Paul E. Hand — Curriculum Vitae

Assistant Professor
Mathematics and Computer Science
College of Science and Khoury College of Computer Sciences
Northeastern University

Room 2209
177 Huntington Avenue
Boston, MA 02115

Phone: 617-373-2450
Email: p.hand@northeastern.edu
Homepage: http://khoury.northeastern.edu/home/hand/

Education

Ph.D. Mathematics, New York University, 5/2009.

Thesis: Homogenization in Cardiac Electrophysiology and Blow-Up in Bacterial Chemotaxis.
Winner of the 2009 Kurt Friedrich's Prize for Outstanding Dissertation in Mathematics.

Advisors: Charles Peskin, Nader Masmoudi.

B.S. Applied and Computational Mathematics, California Institute of Technology, 6/2004.

Positions Held

Assistant Professor, Mathematics and Computer Science, Northeastern University, 8/2018 –

Assistant Professor, Computational and Applied Mathematics, Rice University, 7/2014 – 8/2018

NSF Postdoctoral Fellow, MIT Department of Mathematics, 9/2011 – 5/2014.

Applied Mathematics Instructor, MIT Department of Mathematics, 9/2010 – 7/2013.

Postdoctoral Fellow, New York University School of Medicine, 9/2009 – 8/2010.

Grants and External Support

National Science Foundation (DMS-2022205). TRIPODS Phase II. Foundations of Data Science Institute. $342,415. 2020–2025.

National Science Foundation (DMS-1848087). CAREER Award. Signal Recovery from Generative Priors. $434,899. 2019–2024.

ExxonMobil Corporation. STEM outreach activities under Dr. Hand's direction at Northeastern. $10,000. Received 2018–2019.

National Science Foundation (DMS-1464525). Standard grant. Sparse Principal Component Analysis via the Sparsest Element in a Subspace. $133,789.00. 2014–2018.

National Science Foundation (DMS-1104000). Mathematical Sciences Postdoctoral Research Fellowship (MSPRF). $135,000.00. 2011–2014

Publications

W. Huang, P. Hand, R. Heckel and V. Voroninski. A Provably Convergent Scheme for Compressive Sensing under Random Generative Priors. *Journal of Fourier Analysis and Applications*. 2021. To appear.

J. Cocola, P. Hand, V. Voroninski. No Statistical-Computational Gap in Spiked Matrix Models with Generative Network Priors. *Entropy*. 2021; 23(1):115.

J. Cocola, P. Hand, V. Voroninski. Nonasymptotic Guarantees for Spiked Matrix Recovery with Generative Priors. *Advances in Neural and Information Processing Systems*, 2020.

M. Asim, M. Daniels, O. Leong, A. Ahmed, P. Hand. Invertible generative models for inverse problems: mitigating representation error and dataset bias. *International Conference on Machine Learning*, 2020.

A. Aghasi, A. Ahmed, P. Hand and B. Joshi, Bilinear Compressed Sensing Under Known Signs via Convex Programming, *IEEE Transactions on Signal Processing*, vol. 68, 6366–6379, 2020.

R. Heckel, W. Huang, P. Hand, V. Voroninski. Rate-Optimal Denoising with Deep Neural Networks. *Information and Inference*, To appear, 2020.

J. Cocola, P. Hand. Global Convergence of Sobolev Training for Overparametrized Neural Networks. *Sixth International Conference on Machine Learning, Optimization, and Data Science*, 2020.

A. Aghasi, A. Ahmed, P. Hand, B. Joshi. BranchHull: Convex bilinear inversion from the entrywise product of signals with known signs. *Applied and Computational Harmonic Analysis*, 2020, 49(2), 636–654.

P. Hand, B. Joshi. Global Guarantees for Blind Demodulation with Generative Priors. *Advances in Neural and Information Processing Systems*, 2019.

A. Aghasi, A. Ahmed, P. Hand. Simultaneous Phase Retrieval and Blind Deconvolution via Convex Programming. *Journal of Machine Learning Research*, 2019, To appear.

P. Hand, V. Voroninski. Global guarantees for enforcing deep generative priors by empirical risk. *IEEE Transactions on Information Theory*, 2019, To appear.

