

2014 First place in INFORMS George Nicholson student paper competition

2014 Accel Graduate Fellowship

2013 Oral presentation at machine learning conference NeurIPS (1.4% of submissions)

2011-2014 Stanford Graduate Fellowship

2011 Ferrando Honors Prize: *"Awarded annually to the best senior pursuing honors in Economics" at the University of Michigan.*

Peer Reviewed Journal Papers

For my papers in operations research venues, authors are listed in alphabetical order, except when a student or postdoc is listed as first author in order to highlight their involvement. In machine learning papers that have many junior authors, authorship order is often based on contribution. This applies to the journal paper listed 10th.

1. J. Bhandari and D. Russo, *Global Convergence Guarantees for Policy Gradient Methods.* Operations Research, 2024.

2. D. Russo, *Approximation Benefits of Policy Gradient Methods with Aggregated States.* Management Science, Vol. 69, No. 11, pp. 6898-6911, 2023.

3. D. Russo and B. Van Roy, *Satisficing in Time Sensitive Bandit Learning.* Mathematics of Operations Research, Vol. 47, No. 4, pp. 2815–2839, 2022.

4. A. Kim, S. Balserio, D. Russo, *On the Futility of Dynamics in Robust Mechanism Design.* Operations Research, Vol. 69, No. 6, pp. 1767-1783, 2021.

5. J. Bhandari, D. Russo, and R. Singal, *A Finite Time Analysis of Temporal Difference Learning with Linear Function Approximation.* Operations Research, Vol. 69, No. 3, pp. 950-973, 2021.

6. D. Russo, *A Note on the Equivalence of Upper Confidence Bounds and Gittins Indices for Patient Agents.* Operations Research, Vol. 69, No. 1, pp. 273–278, 2021.

7. D. Russo, *Simple Bayesian Algorithms for Best Arm Identification.* Operations Research, Vol. 68, No. 6, pp. 1625–1647, 2020.

   - First place, INFORMS 2016 JFIG paper competition.

8. D. Russo and J. Zou, *How Much Does Your Data Exploration Overfit? Controlling Bias via Information Usage.* IEEE Transactions on Information Theory, Vol. 66, No. 1, pp. 302–323, 2020.

9. I. Osband, B. Van Roy, D. Russo, and Z. Wen, *Deep Exploration via Randomized Value Functions.* Journal of Machine Learning Research, Vol. 20, No. 124, pp. 1-62, 2019

10. D. Russo, B. Van Roy, A. Kazerouni, I. Osband, and Z. Wen, *A Tutorial on Thompson Sampling.* Foundations and Trends in Machine Learning, Vol. 11, No. 1, pp. 1-96, 2018.

11. D. Russo and B. Van Roy, *Learning to Optimize via Information-Directed Sampling.* Operations Research, Vol. 66, No. 1, pp. 230-252, 2018.

    - First place, INFORMS George Nicholson 2014 student paper competition.

12. D. Russo and B. Van Roy, *An Information Theoretic Analysis of Thompson Sampling.* Journal of Machine Learning Research Vol. 17, pp. 1-30, 2016.

13. D. Russo and B. Van Roy, *Learning to Optimize via Posterior Sampling.* Mathematics of Operations Research. Vol. 39, No. 4, pp. 1221-1243, 2014.

Peer Reviewed Conference Proceedings

*Papers displayed in gray are superseded by published journal papers listed elsewhere.

1. D. Cheikhi, and D. Russo, *On The Statistical Benefits of Temporal Difference Learning.* International Conference on Machine Learning (ICML), 2023

   - Full oral presentation; top 2.2% of submissions.
   - Finalist for the INFORMS Applied Probability Society best student paper award.

2. S. Min and D. Russo, *An Information-Theoretic Analysis of Nonstationary Bandit Learning.* International Conference on Machine Learning (ICML), 2023.

3. T. McDonald, L. Maystre, M. Lalmas, D. Russo, and K. Ciosek, *Impatient Bandits: Optimizing Recommendations for the Long-Term Without Delay.* Conference on Knowledge Discovery and Data Mining (KDD), 2023.

4. L. Maystre and D. Russo, *Temporally-Consistent Survival Analysis*, Advances in Neural Information Proecssing Systems (NeurIPS), 2022.

