Vineet Goyal (Curriculum Vitae)

Contact Information

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Academic Appointments

Professor, IEOR, Columbia — 2025 - Present

Associate Professor (with tenure), IEOR, Columbia — 2017 - 2024

Associate Professor (without tenure), IEOR, Columbia — 2015 - 2016

Assistant Professor, IEOR, Columbia — 2010 - 2015

Postdoctoral Associate, Operations Research Center, MIT — 2008 - Jun 2010

Education

Carnegie Mellon University, Pittsburgh, PA — 2003 - 2008

Ph.D., Algorithms, Combinatorics and Optimization (ACO), an interdisciplinary program in Operations Research, Computer Science and Mathematics.

- Dissertation Topic: "Combinatorial Optimization under Uncertainty"
- Advisor: R. Ravi

M.S., Algorithms, Combinatorics and Optimization, May 2005, GPA 4.0/4.0.

Indian Institute of Technology, Delhi, India — 1999 - 2003

B.Tech., Computer Science and Engineering, GPA: 9.2/10.

Research Interests

Sequential learning and optimization under uncertainty, Robust and Stochastic Optimization, Discrete Optimization, Application in Resource allocation and Revenue management

Grants and Awards

New Frontiers in Research Fund (2023, co-PI, $500,000, Columbia budget: $100,000)

2021 INFORMS Revenue Management and Pricing Section Award for the paper *A Markov Chain Approximation to Choice Modeling* (joint with J. Blanchet and G. Gallego)

Provost Leadership Fellow (2021-2023)

2019 MSOM Society Best Paper Award in Operations Research for the paper *A Markov Chain Approximation to Choice Modeling* (joint with J. Blanchet and G. Gallego)

Amazon Research Award 2019 (Amount: $80K)

DARPA Lagrange for proposal *Real-time control of network physical structures to bypass complexity: Optimization, Stochastics and Structure Recognition* ($782K, Mar 2018-Sep 2019)

NSF Grant for proposal *A Robust Framework for Modeling Preferences and its Applications in Revenue Management* ($323K, Aug 2016-2019)

Adobe Digital Marketing Research Award 2016 (joint with Omar Besbes and Garud Iyengar)

IBM Faculty Award (2014)

NSF CAREER Award for the proposal *A Data-driven Robust Approach for Large Scale Dynamic Optimization.* ($400K, June 2014-2019)

Google Faculty Research Award (2013)

NSF Grant for proposal *New Methodologies for Dynamic Optimization.* ($260K, June 2012-2015)

William Larimer Mellon Fellowship, Tepper School of Business, 2003.

All India Rank 1 in the Joint Entrance Examination conducted by IIT, 1999.

Gold medal at Indian National Physics Olympiad, 1999.

Recent Submissions

Joint Assortment and Inventory Optimization under a Heavy-Tailed Demand (joint with Omar El Housni, S. Humair, Omar Mouchtaki, A. Sadighian and J. Wu). Under Review.

Asymptotically Optimal Competitive Ratio for Online Allocation of Reusable Resources . Under Review.

MNL-Bandit in non-stationary environments (joint with Ayoub Foussoul and V. Gupta). Under Review.

Learning to Price under Competition with MNL demand (joint with Shukai Li and S. Gupta). Under Review.

Dynamic Pricing for a Large Inventory of Substitutable Goods (joint with G. Iyengar and Rajan Udwani). Under Review.

Effective Wages under Workforce Scheduling with Heterogenous Time Preferences (joint with O. Besbes, G. Iyengar and Raghav Singal). Under Review.

A Generalized Markov Chain Model to Capture Dynamic Preferences and Choice Overload (joint with Goutam Kumar and Agathe Soret). Under Review **First Prize in INFORMS OR Undergraduate Student Paper Competition, 2017**

Publications

MNL-Prophet: Sequential Assortment Selection under Uncertainty (joint with S. Humair, Orestis Papadigenopoulos and A. Zeevi). In Proceedings of WINE 2023.

Last Switch Dependent Bandits with Monotone Payoff Functions (joint with A. Foussoul, Orestis Papadigenopoulos and A. Zeevi). In Proceedings of ICML 2023.

Robust Assortment Optimization under the Markov Chain Model (joint with Antoine Desir, B. Jiang, Tian Xie, and J. Zhang). To Appear in *Operations Research*, 2023.

