Cun (Matthew) Mu

(646)-468-8259
mucun1988@gmail.com

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 – Present **Director of Data Science**, *Search Algorithms*.
- Lead and manage a cross-location research team of data scientists and machine learning engineers responsible for search ranking algorithms at Walmart.com

Dec. 2020 – Present **Senior Data Science Manager II**, *Search Algorithms*.
- Lead and manage a research team of data scientists and machine learning engineers towards improving Walmart omni-channel product search experience

Aug. 2019 – Dec. 2020 **Senior Data Science Manager I**, *Search Algorithms*.
- 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 – Aug. 2019 **Data Science Manager**, *Search Algorithms*.
- Lead and manage a team of 3 data scientists on algorithmic development for Walmart store search

Jan. 2017 – Feb. 2019 **Senior Data Scientist**, *Jet.com*.
- 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 – Dec. 2016 **Part-time Consultant**, *Jet.com*.
- 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 – Aug. 2015 **Research Intern**.
- Designed a novel decentralized and fault-tolerant optimization algorithm to coordinate multi-core systems and clusters over peer-to-peer netowrk
- Published a conference paper [11] and a patent [16]

Columbia University, New York, NY

Sep 2011 – Dec. 2016 **Teaching Assistant**.

- 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

Optimization theories and algorithms with applications in data science and artificial intelligence. Recent research includes deep learning, computer vision, information retrieval and natural language processing.

Publications

Google Scholar citations: 1,527 as of Jan 02, 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.

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 Mathmetics (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 Medel, National Univeristy of Singapore

2011 Singapore Mathematical Society Medal and Prize, National Univeristy of Singapore

2011 Lijen Industrial Development Medals, National Univeristy of Singapore

2007-2010 Deans Honor List, Faculty of Science, National Univeristy of Singapore

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