Bobak T. Kiani

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Work Experience

2023-now **Postdoctoral Associate**, Harvard University; Cambridge, MA
Advised by Melanie Weber

2018-2023 **PhD Candidate**, Massachusetts Institute of Technology; Cambridge, MA
Department of Electrical Engineering and Computer Science
Advised by Seth Lloyd

2022 **Student Researcher**, Meta AI, FAIR; New York, NY
Advised by Yann LeCun

2017-2018 **Consultant and Data Analyst**, Gamma (part of Boston Consulting Group); Philadelphia, PA

2015-2018 **Consultant**, Boston Consulting Group; Philadelphia, PA

2014-2015 **Research Assistant,** Troubled Currencies Project, Johns Hopkins University; Baltimore, MD

2011-2015 **Research Assistant,** Ocean PIV Laboratory, Johns Hopkins University; Baltimore, MD

Education

2023 PhD in Electrical Engineering and Computer Science (expected 2023), Massachusetts Institute of Technology

2020 MS in Mechanical Engineering, Massachusetts Institute of Technology

2015 B.Sc. in Mechanical Engineering, Johns Hopkins University

Publications

Anschuetz, Eric R, David Gamarnik, and Bobak Kiani (2023). "Combinatorial NLTS From the Overlap Gap Property". In: *arXiv preprint arXiv:2304.00643*.

Cabannes, Vivien, Bobak T Kiani, Randall Balestriero, Yann LeCun, and Alberto Bietti (2023). "The SSL Interplay: Augmentations, Inductive Bias, and Generalization". In: *arXiv preprint arXiv:2302.02774*.

Puny, Omri, Derek Lim, Bobak T Kiani, Haggai Maron, and Yaron Lipman (2023). "Equivariant Polynomials for Graph Neural Networks". In: *arXiv preprint arXiv:2302.11556*.

Anschuetz, Eric R and Bobak T Kiani (2022). "Quantum variational algorithms are swamped with traps". In: *Nature Communications* 13.1, pp. 1–10.

Castelazo, Grecia, Quynh T Nguyen, Giacomo De Palma, Dirk Englund, Seth Lloyd, and Bobak T Kiani (2022). "Quantum algorithms for group convolution, cross-correlation, and equivariant transformations". In: *Physical Review A* 106.3, p. 032402.

Kiani, Bobak, Randall Balestriero, Yann LeCun, and Seth Lloyd (2022). "projUNN: efficient method for training deep networks with unitary matrices". In: *Advances in Neural Information Processing Systems* 35.

Kiani, Bobak T, Randall Balestriero, Yubei Chen, Seth Lloyd, and Yann LeCun (2022). "Joint Embedding Self-Supervised Learning in the Kernel Regime". In: *arXiv preprint arXiv:2209.14884*.

Kiani, Bobak Toussi, Giacomo De Palma, Dirk Englund, William Kaminsky, Milad Marvian, and Seth Lloyd (2022). "Quantum advantage for differential equation analysis". In: *Physical Review A* 105.2, p. 022415.

Kiani, Bobak Toussi, Giacomo De Palma, Milad Marvian, Zi-Wen Liu, and Seth Lloyd (2022). "Learning quantum data with the quantum earth mover's distance". In: *Quantum Science and Technology* 7.4, p. 045002.

Lawrence, Hannah, Kristian G Georgiev, Andrew K Dienes, and Bobak Kiani (2022). "Implicit Bias of Linear Equivariant Networks". In: *Proceedings of the 39th International Conference on Machine Learning*. Ed. by Kamalika Chaudhuri, Stefanie Jegelka, Le Song, Csaba Szepesvari, Gang Niu, and Sivan Sabato. Vol. 162. Proceedings of Machine Learning Research. PMLR, pp. 12096–12125.

Nguyen, Quynh T, Bobak T Kiani, and Seth Lloyd (2022). "Block-encoding dense and full-rank kernels using hierarchical matrices: applications in quantum numerical linear algebra". In: *Quantum* 6, p. 876.

De Palma, Giacomo, Bobak Kiani, and Seth Lloyd (2021). "Adversarial robustness guarantees for random deep neural networks". In: *International Conference on Machine Learning*. PMLR, pp. 2522–2534.

Lloyd, Seth, Bobak T Kiani, David RM Arvidsson-Shukur, Samuel Bosch, Giacomo De Palma, William M Kaminsky, Zi-Wen Liu, and Milad Marvian (2021). "Hamiltonian singular value transformation and inverse block encoding". In: *arXiv preprint arXiv:2104.01410*.

Kiani, Bobak Toussi, Seth Lloyd, and Reevu Maity (2020). "Learning unitaries by gradient descent". In: *arXiv preprint arXiv:2001.11897*.