5. T. Zhang, D. Russo, A. Zeevi, *Learning to Stop with Surprisingly Few Samples*, Conference on Learning Theory (COLT), 2021.

6. J. Bhandari and D. Russo, *On the Linear Convergence of Policy Gradient Methods for Finite MDPs.* Artificial Intelligence and Statistics (AISTATS), 2021.

7. D. Russo, *Worst-Case Regret Bounds for Exploration via Randomized Value Functions.* Advances in Neural Information Processing Systems (NeurIPS), 2019.

8. J. Bhandari, D. Russo, and R. Singal, *A Finite Time Analysis of Temporal Difference Learning with Linear Function Approximation.* Conference on Learning Theory (COLT), 2018..

9. C. Qin, D. Klabjan and D. Russo, *Improving the Expected-Improvement Algorithm.* Advances in Neural Information Processing Systems (NeurIPS), 2017.

10. D. Russo and J. Zou, *Controlling Bias from Data Exploration via Information Usage.* Artificial Intelligence and Statistics (AISTATS), 2016.

    - Full oral presentation; top 7% of submissions

11. D. Russo, *Simple Bayesian Algorithms for Best Arm Identification.* Conference on Learning Theory (COLT), 2016.

12. D. Russo and B. Van Roy, *Eluder Dimension and the Sample Complexity of Optimistic Exploration.* Advances in Neural Information Processing Systems (NeurIPS), 2013.

    - Full oral presentation; top 1.4% of submissions.

13. I. Osband, D. Russo and B. Van Roy, *(More) Efficient Reinforcement Learning Via Posterior Sampling.* Advances in Neural Information Processing Systems (NeurIPS), 2013.

14. N. Arnosti and D. Russo, *Welfare-Improving Cascades and the Effect of Noisy Reviews.* Workshop on Internet & Network Economics (WINE), 2013.

Papers under review.

1. C. Qin and D. Russo, *Adaptive Experimentation in the Presence of Exogenous Nonstationary Variation.* Major revision at Management Science.

2. L. Maystre, D. Russo, and Y. Zhao, *Optimizing Audio Recommendations for the Long-Term: A Reinforcement Learning Perspective.* Major revision at Management Science.

3. M. Alvo, D. Russo, and Y. Kanoria, *Neural Inventory Control in Networks via Hindsight Differentiable Policy Optimization.* Submitted.

4. C. Qin and D. Russo, *Optimizing Adaptive Experiments: A Unified Approach to Regret Minimization and Best-Arm Identification.* Submitted.

5. S. Min, and D. Russo, *An Information-Theoretic Analysis of Nonstationary Bandit Learning.* Submitted.

6. K. W. Zhang, T. Cai, H. Namkoong, and D. Russo, *Posterior Sampling via Autoregressive Generation.* Submitted.

Other work in progress.

1. D. Cheikhi and D. Russo, *On the Limited Representational Power of Value Functions and its Links to Statistical (In) Efficiency.*

2. K. W. Zhang, T. McDonald, L. Maystre, M. Lalmas, D. Russo, and K. Ciosek, *Impatient Bandits: Optimizing Recommendations for the Long-Term Without Delay.*

   - A full-length paper that greatly expands an earlier conference publication.

3. C. Qin and D. Russo, *Best-arm Identification with Contexts: the Optimality of Context-Independent Experimentation.*

Patents

1. Maystre, L., Russo, D., Zhao, Y., Cantrell, S., Ghael, S.P., and Jebara, T. Systems and methods for training a natural language model. U.S. Patent Application, filed April 5, 2024. Patent Pending.

2. Maystre, L., Baldwin-Mcdonald, T., Lalmas-Roelleke, M., Russo, D., Ciosek, K.A., Wu, T., and Tanguy, G., Spotify AB. Optimizing selection of media content for long-term outcomes. U.S. Patent Application 18/627,301, filed April 4, 2024. Patent Pending.

3. Russo, D., Zhao, Y., Maystre, L., Bansal, S., Bhaskar, S., Wu, T., Gustafsson, D., Bredesen, D., Ojeda, R.S., and Jebara, T., Spotify AB. Systems and methods for providing content to users. U.S. Patent Application 18/472,919, filed September 22, 2023. Patent Pending.