R. Heckel, P. Hand. Deep Decoder: Concise Image Representations from Untrained Non-convolutional Networks. *International Conference on Learning Representations*, 2019.

P. Hand, O. Leong, V. Voroninski. Phase Retrieval Under a Generative Prior. *Advances in Neural and Information Processing Systems*, 2018. Oral Presentation.

A. Aghasi, A. Ahmed, P. Hand. Blind Deconvolutional Phase Retrieval via Convex Programming. *Advances in Neural and Information Processing Systems*, 2018. Spotlight Presentation.

A. Aghasi, A. Ahmed, P. Hand, B. Joshi. A convex program for bilinear inversion of sparse vectors. *Advances in Neural and Information Processing Systems*, 2018.

W. Huang, P.A. Absil, K. Gallavan, P. Hand. ROPTLIB: an object-oriented C++ library for optimization on Riemannian manifolds, *Transactions on Mathematical Software*, 44(4), 2018.

W. Huang, P. Hand. Blind Deconvolution by a Steepest Descent Algorithm on a Quotient Manifold. 2017. *SIAM Journal of Imaging Sciences*, 11(4), 2018.

P. Hand, V. Voroninski. Global guarantees for enforcing deep generative priors by empirical risk. *Conference on Learning Theory*, 2018. Proceedings of Machine Learning Research, 75, 970-978.

A. Aghasi, A. Ahmed, P. Hand. BranchHull: convex bilinear recovery from the entrywise product of vectors with known signs. *Applied and Computational Harmonic Analysis*, 2019.

P. Hand, B. Joshi. A Convex Program for Mixed Linear Regression with a Recovery Guarantee for Well-Separated Data. *Information and Inference: A Journal of the IMA*, 7(3), 2018, 563-579.

P. Hand, V. Voroninski. Corruption Robust Phase Retrieval via Linear Programming. arXiv preprint 1612.03547, 2016.

P. Hand, V. Voroninski. Compressed Sensing from Phaseless Gaussian Measurements via Linear Programming in the Natural Parameter Space. arXiv preprint 1611.05985, 2016.

P. Hand, V. Voroninski. An Elementary Proof of Convex Phase Retrieval in the Natural Parameter Space via the Linear Program PhaseMax, *Communications in Mathematical Sciences* 16(7), 2018.

T. Goldstein, P. Hand, C. Lee, S. Soatto, V. Voroninski. Robust, Scalable Structure from Motion with ShapeFit and ShapeKick. In *European Conference on Computer Vision*, 2016, 289-304. Spotlight Presentation.

P.E. Hand, C. Lee, V. Voroninski. Exact simultaneous recovery of locations and structure from known orientations and corrupted point correspondences. *Discrete and Computational Geometry*, 59(2), 2018, 413-450.

P.E. Hand, C. Lee, V. Voroninski. ShapeFit: Exact location recovery from corrupted pairwise directions. *Communications on Pure and Applied Mathematics*, 71(1), 2018, 3-50.

P.E. Hand. PhaseLift is robust to a constant fraction of arbitrary errors. *Applied and Computational Harmonic Analysis*, 42(3), 2017, 550-562.

L. Demanet and P.E. Hand. Scaling law for finding the sparsest element in a subspace. *Information and Inference*, 3: 295-309, 2014.

P.E. Hand. Conditions for existence of dual certificates in rank-one semidefinite problems. *Commun. Math. Sci.*, 12(7): 1363-1378, 2014.

L. Demanet and P.E. Hand. Stable Optimizationless Recovery from Phaseless Linear Measurements. *J. Fourier Anal. Appl.* 20(1): 199-221, 2014.

P.E. Hand and B.E. Griffith. Empirical study of an adaptive multi scale model for simulating cardiac conduction. *Bulletin of Mathematical Biology* 73(12):3071-3089, 2011.

P.E. Hand and B.E. Griffith. Adaptive multiscale model for simulating cardiac conduction. *Proc. Natl. Acad. Sci USA* 107:14603-14608, 2010.

P.E. Hand and C.S. Peskin. Homogenization of an Electrophysiological Model for a Strand of Cardiac Myocytes with Gap Junctional and Electric-Field Coupling. *Bulletin of Mathematical Biology*, 72: 1408-1424, 2010.

