

Cun (Matthew) Mu

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Education

- 2011–2017 **Doctor of Philosophy**, *Operations Research, Columbia University*, New York.
◦ Dissertation Title: *Structured Tensor Recovery and Decomposition*
◦ Advisors: Donald Goldfarb and John Wright
- 2007–2011 **Bachelor of Science with Double Majors**, *Quantitative Finance & Statistics, National University of Singapore*, Singapore.
- 2009 **Exchange Student**, *Dept. of Combinatorics & Optimization, University of Waterloo*, Canada.

Work Experience

Walmart Labs, Hoboken, NJ

- Dec. 2021 – **Director of Data Science**, *Search Algorithms*.
Present ◦ Lead and manage a research team of data scientists and machine learning engineers towards improving Walmart omni-channel product search experience
- Dec. 2020 – **Senior Data Science Manager II**, *Search Algorithms*.
Dec. 2021 ◦ Lead and manage a research team of data scientists and machine learning engineers towards improving Walmart omni-channel product search experience
- Aug. 2019 – **Senior Data Science Manager I**, *Search Algorithms*.
Dec. 2020 ◦ Lead and manage a research team of 3 data scientists and 4 machine learning engineers to improve ranking algorithms for product search systems of Walmart.com and Walmart stores
◦ Filed two patent applications
- Mar. 2019 – **Data Science Manager**, *Search Algorithms*.
Aug. 2019 ◦ Lead and manage a team of 3 data scientists on algorithmic development for Walmart store search
- Jan. 2017 – **Senior Data Scientist**, *Jet.com*.
Feb. 2019 ◦ Researched and developed visual search system on top of full-text search engine, to better facilitate multimedia search and recommendation in eCommerce [1,2,5]
◦ Designed shipping boxes for Walmart eCommerce, leading to a 3%-reduction in transportation cost and a 5%-reduction in shipping material cost [4]
- Oct. 2016 – **Part-time Consultant**, *Jet.com*.
Dec. 2016 ◦ Developed and executed a data-driven approach for the supply chain team to better order products from Procter & Gamble (P&G), leading to 80%-reduction in out-of-inventory rate and 30%-reduction in operational cost
◦ Renovated the order packing algorithm for the fulfillment team based on mixed integer optimization, leading to 2%-reduction in the number of boxes and 5%-increase in the space utilization rate

NEC Laboratories America, Inc., Princeton, NJ

- May 2015 – **Research Intern**.
Aug. 2015 ◦ Designed a novel decentralized and fault-tolerant optimization algorithm to coordinate multi-core systems and clusters over peer-to-peer network
◦ Published a conference paper [11] and a patent [16]

Columbia University, New York, NY

Sep 2011 – **Teaching Assistant.**

- Dec. 2016
- Prepared recitation sessions, exam questions and solutions for a variety of Ph.D., master and undergraduate classes
 - List of courses TAed: Optimization I (Ph.D. core course), Non-Linear Optimization, Simulation, Financial Engineering, Stochastic Models and Deterministic Models

Research Interest

AI-powered search, large language model, learning to rank

Publications

Google Scholar citations: **1,531** as of Jan 9, 2025. [\[link\]](#)

- [1] **Cun Mu**, Jun Zhao, Guang Yang, Binwei Yang and Zheng Yan. “Fast and Exact Nearest Neighbor Search in Hamming Space on Full-Text Search Engines,” *Proceedings of International Conference on Similarity Search and Applications (SISAP)*, 2019.
- [2] **Cun Mu**, Binwei Yang, and Zheng Yan. “An Empirical Comparison of FAISS and FENSHSES for Nearest Neighbor Search in Hamming Space, ” *Proceedings of ACM Special Interest Group on Information Retrieval (SIGIR) Workshop on eCommerce*, 2019.
- [3] **Cun Mu**, Guang Yang, and Zheng Yan. “Revisiting skip-gram negative sampling model with rectification, ” *Proceedings of Computing Conference*, 2019.
- [4] Guang Yang, **Cun Mu**. “A Machine Learning Approach to Shipping Box Design,” *Proceedings of Intelligent Systems Conference*, 2019.
- [5] **Cun Mu**, Jun Zhao, Guang Yang, Jing Zhang and Zheng Yan. “Towards practical visual search engine within Elasticsearch,” *Proceedings of ACM Special Interest Group on Information Retrieval (SIGIR) Workshop on eCommerce*, 2018.
- [6] Donald Goldfarb, **Cun Mu**, John Wright and Chaoxu Zhou, “Using negative curvature in solving nonlinear programs,” *Computational Optimization and Applications*, vol. 68, no. 3, pp. 479-502, 2017.
- [7] **Cun Mu**, Daniel Hsu and Donald Goldfarb, “Greedy approaches to symmetric orthogonal tensor decomposition,” *SIAM Journal on Matrix Analysis and Applications*, vol. 38, no. 4, pp. 1210-1226, 2017.
- [8] **Cun Mu**, Yuqian Zhang, John Wright, and Donald Goldfarb, “Scalable robust matrix recovery: Frank-Wolfe meets proximal methods,” *SIAM Journal on Scientific Computing*, vol. 38, no. 5, pp. A3291-A3317, 2016.
- [9] Bo Huang, **Cun Mu**, Donald Goldfarb, John Wright, “Provable models for robust low-rank tensor completion,” *Pacific Journal of Optimization*, vol. 11, no. 2, pp. 339-364, 2015.
- [10] **Cun Mu**, Daniel Hsu and Donald Goldfarb, “Successive rank-one approximations for nearly orthogonally decomposable symmetric tensors,” *SIAM Journal on Matrix Analysis and Applications*, vol. 36, no. 4, pp. 1638-1659, 2015.
- [11] **Cun Mu**, Asim Kadav, Erik Kruus, Donald Goldfarb, and Renqiang Min. “Random walk distributed dual averaging method for decentralized consensus optimization, ” *Advances in Neural Information Processing Systems (NeurIPS) Optimization Workshop*, 2015.
- [12] Wei Liu, **Cun Mu**, Rongrong Ji, Shiqian Ma, John R. Smith, and Shih-Fu Chang. “Low-rank similarity metric learning in high dimensions,” *Proceedings of AAAI Conference on Artificial Intelligence*, 2015.
- [13] Wei Liu, **Cun Mu**, Sanjiv Kumar, and Shih-Fu Chang. “Discrete graph hashing,” *Advances in Neural Information Processing Systems (NeurIPS)*, 2014.
- [14] **Cun Mu**, Bo Huang, John Wright, and Donald Goldfarb. “Square deal: Lower bounds and improved relaxations for tensor recovery,” *Proceedings of International Conference on Machine Learning (ICML)*,

