Osman A. Malik
Curriculum Vitae

linkedin.com/in/osmanm
github.com/OsmanMalik
osmanmalik.github.io
Berkeley, CA
Google Scholar ID: WAleKqOAAAAJ

Research Interests machine learning · tensor decomposition · numerical linear algebra
randomized algorithms · optimization · quantum computing

Education

PhD in Applied Mathematics 2016–2021
University of Colorado Boulder Boulder, CO
- Dissertation: Topics in Matrix and Tensor Computations
- Adviser: Stephen Becker

MS in Applied Mathematics 2014–2016
University of Washington Seattle, WA

MS in Mathematics and Finance 2011–2012
Imperial College London London, United Kingdom

BS in Industrial Engineering 2008–2011
Chalmers University of Technology Gothenburg, Sweden

BS in Economics 2009–2011
University of Gothenburg Gothenburg, Sweden

Work Experience

Research Scientist 3/2024–Present
Encube Technologies Berkeley, CA (Remote)
- Working on next-gen product industrialization technology!
- Check out www.getencube.com to learn more about what we do

Alvarez Postdoctoral Fellow 9/2021–3/2024
Lawrence Berkeley National Laboratory Berkeley, CA
- Recipient of the highly prestigious Alvarez Fellowship in Computing Sciences
- Did research on large-scale methods in machine learning, data analysis and simulation which has advanced the state-of-the-art and resulted in 10 research papers

Research Intern 5/2020–8/2020
Fujitsu Laboratories of America Sunnyvale, CA
- Developed quantum-inspired algorithms for doing matrix factorization on the Fujitsu Digital Annealer
- The work resulted in a paper and a patent

Research Intern 5/2019–8/2019
IBM Research, Mathematics of AI group Yorktown Heights, NY
- Developed tensor-based graph neural network for time varying graphs
- The work resulted in a paper and a patent

Research Assistant 7/2017–8/2021
University of Colorado Boulder Boulder, CO
- Developed super-resolution medical imaging reconstruction algorithm (resulted in 1 paper)
- Developed methods for surrogate modeling in uncertainty quantification (resulted in 2 papers)

Publications

* indicates equal contribution.

Preprints

- O. A. Malik, V. Bharadwaj, R. Murray. *Sampling-based decomposition algorithms for arbitrary tensor networks*. arXiv:2210.03828, 2022.
- O. A. Malik*, Y. Xu*, N. Cheng*, S. Becker, A. Doostan, A. Narayan. *Fast algorithms for monotone lower subsets of Kronecker least squares problems*. arXiv:2209.05662, 2022.

Journal papers and journal equivalent refereed conference papers

- Y. Yaniv, P. Ghysels, O. A. Malik, H. A. Boateng, X. S. Li. *Construction of hierarchically semiseparable matrix representation using adaptive Johnson–Lindenstrauss sketching*. **Communications in Applied Mathematics and Computational Science** 20, no. 1, pp. 67–117, 2025.
- V. Bharadwaj, B. T. Rakhshan, O. A. Malik, G. Rabusseau. *Efficient leverage score sampling for tensor train decomposition*. **Advances in Neural Information Processing Systems (NeurIPS)**, pp. 73726–73744, 2024.
- V. Bharadwaj, O. A. Malik, R. Murray, A. Buluç, J. Demmel. *Distributed-memory randomized algorithms for sparse tensor CP decomposition*. **ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)**, pp. 155–168, 2024.
- N. Cheng*, O. A. Malik*, Y. Xu*, S. Becker, A. Doostan, A. Narayan. *Subsampling of parametric models with bifidelity boosting*. **SIAM/ASA Journal on Uncertainty Quantification** 12, issue 2, pp. 213–241, 2024.
- N. Cheng, O. A. Malik, S. De, S. Becker, A. Doostan. *Bi-fidelity variational auto-encoder for uncertainty quantification*. **Computer Methods in Applied Mechanics and Engineering** 421, 2024.
- V. Bharadwaj, O. A. Malik, R. Murray, L. Grigori, A. Buluç, J. Demmel. *Fast exact leverage score sampling from Khatri-Rao products with applications to tensor decomposition*. **Advances in Neural Information Processing Systems (NeurIPS)**, pp. 47874–47901, 2023.
- R. Border*, O. A. Malik*. *rBahadur: efficient simulation of structured high-dimensional genotype data with applications to assortative mating*. **BMC Bioinformatics** 24, 314, 2023.
- O. A. Malik. *More efficient sampling for tensor decomposition with worst-case guarantees*. **International Conference on Machine Learning (ICML)**, PMLR 162, pp. 14887–14917, 2022.
- O. A. Malik, H. Ushijima-Mwesigwa, A. Roy, A. Mandal, I. Ghosh. *Binary matrix factorization on special purpose hardware*. **PLOS ONE** 16(12): e0261250, 2021.
- O. A. Malik, S. Becker. *A sampling-based method for tensor ring decomposition*. **International Conference on Machine Learning (ICML)**, PMLR 139, pp. 7400–7411, 2021.
- O. A. Malik, S. Ubaru, L. Horesh, M. E. Kilmer, H. Avron. *Dynamic graph convolutional networks using the tensor M-product*. **SIAM International Conference on Data Mining (SDM)**, pp. 729–737, 2021.