P.E. Hand, B.E. Griffith, and C.S. Peskin. Deriving Macroscopic Myocardial Conductivities by Homogenization of Microscopic Models. *Bulletin of Mathematical Biology.* 71(7): 1707–1726, 2009.

P.E. Hand. *Homogenization in Cardiac Electrophysiology and Blow-Up in Bacterial Chemotaxis.* Ph.D. thesis, New York University, New York, 2009.

Publications Under Review

W. Huang, P. Hand, R. Heckel, V. Voroninski. A Provably Convergent Scheme for Compressive Sensing under Random Generative Priors. Under review.

J. Park, N. Smedemark-Margulies, M. Daniels, R. Yu, J. van de Meent, P. Hand. Generator Surgery for Compressed Sensing. Under review.

P. Hand, O. Leong, and V. Voroninski. Compressive Phase Retrieval: Optimal Sample Complexity with Deep Generative Priors. Under review.

Talks

Worcester Polytechnic Institute. Seminar talk. 17 September 2020.

Information Theory and Applications. Invited talk. 3 February 2020.

University of Massachusetts, Lowell. Machine Learning Seminar. 4 December 2019.

Technical University of Munich. Electrical and Computer Engineering. 29 November 2019.

Virginia Tech. Mathematics Department Colloquium. 22 November 2019.

Asilomar Conference on Signals, Systems, and Computers. 5 November 2019.

SPIE Optical Engineering + Applications. San Diego. 14 August 2019.

Randomness and Determinism in Compressive Data Acquisition concentration week. Texas A&M. 24 July 2019.

Probability Seminar. Georgia Tech. 11 April 2019.

Theory Seminar. Khoury College of Computer Sciences. Northeastern University. 13 February 2019.

Theoretical Basis of Machine Learning. International Centre for Information Sciences. Bangalore, India. 29 Dec 2018.

Theoretical Basis of Machine Learning. International Centre for Information Sciences. Bangalore, India. 27 Dec 2018.

Northeastern University. 18 Jan 2018.

Northeastern University. 8 Jan 2018.

Applied Mathematics Special Seminar. CU Boulder. 7 Dec 2017.

Département de mathématiques et applications seminar. École normale supérieure. 24 Nov 2017.

Operations Research Seminar. Rutgers. 10 Oct 2017.

Data Science Seminar. IMA, University of Minnesota. 3 Oct 2017.

Electrical Engineering Seminar. Harvard. 28 Sep 2017.

Algorithms and Complexity Seminar. MIT CSAIL. 27 Sep 2017.

SPIE Optical Engineering + Applications. San Diego. 9 Aug 2017.

Machine Learning Seminar. IBM Watson Research Center. 13 Apr 2017.

Statistical Sciences and Operations Research Seminar. Virginia Commonwealth University. 24 Mar 2017.

Statistics Colloquium. University of Chicago. 1 Feb 2017.

Machine Learning Workshop. Rice. 24 Jan 2017.

Asilomar Conference on Signals, Systems, and Computers. 8 Nov 2016.

Spotlight Session. European Conference on Computer Vision. Amsterdam, Netherlands. 13 Oct 2016.

Ken Kennedy Institute Member Luncheon. Rice University. 7 Oct 2016.

Numerical Analysis Seminar. University of Maryland. Department of Computer Science. 15 Sep 2016.

SIAM Conference on Imaging Sciences. Mini symposium on Convex Signal Recovery from Pairwise Measurements. 24 May 2016.

IDeAS Seminar. Applied Mathematics. Princeton University. 4 May 2016.

Statistics Colloquium. University of Chicago. 25 April, 2016.

Scientific Computing Seminar. Brown University. Jan 28, 2016.

AMS Session on Computer Science, Information, Control Theory, and Economics. Joint Mathematics Meetings. Jan 8, 2016.

Georgia Tech. Stochastics Seminar. Dec 3, 2015.

Oregon State University. Mathematics Colloquium/Applied Mathematics Seminar. Nov 20, 1015.

University of Houston. Scientific Computing Seminar. Nov 5, 2015.