Kiani, Bobak Toussi, Agnes Villanyi, and Seth Lloyd (2020). "Quantum Medical Imaging Algorithms". In: *arXiv*, arXiv–2004.

Lloyd, Seth, Samuel Bosch, Giacomo De Palma, Bobak Kiani, Zi-Wen Liu, Milad Marvian, Patrick Rebentrost, and David M Arvidsson-Shukur (2020). "Quantum polar decomposition algorithm". In: *arXiv preprint arXiv:2006.00841*.

Lloyd, Seth, Giacomo De Palma, Can Gokler, Bobak Kiani, Zi-Wen Liu, Milad Marvian, Felix Tennie, and Tim Palmer (2020). "Quantum algorithm for nonlinear differential equations". In: *arXiv preprint arXiv:2011.06571*.

De Palma, Giacomo, Bobak Kiani, and Seth Lloyd (2019). "Random deep neural networks are biased towards simple functions". In: *Advances in Neural Information Processing Systems* 32.

Nayak, Aditya R, Cheng Li, Bobak T Kiani, and Joseph Katz (2015). "On the wave and current interaction with a rippled seabed in the coastal ocean bottom boundary layer". In: *Journal of Geophysical Research: Oceans* 120.7, pp. 4595–4624.

Talks

Kiani, BT, Randall Balestriero, Yubei Chen, Yann LeCun, and Seth Lloyd (2022) "Joint Embedding Self-Supervised Learning in the Kernel Regime." Rough Paths Seminar at The Alan Turing institute, London, England. (*Given Online*)

Kiani, BT, Randall Balestriero, Yubei Chen, Yann LeCun, and Seth Lloyd (2022) "Joint Embedding Self-Supervised Learning in the Kernel Regime." Conference on the Mathematical Theory of Deep Neural Networks (DeepMaths), San Diego, CA, USA.

Kiani, BT (2022) "Efficient methods for training deep networks with unitary matrices." The Pacific Northwest Seminar on Topology, Algebra, and Geometry in Data Science, University of Washington Math Department, Seattle, Washington. (*Given Online*)

Kiani, BT (2022) "Quantum algorithms for group convolution, cross-correlation, and equivariant transformations." International Conference on Bayesian and Maximum Entropy methods in Science and Engineering (MaxEnt), Paris, France. (*Invited Talk*)

Kiani, BT (2021) "Quantum machine learning with the quantum earth mover's (EM) distance." Quanta Seminar at Cavendish Laboratory at Cambridge University, Cambridge, UK. (*Given Online*)

Lloyd, S, Giacomo De Palma, Bobak T Kiani, and Milad Marvian (2021). "Applications and experimental realizations of quantum generative adversarial networks." Bulletin of the American Physical Society

Nayak, A, Cheng Li, Bobak T Kiani, and Joseph Katz (2013) "Wave, current, and bottom topographical interactions in the coastal ocean bottom boundary layer." 10th International Symposium on Particle Image Velocimetry, Delft, Netherlands.

Nayak, A, Cheng Li, Bobak T Kiani, and Joseph Katz (2013) "Field PIV measurements reveal scaling trends of velocity and Reynolds stress profiles in the rough wall coastal ocean bottom boundary layer." European Geosciences Union General Assembly, Vienna, Austria.

Grants, honours & awards

2022	NeurIPS 2022 Top Reviewer
2019-2021	MIT Energy Initiative Fellowship
2015	Engineer in Training (EIT) certification
2014-now	Member, Pi Tau Sigma (Mechanical Engineering Honor Society)
2014-now	Member and former officer, Tau Beta Pi (Engineering Honor Society)
2014	JHU American Society of Mechanical Engineers Award
2011-2015	Co-founder and Vice Chair, American Society of Mechanical Engineers (ASME), JHU Chapter
2011-2015	Dean's List, Johns Hopkins University

Media Appearances

2021 Max G. Levy (January 5, 2021), "New Quantum Algorithms Finally Crack Nonlinear Equations", *Quantum Magazine*

Teaching

2023 Invited Lecturer: UCLA Challenge Institute for Quantum Computing Winter School
2022 Teaching Assistant: Advanced Quantum Algorithms, Massachusetts Institute of Technology
2014 Teaching Assistant: Thermodynamics, Johns Hopkins University

Mentorship

Undergraduate students supervised:
2021-2022 Quynh T. Nguyen (MIT, UROP)
2021-2022 Grecia Castelazo (MIT, UROP)
2019-2020 Agnes Villanyi (MIT, UROP)

Service to the profession

Reviewer: International Conference on Machine Learning (ICML)
Reviewer: Neural Information Processing Systems (NeurIPS)
Reviewer: PRX Quantum
Reviewer: Quantum Computing Theory in Practice
Reviewer: Quantum Information Processing (QIP) Conference
Reviewer: Quantum Journal