Thompson Sampling for the MNL-Bandit (joint with S. Agrawal, Vashist Avadhanula and A. Zeevi). To Appear in *Math of Operations Research*, 2023.

Robust Policies For Proactive ICU Transfers (joint with C. Chan and Julien Grand-Clement). To Appear in *Operations Research*, 2023.

Revenue Management with Product Retirements and Customer Selection (joint with A. Elmachtoub, R. Lederman and Harsh Sheth). In Proceedings of WINE 2022.

A First-Order Approach To Accelerated Value Iteration (joint with Julien Grand-Clement). *Operations Research*, 2022.

Robust Markov Decision Processes: Beyond Rectangularity (joint with Julien Grand-Clement). *Math of Operations Research*, 2022.

Online Matching with Stochastic Rewards: Optimal Competitive Ratio via Path Based Formulation (joint with Rajan Udwani). *Operations Research*, 2022. A preliminary version appeared in Proceedings of EC 2020.

Dynamic Pricing and Assortment under a contextual MNL demand (joint with Noemie Perivier). In Proceedings of NeurIPS, 2022

Shapley meets Uniform: An Axiomatic Approach to Attribution in Online Advertising (joint with Raghav Singhal, O. Besbes, Antoine Desir and G. Iyengar). *Management Science*, 2022.

Quantifying Utilitarian Outcomes to Inform Triage Ethics: Simulated Performance of a Ventilator Triage Protocol Under SARS-Cov-2 Pandemic Surge Conditions (joint with E. Chuang, Julien Grand-Clement, J. Chen, C. Chan and M. Gong). *AJOB Empirical Bioethics*, 2022.

LP-based Approximations for Disjoint Bilinear and Two-Stage Adjustable Robust Optimization (joint with Omar El Housni and Ayoub Foussoul). In Proceedings of IPCO 2022.

Online Allocation of Reusable Resources: Achieving Optimal Competitive Ratio (joint with G. Iyengar and Rajan Udwani). In Proceedings of WINE 2021.

MNL-Bandits with Knapsacks (joint with Abdellah Aznag and Noemie Perivier). In Proceedings of EC 2021.

Matching Drivers to Riders: A Two-stage Robust Approach (joint with Omar El Housni, Oussama Hanguir and C. Stein). In Proceedings of APPROX 2021.

Capacity Constrained Assortment Optimization: Hardness and Approximations (joint with Antoine Desir and J. Zhang). *Operations Research*, 2021.

Online Assortment Optimization with Reusable Resources (joint with X. Gong, G. Iyengar, D. Simchi-Levi, Rajan Udwani and Shuangyu Wang). *Management Science*, 2021.

On the Power of Static Assignment Policies for Robust Facility Location Problems (joint with Omar El Housni and D. Shmoys). In Proceedings of IPCO 2021

Mallows-Smoothed Distribution over Rankings Approach to Modeling Choice (joint with Antoine Desir, S. Jagabathula and D. Segev). Operations Research (2020)

On the Optimality of Affine Policies under Budgeted Uncertainty Sets (joint with Omar El Housni). To Appear in *Math of Operations Research*. **Second Place in 2020 INFORMS George Nicholson Student Paper Competition**.

MNL-Bandit: A Dynamic Learning Approach to Assortment Selection (joint with S. Agrawal, Vashist Avadhanula and A. Zeevi). *Operations Research*, 2019

A Tractable Approach for Designing Piecewise Affine Policies in Dynamic Robust Optimization (joint with A. Ben-Tal and Omar El Housni). *Math Programming* 182(1), 57-102, 2020

Shapley meets Uniform: An Axiomatic Approach to Attribution in Online Advertising (joint with Raghav Singal, O. Besbes, Antoine Desir, and G. Iyengar). To Appear in *Management Science* (2021). A preliminary version appeared in Proceedings of WWW 2019. **Second place in 2019 INFORMS Revenue Management and Pricing Student Paper Competition**.

Capacity Constrained Assortment Optimization under the Markov Chain Based Choice Model (joint

with Antoine Desir, D. Segev and C. Ye). *Management Science*, 2018 Selected as **Finalist** in **INFORMS George Nicholson Student Paper Competition (2015)**.