University of Maryland. Norbert Wiener Center Seminar. Oct 13, 2015.

New York University Applied Mathematics Seminar. Oct 9, 2015.

Tufts University Department of Mathematics Colloquium. Sep 25, 2015.

Tufts University Applied/Computational Mathematics Seminar. Sep 23, 2015.

Rice University Department of Mathematics Colloquium. Aug 27, 2015.

Invited Session on High-dimensional Data Analysis. 45th Symposium on the Interface of Computing Science and Statistics. Jul 11, 2015.

General Session on Optimality and Computation. 11th International Conference on Sampling Theory and Applications (SampTA). May 29, 2015.

Mitsubishi Electric Research Laboratories. May 5, 2015.

Texas A&M Numerical Analysis Seminar. Apr 29, 2015.

Rice University Computational and Applied Mathematics Colloquium. Apr 20, 2015.

Special Session on Phase Retrieval, AMS Sectional Meeting. East Lansing, MI. Mar 14, 2015.

University of Indiana - Bloomington Probability Seminar. Mar 12, 2015

University of Wisconsin-Madison Applied and Computational Mathematics Seminar. Mar 7, 2014.

Rice University Special Lecture in Computational and Applied Mathematics. Feb 20, 2014.

Columbia University Applied Mathematics Colloquium. Feb 18, 2014.

University of Wisconsin-Madison Mathematics Colloquium. Dec 6, 2013.

Drexel Mathematics Colloquium. Oct 2, 2013.

Invited Session on Advances in Compressive Sensing. 10th International Conference on Sampling Theory and Applications (SampTA). Jul 4, 2013.

Applied and Computational Mathematics Seminar. Dartmouth College. Nov 20, 2012.

Graduate Student Supervision

Babhru Joshi. Graduated 5/2019, Rice University. Now a postdoc at University of British Columbia.

Oscar Leong. Rice University. Anticipated graduation 5/2021.

Jorio Cocola. Northeastern University. Anticipated graduation 5/2022.

Daniel Goldfarb. Northeastern University. Anticipated graduation 5/2024.

Sean Gunn. Northeastern University. Anticipated graduation 5/2024.

Undergraduate Student Supervision

Grady (Max) Daniels. Northeastern University. Major: Math and Computer Science (combined). Anticipated graduation 5/2022. Has a co-first author paper at the International Conference on Machine Learning. Received Goldwater Scholarship in 2020. Receive Northeastern PEAK research award in 2019.

Honors & Awards

NSF CAREER Award, 2019.

Kurt O. Friedrichs Prize for Outstanding Dissertation In Mathematics, 2009.

NYU Dean's Dissertation Fellowship, 2008-2009.

National Defense Science and Engineering Graduate Fellowship, 2004-2007.

Caltech Upperclass Merit Award, 2002-2004.

Barry M. Goldwater Scholar, 2002.

Teaching

New York University

Quantitative Reasoning. Undergraduate-level course. Fall 2007.

The Cooper Union

Ordinary Differential Equations. Undergraduate-level course. Fall 2005.

Boundary Value Problems. Undergraduate-level course. Spring 2005.

Probability and Statistics. Undergraduate-level course. Fall 2006.

Boundary Value Problems. Undergraduate-level course. Spring 2007.

Ordinary Differential Equations. Undergraduate-level course. Fall 2008.

MIT

Computational Science and Engineering I. Masters-level course. Spring 2012.

Computational Science and Engineering I. Masters-level course. Spring 2013.

Rice University

Analysis I. Graduate-level course. CAAM 501. Fall 2014.

Topics in Optimization - Sparse Structure Recovery. Graduate-level course. CAAM 654. Spring 2015.

Masters Thesis Writing. Graduate-level course. CAAM 600. Cotaught with Jan Hewett and Tim Warburton. Spring 2015.

Analysis I. Graduate-level course. CAAM 501. Fall 2015.

Matrix Analysis. Undergraduate-level course. CAAM 335. Spring 2016.

Masters Thesis Writing. Graduate-level course. CAAM 600. Cotaught with Jan Hewett. Spring 2016.

Analysis I. Graduate-level course. CAAM 501. Fall 2016.