- O. A. Malik, S. Becker. *Randomization of approximate bilinear computation for matrix multiplication*. **International Journal of Computer Mathematics: Computer Systems Theory** 6, issue 1, pp. 54–93, 2021.

- O. A. Malik, S. Becker. *Fast randomized matrix and tensor interpolative decomposition using CountSketch*. **Advances in Computational Mathematics** 46, article number 76, 2020.

- O. A. Malik, S. Becker. *Guarantees for the Kronecker fast Johnson–Lindenstrauss transform using a coherence and sampling argument*. **Linear Algebra and its Applications** 602, pp. 120–137, 2020.

- O. A. Malik, S. Becker. *Low-rank Tucker decomposition of large tensors using TensorSketch*. **Advances in Neural Information Processing Systems (NeurIPS)**, pp. 10096–10106, 2018.

Refereed workshop papers and extended abstracts

- O. A. Malik, V. V. Narumanchi, S. Becker, T. W. Murray. *Superresolution photoacoustic tomography using random speckle illumination and second order moments*. **IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)**, pp. 141–145, 2021.

- O. A. Malik, S. Ubaru, L. Horesh, M. E. Kilmer, H. Avron. *Tensor graph neural networks for learning on time varying graphs*. **NeurIPS Workshop on Graph Representation Learning**, 2019.

Technical reports

- R. Murray, J. Demmel, M. W. Mahoney, N. B. Erichson, M. Melnichenko, O. A. Malik, L. Grigori, P. Luszczek, M. Derezinski, M. E. Lopes, T. Liang, H. Luo, J. Dongarra. *Randomized numerical linear algebra: A perspective on the field with an eye to software*. Technical Report No. UCB/EECS-2023-19, EECS Department, University of California, Berkeley, 2023.

Patents

- O. A. Malik, H. Ushijima, A. Mandal, I. Ghosh, A. Roy. *Data clustering*. US Patent Number: 11,537,637. Date of Patent: 27 December 2022.

- L. Horesh, O. A. Malik, S. Ubaru, M. E. Kilmer, H. Avron. *Tensor-based predictions from analysis of time-varying graphs*. US Patent Number: 11,386,507. Date of Patent: 12 July 2022.

Talks and Poster Presentations

- *Sampling-based decomposition algorithms for arbitrary tensor networks* (talk). Presented in the Tensor Network Reading Group at Mila. Held virtually, 30 January 2024.

- *Structured sketching and tensor decomposition* (talk). Presented at the Workshop on Sparse Tensor Computations. Chicago, IL, 19 October 2023.

- *Recent advances in sampling-based methods for tensor decomposition* (talk). Presented at the 2023 Joint Mathematics Meetings (JMM), Special Session on Applications of Tensors in Computer Science. Boston, MA, 5 January 2023.

- *More efficient sampling for tensor decomposition with worst-case guarantees* (talk and poster). Presented at the 39th International Conference on Machine Learning (ICML). Baltimore, MD, 21 July 2022.
- *Superresolution photoacoustic tomography using random speckle illumination and second order moments* (talk and poster). Presented at the IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA). Held virtually, 19 October 2021.
- *A sampling-based method for tensor ring decomposition* (talk). Presented in the Tensor Learning Team Seminar at RIKEN AIP. Held virtually, 30 July 2021.
- *A sampling-based method for tensor ring decomposition* (talk and poster). Presented at the 38th International Conference on Machine Learning (ICML). Held virtually, 22 July 2021.
- *A sampling based method for tensor ring decomposition* (talk). Presented at the SIAM Conference on Applied Linear Algebra (LA21), Minisymposium on Tensor Methods: Theory and Practice. Held virtually, 17 May 2021.
- *Dynamic graph convolutional networks using the tensor M-product* (talk). Presented at the SIAM International Conference on Data Mining (SDM21). Held virtually, 1 May 2021.
- *Low-rank Tucker decomposition of large tensors using TensorSketch* (talk). Presented at the INFORMS Annual Meeting, Session on Methods for Large Scale, Nonlinear and Stochastic Optimization. Held virtually, 8 November 2020.
- *Tensor graph convolutional networks for prediction on dynamic graphs* (talk). Presented at the SIAM Conference on Mathematics of Data Science (MDS20), Minisymposium on Computation and Applications of Tensor Decompositions. Held virtually, 18 June 2020.
- *Tensor graph neural networks for learning on time varying graphs* (poster). Presented at the NeurIPS Workshop on Graph Representation Learning. Vancouver, Canada, 13 December 2019.
- *Low-rank Tucker decomposition of large tensors using TensorSketch* (talk). Presented in the Math/Physics of AI & Reasoning Seminar Series at IBM Research. Yorktown Heights, NY, 30 July 2019.
- *Low-rank Tucker decomposition of large tensors using TensorSketch* (talk). Presented at the SIAM Conference on Computational Science and Engineering (CSE19), Minisymposium on Surrogate Modeling and Data Compression for Exascale Applications. Spokane, WA, 27 February 2019.
- *Fast randomized matrix and tensor interpolative decomposition using CountSketch* (talk). Presented in the Statistics, Optimization and Machine Learning Seminar Series at University of Colorado Boulder. Boulder, CO, 5 February 2019.
- *Low-rank Tucker decomposition of large tensors using TensorSketch* (poster). Presented at the 32nd Conference on Neural Information Processing Systems (NeurIPS). Montreal, Canada, 4 December 2018.
- *Tensor methods in machine learning and data analysis* (poster). Presented at the 2nd Planning Workshop for Center On Pervasive Personalized Intelligence. Boulder, CO, 9 November 2018.
- *Tensor methods in machine learning and data analysis* (poster). Presented at the 1st Planning Workshop for Center On Pervasive Personalized Intelligence. Portland, OR, 11 October 2018.

