

# Amirali Aghazadeh

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## RESEARCH INTEREST

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Machine Learning, Statistical Signal Processing, Algorithms, Optimization, Deep Learning, Combinatorics  
Applications: Computational Biology, Chemistry, Science

## ACADEMIC POSITIONS

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### University of California, Berkeley

*Postdoctoral Associate*

Advisor: **Prof. Kannan Ramchandran**

Affiliations: EECS, BASICS, BLISS, RISELab, BAIR

Berkeley, CA

June 2019 - Present

### Stanford University

*Postdoctoral Associate*

Advisor: **Prof. David Tse**

Affiliations: EE, ISL, Bio-X, Chan Zuckerberg Biohub

Stanford, CA

Sep. 2017 - June 2019

## EDUCATION

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### Rice University

*Doctor of Philosophy in Electrical and Computer Engineering*

Houston, TX

2014 – 2017

*Master of Science in Electrical and Computer Engineering*

2010 – 2014

Advisor: **Prof. Richard Baraniuk**

### Sharif University of Technology

*Bachelor of Science in Electrical Engineering*

Tehran, Iran

2006 – 2010

## FELLOWSHIPS AND AWARDS

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**ICML Top 33% Reviewer Award** (2020)

**Berkeley Postdoctoral Association Professional Development Award** (2020)

**ICASSP Travel Grant** (2018)

**Hershel M. Rich Invention Award** (2017)

**Schlumberger Best PhD Presenter Award** (2017)

**Biological Data Science Meeting Travel Grant** (2016)

**NASA Space Health Innovation Challenge Hackathon Finalist** (2013)

**Texas Instruments Fellowship** (2010)

## PUBLICATIONS AND PREPRINTS (\* SIGN DENOTES EQUAL CONTRIBUTIONS)

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1. Nick Sapoval\*, **Amirali Aghazadeh\***, Dinler Antunes, Advait Balaji, Richard Baraniuk, CJ Barberan, Ruth Dannenfelser, Chen Dun, Mohammadamin Edrisi, Leo Elworth, Bryce Kille, Anastasios Kyriolidis, Luay Nakhleh, Michael Nute, Cameron Wolfe, Zhi Yan, Vicky Yao, and Todd Treangen, “A Practical Guide to Deep Learning across Computational Biology: Recent Progress, Current Limitations, and Future Perspectives”, *under review Nature Communications*.
2. Farzan Farnia, **Amirali Aghazadeh**, James Zou, David Tse, “Group Structured Adversarial Learning”, *under review Neural Information Processing Systems (NeurIPS 2021) arXiv:2106.10324*.
3. David H. Brookes, **Amirali Aghazadeh**, and Jennifer Listgarten, “On the sparsity of fitness functions and implications for learning”, *under review Proceedings of the National Academy of Sciences (PNAS), bioRxiv:2021.05.24.445506*.