Teaching Experience

Fall 2024	B6100-004 Managerial Statistics, Columbia GSB
	B6100-008 Managerial Statistics, Columbia GSB
	B6100-009 Managerial Statistics, Columbia GSB
	B6100-010 Managerial Statistics, Columbia GSB
Fall 2023	B9120-001 Dynamic Programming, Columbia GSB

Fall 2022	B6100-002 Managerial Statistics, Columbia GSB
	B6100-003 Managerial Statistics, Columbia GSB
	B6100-004 Managerial Statistics, Columbia GSB
	B6100-005 Managerial Statistics, Columbia GSB
Spri 2022	B9152-001 Dynamic Programming II, Columbia GSB
	B6100-001 Managerial Statistics, Columbia GSB
	B6100-002 Managerial Statistics, Columbia GSB
	B6100-003 Managerial Statistics, Columbia GSB
Fall 2020	B6100-005 Managerial Statistics, Columbia GSB
	B6100-006 Managerial Statistics, Columbia GSB
	B6100-007 Managerial Statistics, Columbia GSB
	B6100-008 Managerial Statistics, Columbia GSB
Spri 2020	B9120-001 Dynamic Programming, Columbia GSB
Fall 2019	B6100-003 Managerial Statistics, Columbia GSB
	B6100-005 Managerial Statistics, Columbia GSB
	B6100-006 Managerial Statistics, Columbia GSB
	B6100-007 Managerial Statistics, Columbia GSB
Fall 2018	B6100-003 Managerial Statistics, Columbia GSB
	B6100-004 Managerial Statistics, Columbia GSB
	B6100-007 Managerial Statistics, Columbia GSB
	B6100-008 Managerial Statistics, Columbia GSB
Spri 2018	B6100-003 Managerial Statistics, Columbia GSB
Fall 2017	B9140-001 Dynamic Programming and RL, Columbia GSB
Spri 2016	OPNS-430: Operations Management, Northwestern
	OPNS-525: Learning in Sequential Decision Making, Northwestern

Doctoral Dissertation Committee Service

- David Cheikhi, third year PhD student at Columbia University. Advisor.
- Matias Alvo, third year PhD student at Columbia University. Co-Advisor.
- Chao Qin. Next position: Postdoctoral Researcher, Stanford University. Advisor.
  - Dissertation: in progress.
- Tianyi Zhang, Quantitative Researcher at Cubist Systematic (Part of Point72), Co-advisor.
  - Dissertation: Horizon-Free Reinforcement Learning in Dynamic Optimization (2024).
- Omar Mouchtaki, Assistant Professor, New York University. Committee Member.
  - Dissertation:Data-driven Decision-making: New Insights on Algorithm Performance and Data Value (2024).
- Yunbei Xu, Assistant Professor at National University of Singapore. Committee member.
  - Dissertation: Algorithm Design and Localization Analysis in Sequential and Statistical Learning (2023)

- Anand Kalvit, Postdoctoral Fellow, Stanford Immigration Policy Lab. Committee Member.
  - Dissertation: Improved Asymptotics for Multi-armed Bandit Experiments under Optimism-based Policies: Theory and Applications (2023).
- Yunhao Tang, Research Scientist at DeepMind. Committee Member.
  - Dissertation: Reinforcement Learning: New Algorithms and Applications for Integer Programming Problems (2021).
- Seungki Min, Assistant Professor, KAIST. Committee Member.
  - Dissertation: Modern Dynamic Programming Approaches to Sequential Decision Making (2021).
- Muye Wang, Two Sigma Investments. Committee Member.
  - Dissertation: Applications of Machine Learning in Financial Markets (2021).
- Jalaj Bhandari, Postdoctoral Researcher at Meta. Advisor.
  - Dissertation: Optimization Foundations of Reinforcement Learning (2020).
- Randy Jia, Applied Scientist at Afresh. Committee Member.
  - Dissertation: New Algorithms and Analysis Techniques for Reinforcement Learning (2020).
- Shuoguang Yang, Assistant Professor at HKUST. Committee Member.
  - Dissertation: Optimization and Revenue Management in Complex Networks (2020).