Signal Recovery: Theory and Simulation. Graduate-level course. CAAM 567. Spring 2017.

Analysis I. Graduate-level course. CAAM 501. Fall 2017.

Northeastern University

Probability and Statistics. Undergraduate-level course. MATH 3081. Fall 2018.

Algorithms and Data. Undergraduate-level course. CS 3000. Spring 2019.

Probability and Statistics. Undergraduate-level course. MATH 3081. Fall 2019.

Special Topics in AI. Graduate-level course. CS 7180. Spring 2020.

Deep Learning. Graduate-level course. CS 7150. Summer-Full 2020.

Probability and Statistics. Undergraduate-level course. MATH 3081. Fall 2020.

Deep Learning. Graduate-level course. CS 7150. Spring 2021.

PhD/MA Committees Served On

Ph.D. Thesis Proposal (Rice CAAM) external committee member. Oscar Leong. Aug 10, 2020.

Ph.D. Candidacy committee member (Northeastern Math). Jorio Cocola. May 5, 2020.

Masters defense (Rice CAAM) external committee member. Oscar Leong. Oct 25, 2018.

Ph.D. Thesis defense (Rice CAAM) committee member. Jian Zhai. Apr 5, 2018.

Masters defense (Rice CAAM) committee member. Temitayo Ajayi. Apr 5, 2018

Ph.D. Thesis proposal (Rice CAAM). Jian Zhai. Mar 27, 2017.

Masters defense (Rice CAAM) committee member. Babhru Joshi. Sep 26, 2016.

Ph.D. Thesis defense (New York University, Mathematics Department). Thang Huynh. External reader. June 29, 2016.

Ph.D. thesis defense (Rice STAT) committee member. Yue Hu. Apr 28, 2016.

Masters thesis defense (Rice Applied Physics) committee member. Jian Chen. Apr 13, 2016.

Masters defense (Rice CAAM) committee member. Boris Brimkov. May 12, 2015.

Thesis proposal (Rice STAT) committee member. Yue Hu. Apr 8, 2015.

Ph.D. defense (Rice CAAM) committee member. Jorge Castanon. Nov 7, 2014.

Rice CAAM Department Service

CAAM Colloquium Chair. 2015–2016.

CAAM Undergraduate Committee. 2015–2016, 2016–2017.

CAAM Graduate Committee. 2014–2015, 2017–2018.

Rice School of Engineering Service

Committee to explore online masters degrees. Committee member. 2017–2018.

Presenter. Data Science meeting at NASA JSC. November 29, 2017.

Engineering Admit Day Panelist. April 24, 2017.

Peer Teaching Evaluator in ENG. Spring 2016. STAT 385, CAAM 210, COMP 130.

Peer Teaching Evaluator in ENG. Fall 2016. STAT 405, CAAM 335.

ELEC 599 committee member. Jeff Lievense. May 1, 2015.

Rice University Service

Center for Written, Oral, and Visual Communication workshop panelist. Apr 6, 2018.

University Library Committee. 2016–2017, 2017–2018.

Security Marshall. Commencement. May 2015.

Participant in faculty working group on Active Learning. Mar 19, 2015.

IBM/Rice Collaboration Workshop participant. Nov 12, 2015.

Mentor. Tapia ELA Faculty Mentoring Program. Fall 2014.

Northeastern University Math Department Service

Math Faculty Hiring committee, 2018–2019.

Joint Math/CCIS Hiring subcommittee, 2018–2019.

Math ZRI Hiring committee, 2018–2019.

Math Graduate committee, 2018–2019.

Joint Math/Khoury Faculty Hiring committee, 2020–2021.

Northeastern University Khoury College Service

Ph.D. Admissions Committee, 2019–2020.

Joint Math/Khoury Faculty Hiring committee, 2020–2021.

Northeastern University College of Science Service

Dean's Lunch and Learn talk. 28 February 2019.

COS Welcome Day Elective Session. 30 March 2019.

COS Welcome Day Elective Session. 7 April 2019.

COS Emeriti Faculty Lunch talk. 5 June 2019.

COS Connects Talk. 15 December 2020.