4. **Amirali Aghazadeh**, Hunter Nisonoff, Orhan Ocal, Yijie Huang, Ozan Koyluoglu, Jennifer Listgarten, and Kannan Ramchandran, “Sparse Epistatic Regularization of Deep Neural Networks for Inferring Fitness Functions”, *accepted Nature Communications, bioRxiv:2020.11.24.396994*.
5. **Amirali Aghazadeh**, Vipul Gupta, Alex DeWeese, Ozan Koyluoglu, and Kannan Ramchandran, “BEAR: Sketching BFGS Algorithm for Ultra-High Dimensional Feature Selection with Sublinear Memory”, *Mathematical and Scientific Machine Learning (MSML)*, Aug. 2021.
6. Vida Jamali, Cory Hargus, Assaf Ben Moshe, **Amirali Aghazadeh**, Hyun Dong Ha, Kranthi K Mandadapu, and Paul Alivisatos, “Anomalous Nanoparticle Surface Diffusion in Liquid Cell TEM is Revealed by Deep Learning-Assisted Analysis”, *Proceedings of the National Academy of Sciences (PNAS)* 118, 10 (2021).
7. **Amirali Aghazadeh**, Orhan Ocal, and Kannan Ramchandran, “CRISPRLand: Interpretable Large-Scale Inference of DNA Repair Outcome Based on a Spectral Approach”, *Bioinformatics* 36, i560–i568 (2020).
8. **Amirali Aghazadeh**, Orhan Ocal, and Kannan Ramchandran, “CRISPRLand: Interpretable Large-Scale Inference of DNA Repair Outcome Based on a Spectral Approach”, *Intelligent Systems for Molecular Biology (ISMB)*, July 2020.
9. Ryan Leenay\*, **Amirali Aghazadeh\***, Joseph Hiatt\*, David Tse, Theodore Roth, Ryan Apathy, Eric Shifrut, Judd Hulquist, Nevan Krogan, Zhenqin Wu, Alexander Marson, Andrew May, and James Zou, “Large dataset enables prediction of repair after CRISPR–Cas9 editing in primary T cells”, *Nature Biotechnology* 36, 1 (2019).
10. Debarshi Sen, **Amirali Aghazadeh**, Ali Mousavi, Satish Nagarajaiah, Richard Baraniuk, and Anand Dabak, “Data-driven approaches to structural health monitoring of steel pipes”, *Mechanical Systems and Signal Processing (MSSP)* 131, 524–537 (2019).
11. Debarshi Sen, **Amirali Aghazadeh**, Ali Mousavi, Satish Nagarajaiah, and Richard Baraniuk, “Sparsity-based data-driven approaches for damage detection in plates”, *Mechanical Systems and Signal Processing (MSSP)* 117, 333–346 (2019).
12. **Amirali Aghazadeh**, Mohammad Golbabaei, Andrew Lan, and Richard Baraniuk, “Insense: Incoherent sensor selection for sparse signals”, *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, April 2018.
13. **Amirali Aghazadeh\***, Ryan Spring\*, Daniel LeJeune, Gautham Dasarathy, Anshumali Shrivastava, and Richard Baraniuk, “MISSION: Ultra Large-Scale Feature Selection using Count Sketches”, *International Conference on Machine Learning (ICML)*, July 2018.
14. **Amirali Aghazadeh**, Mohammad Golbabaei, Andrew Lan, and Richard Baraniuk, “Insense: Incoherent sensor selection for sparse signals”, *Signal Processing* 150, 57–65 (2018).
15. **Amirali Aghazadeh**, Andrew Lan, Anshumali Shrivastava, and Richard Baraniuk, “RHash: Robust hashing via  $\ell_\infty$ -norm Distortion”, *International Joint Conferences on Artificial Intelligence (IJCAI)*, Aug. 2017.
16. **Amirali Aghazadeh\***, Adam Lin\*, Mona Sheikh\*, Allen Chen, Lisa Atkins, Coreen Johnson, Joseph Petrosino, Rebekah Drezek, and Richard Baraniuk, “Universal microbial diagnostics using random DNA probes”, *Science Advances* 2, e1600025 (2016).
17. **Amirali Aghazadeh**, Ali Ayremlou, Dan Calderón, Tom Goldstein, Raj Patel, Divianshi Vats, and Richard Baraniuk, “Adaptive step size selection using ski rental problem”, *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, May 2013.

## PATENTS

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“Universal microbial diagnostics using random DNA probes”: US20180355411A1

“A feature selection algorithm for subset selection in ultra-high dimensions”: Ref No. 17500/095001

## GRANT PROPOSAL WRITING EXPERIENCE

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**ARO (\$360k):** *Next generation of Fast, Low-power, and Distributed Signal Recovery and Classification using Artificial Intelligence.* Lead writer. PI: Kannan Ramchandran.

**NSF-CIF: Small (\$500k):** *Foundations of Serverless Computing: Optimizing Latency and Utility.* Co-writer. PI: Kannan Ramchandran, Co-PI: Thomas Courtade.

**ONR-DURIP (\$400k):** *Randomized Numerical Linear Algebra for Large-Scale, Efficient Matrix Computations.* Co-writer. PIs: Anshumali Shrivastava, Richard Baraniuk, and Micheal Mahoney.

**DoD-VBFF (\$3M):** *New Theory and Methods for Low-Dimensional Signal Modeling, Sensing, and Processing.* Co-writer. PI: Richard Baraniuk.