Professional Activities

Editorial Service

- Associate Editor, *Management Science*, 2022-present.
- Associate Editor, *Operations Research*, 2024-present.
- Associate Editor, *Stochastic Systems*, 2021-present.
- Ad-hoc Reviewer (Journals): *Operations Research; Management Science; Journal of Machine Learning Research; Stochastic Systems; Electronic Journal of Statistics; Journal of Applied Probability; Computational Optimization and Applications; Production and Operations Management; IEEE Transaction on Information Theory; Annals of Statistics*
- Reviewer (Conferences): *NeurIPS; ICML; COLT; AISTATS; ALT; ICLR (area chair in 2023)*

Other Service for the Professional Community

- Council Member, INFORMS Applied Probability, 2024-2025.
- Organizer, Workshop on Strategic and Utility-aware REcommendation, ACM Conference on Recommender Systems, 2024.
- Prize Committee, INFORMS George Nicholson Paper Competition, 2022-2023.
- Host, Virtual RL Theory Seminar, 2020.

Internal Service

- DRO PhD program director, 2024-present.
- Digital Future Initiative postdoc search committee, 2024.
- DRO admission committee, 2017-present.
- DRO qualifying exam committee, 2017-present.
- DRO faculty search committee, 2019-2020 and 2022-2023.
- Co-organizer, machine learning reading group, 2021, 2023-present.

Invited Talks

2023-2024
Marshall School of Business, University of Southern California
Data Science Lab, MIT
Kellogg School of Management, Northwestern University
Reinforcement Learning Symposium, Boston University
Deming Center Supply Chain Innovation Network, Columbia Business School

2022-2023
Simons Institute for the Theory of Computing, UC Berkeley
Consequences & Reveal Workshop, ACM Conference on Recommender Systems
Conference on Digital Experimentation, MIT
Business School, Hong Kong University of Science and Technology
Tepper School of Business, Carnegie Mellon University
Data Science Institute, Columbia University
Utah Winter Operations Conference
McCombs School of Business, University of Texas Austin
Booth School of Business, University of Chicago

2021-2022
Technology and Operations Management Seminar, INSEAD
Operations Research Colloquium, Penn State
Young Mathematicians Lecture Series, National University of Singapore
Industrial and Systems Engineering, University of Minnesota
Information Systems Laboratory, Stanford University
Stochastic Networks, Applied Probability, and Performance (SNAPP) Seminar
Cornell Tech
Graduate School of Business, Stanford University
Reinforcement Learning Theory Online Seminar
Machine Learning Seminar, University of Washington
Data Science Seminar, LinkedIn

2020-2021
Simons Institute for the Theory of Computing, UC Berkeley
Institute for Data Science and Dynamical Systems, University of Illinois
Operation Research Center Colloquium, MIT
Data Science Lab, MIT
Machine Learning Seminar, Georgia Institute of Technology
Cornell Tech
Reinforcement Learning Theory Seminar

2019-2020 Department of Operations Research and Industrial Engineering, Cornell University
ADSI Workshop on Learning and Control, University of Washington
Mostly OM workshop, Chinese University of Hong Kong
Microsoft Research New York

2018-2019 Economic Theory Seminar, Columbia University
Two Sigma
Electrical and Computer Engineering, University of Michigan
Institute for Mathematics and its Applications, University of Minnesota
Electrical and Computer Engineering, Princeton University

2017-2018 Laboratory for Information and Decision Systems, MIT
Columbia Business School, Columbia University
Netflix Research

2016-2017 Business School, National University of Singapore
Google Deep Mind
Uber Data Science
Reinforcement Learning Forum, Stanford University

2015-2016 Fuqua School of Business, Duke University
Microsoft Research, New York
Chulalongkorn University
Graduate School of Business, Stanford University
School of Engineering and Applied Sciences, Harvard University
Industrial and Operations Engineering, University of Michigan
Industrial and Systems Engineering, Georgia Tech
Booth School of Business, University of Chicago
Marshall School of Business, University of Southern California
Electrical and Computer Engineering, University of Texas Austin
Microsoft Research, New England
Industrial Engineering and Operations Research, Columbia University
Columbia Business School, Columbia University
Stern School of Business, New York University

2014-2015 Kellogg School of Management, Northwestern University
Microsoft Research, Redmond
Information Theory Forum, Stanford University
Allerton Conference–invited session showcasing the "Class of 2014"
NeurIPS Bayesian Optimization Workshop - speaker and panelist

2013-2014 NeurIPS Oral Presentation