Beyond Worst-case: A Probabilistic Analysis of Affine Policies in Dynamic Optimization (joint with Omar El Housni). Advances in Neural Information Processing Systems (NIPS), 2017

On the Adaptivity Gap in Two-stage Robust Linear Optimization under Uncertain Constraints (joint with P. Awasthi and Brian Lu). *Math Programming*, 2017 Selected as **Finalist** in **INFORMS George Nicholson Student Paper Competition (2015)**.

Piecewise Static Policies for Two-stage Adjustable Robust Linear Optimization Under Uncertainty (joint with Omar El Housni). *Math Programming*, 2017. Selected as **Finalist** in **INFORMS Undergraduate OR Student Paper Competition (2015)**.

A Markov Chain Approximation to Choice Modeling (joint with J. Blanchet and G. Gallego). *Operations Research* 64(4), pages 886-905, 2016. 2019 MSOM Society **Best Paper Award** in Operations Research journal.

Near-Optimal Algorithms for the Assortment Planning Problem under Dynamic Substitution and Stochastic Demand (joint with R. Levi and D. Segev).*Operations Research* 64(1), pages 219-235, 2016.

Assortment Optimization under the Mallows Model (joint with Antoine Desir, S. Jagabathula and D. Segev). Advances in Neural Information Processing Systems (NIPS), 2016.

A Near-Optimal Exploration-Exploitation Approach for Assortment Selection (joint with S. Agrawal, Vashist Avadhanula and A. Zeevi). In *ACM Conference on Electronic Commerce (EC)*, 2016.

Assortment Optimization under a Random Swap based Distribution over Permutations Model (joint with Antoine Desir and D. Segev). In *ACM Conference on Electronic Commerce (EC)*, 2016.

On the Tightness of an LP Relaxation for Rational Optimization and its Applications (joint with Vashist Avadhanula, Jalaj Bhandari and A. Zeevi). *Operations Research Letters* 44(5), pages 612-617, 2016.

A Tight Characterization of the Performance of Static Solutions for Two-stage Adjustable Robust Linear Optimization (joint with D. Bertsimas and Brian Lu). *Math Programming* 150(2), pages 281-319, 2015.

Improved Approximation Algorithms for Robust and Stochastic Min-Cut Problems (joint with D. Golovin, V. Polishchuk, R. Ravi, M. Sysikaski). *Math Programming* 149(1), pages 167-194, 2015.

Sparse Process Flexibility Designs: Is Long Chain Really Optimal? (joint with Antoine Desir, Y. Wei and J. Zhang). *Operations Research* 64(2), pages 416-431, 2016. Selected as **Finalist** in **INFORMS George Nicholson Student Paper Competition (2014)** and **MSOM Student Paper Competition (2014)**.

Optimal Price Rebates for Demand Response under Power Flow Constraints (joint with G. Iyengar, Q. Schwarz and Shuangyu Wang). In IEEE SmartGridComm (2014).

An FPTAS for Minimizing a Quasi-Concave Function over a Convex Domain (joint with R. Ravi). *Operations Research Letters*, 41(2), pages 191-196, 2013

Near-optimal Execution Policies for Demand-Response Contracts in Electricity Markets (joint with

G. Iyengar and Zhen Qiu). In IEEE Conference on Decision and Control (CDC) 2013.

On the Approximability of Adjustable Robust Convex Optimization under Uncertainty (joint with D. Bertsimas). *Mathematical Methods of Operations Research* 77(3), pages 323-343, 2013.

On the Power and Limitations of Affine Policies in Two-Stage Adaptive Optimization Problems (joint with D. Bertsimas). *Mathematical Programming* 134(2), pages 491-531, 2012.

On Simulating a class of Bernstein polynomials (joint with Karl Sigman). *ACM Transacation on Modeling and Computer Simulation (TOMACS)*, 22(2), 2012.

A Geometric Characterization of the Power of Finite Adaptability in Multi-Stage Stochastic and Adaptive Optimization Problems (joint with D. Bertsimas and A. Sun). *Math of Operations Research*, 36(1), pages 24-54, 2011.

An FPTAS for Minimizing the Product of Two Non-negative Linear Cost Functions (joint with L. Kaya and R. Ravi). *Mathematical Programming* 26(2), pages 401-405, 2011.

On the Power of Robust Solutions in Two-Stage Stochastic and Adaptive Optimization Problems (joint with D. Bertsimas). *Math of Operations Research*, 35(2), pages 284-305, 2010.