2014.

- [15] Yuqian Zhang, **Cun Mu**, Han-Wen Kuo, and John Wright. “Toward guaranteed illumination models for non-convex objects,” *Proceedings of IEEE International Conference on Computer Vision (ICCV)*, 2013.

Patents Issued

- [16] Asim Kadav, Renqiang Min, Erik Kruus, and **Cun Mu**. “System and method for fault-tolerant parallel learning over non-i.i.d. data,” *US Patent US10291485B2*, filed Oct. 18, 2016 and issued May 14, 2019.
- [17] Theban Stanley, Binwei Yang, and **Cun Mu**. “Systems and methods for identifying non-compliant images using neural network architectures,” *US Patent US11758069B2*, filed Jan. 18, 2020 and issued Sep. 12, 2023.
- [18] Binwei Yang, Omer Ovenc, Behzad Ahmadi, **Cun Mu**, Zheng Yan, Guang Yang, Jun Zhao. “Image searching using a full-text search engine,” *US Patent US11625429B2*, filed Jan. 31, 2020 and issued Apr. 11, 2023.
- [19] Binwei Yang and **Cun Mu**. “System and method for determining item labels based on item images ,” *US Patent US11966434B2*, filed Feb. 12, 2021 and issued Apr. 23, 2024.
- [20] Yu Wang, Dianhui Zhu, Ayush Parshotam Ruchandani, **Cun Mu**, Ying Michelle and SunSaumya Agarwal. “Systems and methods for facilitating online search based on offline transactions,” *US Patent US11928723B2*, filed Jul. 29, 2021 and issued Mar. 12, 2024.
- [21] Xinyi Liu, Varun Joshi, JungWoo HAN, **Cun Mu**, Rajyashree Mukherjeed. “Systems and methods for improving ecommerce search ranking via query-price affinity values Inventors,” *US Patent US12093988B2*, filed May 5, 2021 and issued Sep. 17, 2024.

Invited Presentations

- Oct 2019 International Conference on Similarity Search and Applications, Neward, NJ
- Jul 2019 ACM SIGIR Workshop on eCommerce, Paris, France
- Nov 2018 INFORMS, San Francisco, CA
- Jul 2018 ACM SIGIR Workshop on eCommerce, Ann Arbor, MI
- Jul 2016 SIAM Annual Meeting, Boston, MA
- Jan 2015 Microsoft Research, New York, NY
- Nov 2014 INFORMS, San Francisco, CA
- Jun 2014 International Conference on Machine Learning, Beijing, China
- May 2014 SIAM Conference on Optimization, San Diego, CA
- Feb 2014 Department of Math, UCLA, Los Angeles, CA

Academic Services

Reviews for Journals (19 invitations)

- IEEE Transactions: Pattern Analysis and Machine Intelligence (3), Computational Imaging (1), Neural Networks and Learning Systems (1)
- IEEE Access (2)
- SIAM Journals: Imaging Sciences (1), Scientific Computing (1), Matrix Analysis and Applications (1)
- Neurocomputing (3)
- Pattern Recognition (2)
- Journal of Visual Communication and Image Representation (1)
- Math Programming (1)
- Pacific Journal of Optimization (1)
- Journal of Computational Mathematics (1)

Reviews for Conferences (8 invitations)

SDM 2022, KDD 2020 & 2019, AAAI 2021 & 2019, CDC 2019 & 2014, STOC 2016

Awards & Recognitions

- 2019 Honoree of Elastic Search Cluster Award for Technology Innovation, Elastic [\[link\]](#)
- 2019 Finalist, Caterpillar and INFORMS Analytics Society Innovative Applications of Analytics Award, the Analytics Society of the Institute for Operations Research and the Management Sciences (INFORMS) [\[link\]](#)
- 2019 Semi-Finalist, Franz Edelman Award, INFORMS
- 2014 Class of 1988 Doctoral Fellowship, Columbia University
- 2014 Travel Award, International Conference on Machine Learning (ICML)
- 2011 Lee Kuan Yew Gold Medal, National University of Singapore
- 2011 Singapore Mathematical Society Medal and Prize, National University of Singapore
- 2011 Lijen Industrial Development Medals, National University of Singapore
- 2007-2010 Deans Honor List, Faculty of Science, National University of Singapore

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