- *Low-rank Tucker decomposition of large tensors using TensorSketch* (talk). Presented in the Statistics, Optimization and Machine Learning Seminar Series at University of Colorado Boulder. Boulder, CO, 11 September 2018.

Grants and Awards

- Among the top 10% of reviewers at ICML 2022.
- Travel award for attending SIAM ACDA 2021.
- Travel award for presenting at SIAM LA 2021.
- Travel award for presenting at SDM 2021.
- Travel award for presenting at SIAM MDS 2020.
- Travel award for presenting at NeurIPS 2019.
- Best poster award at the CU Boulder APPM 30th Anniversary Poster Session, March 2019.
- Travel award for presenting at SIAM CSE 2019.
- Travel award for presenting at NeurIPS 2018.
- Scholarship from Anna Whitlock's Memorial Foundation for PhD studies, November 2016.
- Scholarship from Dr. Tech. Marcus Wallenberg Foundation for MS studies, June 2015.
- Scholarship from Dr. Tech. Marcus Wallenberg Foundation for MS studies, June 2014.
- Scholarship from Dr. Tech. Marcus Wallenberg Foundation for MS studies, May 2011.

Teaching Experience

Guest lectures

- *Matrix and Tensor Decomposition Using Fast Sketching*. Guest lecture in the course "Randomized Algorithms" at University of Colorado Boulder, 15 March 2019.

Teaching assistant positions at University of Colorado Boulder on courses offered by the Department of Applied Mathematics

- Calculus 3 for Engineers, Fall 2017.
- Calculus 2 for Engineers, Spring 2017.
- Calculus 1 for Engineers, Fall 2016.

Teaching assistant positions at University of Washington on courses in the Computational Finance & Risk Management (CFRM) program

- Mathematical Methods for Quantitative Finance, Summer 2016.
- Monte Carlo Methods in Finance, Spring 2016.
- Fixed Income Analytics and Portfolio Management, Winter 2016.
- Options and Other Derivatives, Fall 2015.
- Investment Science I, September 2015.
- Mathematical Methods for Quantitative Finance, Summer 2015.
- Portfolio Optimization and Asset Management, Spring 2015.
- Financial Software Development and Integration with C++, Winter 2015.
- Options and Other Derivatives, Fall 2014.

Scholarly Service and Memberships

Workshop and symposium organization

- Co-organizer (with Juliane Mueller and Aditi Krishnapriyan) of "Luis W. Alvarez and Admiral Grace Hopper Fellowship Symposium" at Lawrence Berkeley National Laboratory, 15 June 2023
- Co-organizer (with Misha Kilmer and Stephen Becker) of minisymposium "Tensor Methods: Theory and Practice" at SIAM Conference on Applied Linear Algebra (LA21), virtual conference, 17–21 May 2021

Reviewed papers for the following conferences

- International Conference on Artificial Intelligence and Statistics (AISTATS) 2021, 2022, 2023
- International Conference on Learning Representations (ICLR) 2021, 2022, 2023
- International Conference on Machine Learning (ICML) 2021, 2022
- International Joint Conference on Artificial Intelligence (IJCAI) 2022, 2023

Reviewed papers for the following journals

- Advances in Computational Mathematics
- Applied Mathematical Modelling
- IEEE Control Systems Letters
- IEEE Journal of Selected Topics in Signal Processing
- IEEE Signal Processing Letters
- IEEE Transactions on Knowledge and Data Engineering
- IEEE Transactions on Parallel and Distributed Systems
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Signal Processing
- International Journal for Uncertainty Quantification
- Journal of Machine Learning Research (JMLR)
- Journal of Visual Communication and Image Representation
- Neural Processing Letters
- Numerical Mathematics: Theory, Methods and Applications
- SIAM Journal on Mathematics of Data Science (SIMODS)
- SIAM Journal on Matrix Analysis and Applications (SIMAX)
- SIAM Journal on Scientific Computing (SISC)
- The Journal of Supercomputing

Reviewed papers for the following other publications

- SIAM Undergraduate Research Online (SIURO)

Other service

- SIAM Graduate Student Chapter Officer, 2020–2021

Programming Skills

- Python (including PyTorch)
- Matlab

- C++
- C

Languages

- English (Native or bilingual proficiency)
- Swedish (Native or bilingual proficiency)