Outreach

Dr. Hand has held multiple director level positions for STEM camps at Rice University for K12 students and professional development for educators. Total number of student participants from 2017–2020: 1066 (of which 227 were in 2020). Total number of educator participants from 2017–2020: 478 (of which 214 were in 2020). Among student participants, 56% Hispanic/Latino, 14% Black/African American, 47% Female. Revenue for programs from 2017–2020 due to grants and sales: $1,277,365.92. Dr. Hand has been featured and interviewed in Houston TV News: CW39 Houston, FOX 26 Houston. Programs won awards: 2019 Insight into Diversity for Inspiring Programs in STEM Award by Insight Into Diversity; 2019: Eleanor P. Eells Award for Program Excellence by American Camp Association; 2019.

Director of STEM Curriculum, Tapia Center for Excellence and Equity, Rice University. 2019-PRESENT.

Interim Executive Director, Tapia Center for Excellence and Equity, Rice University. 2018-2019.

Director, Tapia Say STEM Camps, Rice University. Summer 2018, Summer 2019.

Director of Curriculum and Instruction, Tapia Camps in Math, Physics, and Computer Science. Rice University. Summer 2017.

Lead instructor of STEM Communication at Tapia Math-Science Scholars camp. Rice University. Summer 2016.

Summer Enhancement Lecturer. Tapia Math Science Scholars Program. Rice University. Summer 2015.

Dr. Hand has created an online learning resource for problem solving, freely available at the website www.leadinglesson.com. It is a collection of over a hundred multivariable calculus problems with detailed solutions. The solutions reveal the thought process and expert would use in solving the problems. The site has received over 800,000 users and 1,600,000 page views and is freely accessible.

Significant Professional Service

Workshop co-organizer for Neural Information Processing Systems, 2020. 'Workshop on Deep Learning and Inverse Problems'. Workshops proposals are rigorously peer reviewed. I co-managed the review process of 32 paper submissions.

Workshop co-organizer for Neural Information Processing Systems, 2019. 'Solving inverse problems with deep networks: New architectures, theoretical foundations, and applications'. Workshops proposals are rigorously peer reviewed. I co-managed the review process of 49 paper submissions.

In 2018–2019, I was the interim executive director for the Tapia Center for Excellence and Equity in Education at Rice University. The center's mission is to empower motivated, academically successful, underrepresented students, who are passionate about their education. I was responsible for the center's vision, fundraising, programming, staffing, and hiring of a permanent executive director.

Other Professional Service

Reviewer for International Conference on Learning Representations, 2021.

Reviewer for International Journal on Computer Vision, 2020.

Reviewer for EURASIP Journal on Advances in Signal Processing, 2020.

Reviewer for Neural Information and Processing Systems, 2020. Rated by the conference as being in "Top 10% of high-scoring reviewers".

Reviewer for Information and Inference: A Journal of the IMA, 2020.

Grant Reviewer for Israel Science Foundation, 2020.

Grant Panelist for National Science Foundation, 2020.

Reviewer for Signal Processing, 2020.

Reviewer IEEE Transactions in Signal Processing, 2020.

Reviewer for ISIT, 2020.

Reviewer for Mathematical and Scientific Machine Learning conference, 2020.

Reviewer for Information and Inference, 2020.

Session Chair for 'Deep Learning and Inverse Problems' at Asilomar Conference on Signals, Systems, and Computers, 2019.

Reviewer for IEEE Journal on Special Topics in Information Theory, 2019.

Reviewer for IEEE Transactions on Information Theory, 2019.

Reviewer for Neural and Information Processing Systems, 2019.

Technical Program Committee, Conference on Sampling Theory and Applications, 2019.

Reviewer for Cambridge University Press.

Reviewer for IMA Information and Inference.

Grant Review Panelist. National Science Foundation. Division of Mathematical Sciences.

Reviewer for IEEE Transactions on Signal Processing.

Reviewer for proceedings of Sampling Theory and Applications (SampTA) conference.

Reviewer for Foundations of Computational Mathematics.

Reviewer for SIAM Journal of Imaging Sciences.

Minisymposium organizer for SIAM Conference on Imaging Sciences, 2016.

<center>Last updated: February 5, 2021</center>