A Plant Location Guide for the Unsure (joint with B. Anthony, A. Gupta and V. Nagarajan). *Math of Operations Research*, 35(1), pages 79-101, 2010.

A PTAS for Chance Constrained Stochastic Knapsack Problem with Random Item Sizes(joint with R. Ravi). *Operations Research Letters*, 38(3), pages 161-164. 2010.

MIP Reformulations of the Probabilistic Set Covering Problem (joint with A. Saxena and M. Lejeune). *Mathematical Programming*, 121(1), pages 1-31, 2008.

A Plant Location Guide for the Unsure (joint with B. Anthony, A. Gupta and V. Nagarajan). In *Proceedings of 19th Annual ACM-SIAM symposium on Discrete algorithms*, pages 1164-1173, 2008.

Pricing Tree Access Networks with Connected Backbones (joint with A. Gupta, S. Leonardi and R. Ravi). In *Proceedings of 15th Annual European Symposium on Algorithms (ESA)*, pages 498-509, 2007.

Pay Today for a Rainy Day: Improved Approximations for Demand-Robust Min-Cut and Shortest Path Problems (joint with D. Golovin and R. Ravi). In *Proceedings of 23rd Annual Symposium on Theoretical Aspects of Computer Science (STACS)*, pages 206-217, 2006.

How to Pay, Come what May: Approximation Algorithms for Demand-Robust Covering Problems (joint with K. Dhamdhere, R. Ravi and M. Singh). In *Proceedings of 46th Annual IEEE Symposium on Foundations of Computer Science(FOCS)*, pages 367-378, 2005.

On the Crossing Spanning Tree Problem (joint with V. Bilo, R. Ravi and M. Singh). In *Proceedings of 7th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX)*, pages 51-60, 2004.

Technical Reports

Balanced Facility Location (joint with R. Ravi). *Technical Report, GSIA*, 2004.

A 5/4-Approximation for the 2-Edge Connected Subgraph Problem on Hamiltonian Graphs (joint with N. Garg, A. Kushal and M. Singh). *Technical Report, IIT Delhi*, 2003.

PhD Students Supervision

Brian Lu (PhD: March 2016, First position: Engineer's Gate)

Antoine Desir (PhD: June 2017, First Position: Assistant Professor, INSEAD). Awarded **2019 INFORMS Revenue Management Dissertation Prize**

Vashist Avadhanula (co-advised with Shipra Agrawal and Assaf Zeevi, PhD: September 2018, First Position: Facebook Research)

Shuangyu Wang (co-advised with Garud Iyengar, PhD: October 2018)

Omar El-Housni (PhD: June 2020, First Position: Assistant Professor, Cornell Tech)

Kumar Goutam (PhD: June 2020, First Position: Amazon)

Raghav Singhal (co-advised with Garud Iyengar, PhD: June 2020, First Position: Assistant Professor, Dartmouth)

Julien Grand-Clement (co-advised with Carri Chan, PhD: June 2021, First Position: Assistant Professor, HEC Paris)

Noemie Perivier (co-advised with Eric Balkanski, PhD: Dec 2022)

Harsh Sheth (co-advised with Adam Elmachtoub, PhD: Dec 2023)

Ayoub Foussoul

Chia-Hao Chang

Soufiane Fafe

Postdoc

Orestis Papadigenopoulos (2022-Present)

Rajan Udwani (2018-2020, First Position: Assistant Professor, UC Berkeley)

Professional Service

Associate Editor, Operations Research (May 2018-Present)

Chair, INFORMS George Dantzig Dissertation Prize Committee, 2020

Member, INFORMS George Dantzig Dissertation Prize Committee, 2018-2019

Chair, Organizing Committee for BIRS Workshop on Sequential Decision Making Under Uncertainty, Banff, January 2019

INFORMS George Dantzig Dissertation Prize Committee (2018-2019)

INFORMS OR & Analytics Undergraduate Competition Committee (2018)

INFORMS Optimization Society Student Paper Prize Committee, Chair (2017)

MSOM Conference Program Committee 2012

INFORMS George Nicholson Student Paper Prize Committee (2011-2013)

NSF Panelist (2012, 2014)

Reviewer for Math of Operations Research, Operations Research, Math Programming, Management Sci., SIAM Journal of Optimization, Production and Operations Management, Naval Research Logistics, SODA, IPCO, OR Letters

SEAS Adhoc P&T Committee, Fall 2017, Fall 2018

Director of IEOR PhD Program (Fall 2018-Present)

Chair, IEOR PhD Admissions Committee (Fall 2016-Present), Graduate Admissions Committee 2010-present; Qualifying Exam Committee 2012-2014; Department Undergraduate Committee 2013-2018

DSI PhD Committee (Fall 2018-Present)

SEAS Advisory Committee on Undergraduate Curriculum, 2014

Teaching

IEOR E6613: Optimization I (1^{st} year core Ph.D. class)	Fall 2012, 2016, 2018, 2020, 2021
IEOR E3608: Foundations of Optimization	Fall 2019, 2020
IEOR E4601: Dynamic Pricing and Revenue Management	Spring 2016, 2017, 2020, 2021, 2022
IEOR E4004: Introduction to OR: Deterministic Models	Spring 2012, Spring 2015, Fall 2021
IEOR E8100: Dynamic Learning and Optimization,	Spring 2011, Spring 2014, Spring 2020
IEOR E4000: Production Management,	Fall 2010, Fall 2011, Fall 2013, Fall 2016
IEOR E4407: Game Theoretic Models of Operations	Fall 2011, 2012, 2014, 2017, 2018
IEOR E4600: Applied Integer Programming	Spring 2014, Spring 2015

Selected Invited Talks

Optimal Competitive Ratio for Online Assortment Optimization with Reusable Resources
- NYC Ops Day, Cornell Tech — April 2022

On the Optimality of Affine Policies under Budgeted Uncertainty Sets
- Shanghai Jiao Tong University — October 2021

Joint Assortment and Inventory Optimization under Heavy Tailed Demand
- Amazon — June 2021

Online Assortment Optimization with Reusable Resources
- IMA Workshop on Data-driven Supply Chain Management — October 2018

On Optimality of Affine Policies in Dynamic Optimization
- International Conference on Continuous Optimization, Berlin (August 2019)
- ORIE Seminar, UT Austin — April 2019
- Optimization Seminar, Northwestern University — May 2018
- ISyE Department Seminar, Georgia Tech — April 2018
- Workshop on Distributionally Robust Optimization, Banff — March 2018

MNL-Bandit: A Dynamic Approach to Assortment Selection
- Colloquium, IIT Delhi Computer Science Department — January 2018
- Operations Research Seminar, Carnegie Mellon University — November 2017

Assortment Optimization under the Mixture of Mallows Distribution over Permutations
- Workshop on Applications of Partition Functions, EPFL — November 2018
- Google Research — March 2017

Piecewise Affine policies for Dynamic Robust Optimization
- EUROPT Workshop on Advances in Continuous Optimization — July 2017
- MIP Workshop — May 2016
- Optimization Days, Montreal — May 2016

Capacity Constrained Assortment Optimization under the Markov chain Choice Model

- Operations Management Seminar, University of California, Irvine — November 2017
- Amazon, Seattle — October 2016
- Princeton ORFE, Optimization Seminar — March 2016
- CS Department Colloquium, IIT Delhi — January 2016
- Microsoft Research India — December 2015
- Flipkart, India — December 2015
- Google Research — November 2015
- UIUC, ISE Department Seminar — October 2015
- Kellogg Operations Seminar — September 2015
- Chicago Booth, OM Seminar — September 2015

A Markov Chain Approximation to Choice Modeling

- Shanghai Jiao Tong University — March 2015
- Stanford University, 'New Directions Lecture Series' — Oct 2014
- EPFL, Computer Science Department Seminar — July 2014
- Google Research, New York — June 2014
- Mostly OM Workshop, Tsinghua University — June 2014
- MIT, ORC Seminar — October 2013
- Oracle Labs — October 2013
- NYU, IOMS Department Seminar — September 2013

Adaptivity Gap in Robust Dynamic Optimization

- Cornell ORIE Colloquium — October 2015
- CMU, OR Seminar — March 2015
- Penn State, Distinguished Lecture Series — March 2015
- INFORMS 2014 — November 2014
- Stanford MS&E, OR Colloquium — October 2014

Sparse Process Flexibility Designs: Is Long Chain Really Optimal?

- MIT, OM Seminar — March 2015
- Flexible Network Design Workshop, Lugano — July 2014
- TIFR, Mumbai — May 2014