## TALKS AND PRESENTATIONS

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1. "*Inferring Biological Functions with Explainable Algorithms*", invited talk at **ACMS Department at the University of Notre Dame**, Notre Dame, IN, USA, April 2021.
2. "*Inferring Biological Functions with Explainable Algorithms*", invited talk at **ECE Department at Penn State University**, Virtual: State College, PA, USA, March 2021.
3. "*Inferring Biological Functions with Explainable Algorithms*", invited talk at **BMI Department at the University of Wisconsin-Madison**, Virtual: Madison, WI, USA, Feb 2021.
4. "*Inferring Biological Functions with Explainable Algorithms*", invited talk at **Toyota Technological Institute at Chicago (TTIC)**, Virtual: University of Chicago, IL, USA, Feb 2021.
5. "*Inferring Biological Functions with Explainable Algorithms*", invited talk at **Computer Science Department at Drexel University**, Virtual: Philadelphia, PA, USA, Feb 2021.
6. "*Inferring Biological Functions with Explainable Algorithms*", invited talk at **Microsoft Research New England (MSR-NE)**, Virtual: Boston, MA, USA, Jan 2021.
7. "*Black-Box Interpretation of Neural Networks using Sparse-Fourier Algorithms*", talk at **Berkeley Artificial Intelligence Research (BAIR/BDD) Workshop**, University of California, Berkeley, CA, USA, Aug 2020.
8. "*CRISPRLand: Interpretable Large-Scale Inference of DNA Repair Landscape Based on a Spectral Approach*", talk at **Intelligent Systems for Molecular Biology (ISMB)**, Virtual Conference, Aug 2020.
9. "*Sensing and Learning at Scale: On the Power of Randomized Algorithms*", invited talk at **Berkeley Laboratory for Information and System Sciences (BLISS)**, University of California, Berkeley, CA, USA, May 2019.
10. "*From CRISPR Gene Editing to Group Structured Adversarial Learning*", invited talk at **Conference on Information Sciences and Systems (CISS)**, Johns Hopkins University, Baltimore, MD, USA, March 2019.
11. "*Machine Learning Prediction of DNA Repair Outcomes*", poster at **Stanford Compression Workshop**, Stanford, CA, USA, February 2019.
12. "*From CRISPR Gene Editing to Group Structured Adversarial Learning*", invited talk at **Information Theory and Applications Workshop (ITA)**, University of California, San Diego, CA, USA, February 2019.
13. "*Machine Learning meets CRISPR Gene Editing*", invited talk at Electrical and Computer Engineering Department, **Rice University**, Houston, TX, USA, October 2018.
14. "*MISSION: Ultra Large-Scale Feature Selection using Count Sketches*", talk at **International Conference on Machine Learning (ICML)**, Stockholm, Sweden, July 2018.
15. "*Insense: Incoherent Sensor Selection for Sparse Signals*", poster at **International Conference on Acoustics, Speech and Signal Processing (ICASSP)**, Calgary, Canada, April 2018.
16. "*RHash: Robust hashing via  $\ell_\infty$ -norm Distortion*", talk at **International Joint Conference on Artificial Intelligence (IJCAI)**, Melbourne, Australia, August 2017.
17. "*Machine Learning in Large-scale Genomic: Sensing, Processing, and Analysis*", invited talk at Electrical Engineering Department, **Stanford University**, Stanford, CA, USA, May 2017.
18. "*Universal microbial diagnostics using random DNA probes*", invited talk at Computer Science and Artificial Intelligence Laboratory (CSAIL), **MIT**, Cambridge, MA, USA, March 2017.

19. "Universal microbial diagnostics using random DNA probes", invited talk at **The Broad Institute**, Cambridge, MA, USA, March 2017.
20. "Machine Learning in Large-scale Genomics: Sensing, Processing, and Analysis", talk at School of Public Health, **Harvard University**, Cambridge, MA, USA, February 2017.
21. "Universal Microbial Diagnostics using random DNA probes", poster at Biological Data Science Meeting, **Cold Spring Harbor Lab**, Cold Spring Harbor, NY, USA, October 2016.

## PROFESSIONAL ACTIVITIES

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**Reviewer:** Intl. Conf. Machin. Learn. Research (ICML), Conf. Neural Info. Process. Sys. (NeuRIPS), Intl. Conf. Learning Representations (ICLR), AAAI Conf. Artif. Intell. (AAAI), Intl. Joint Conf. Artif. Intell. (IJCAI), Intl. Conf. Acoust. Speech Signal Process. (ICASSP), Europ. Signal Process. Conf. (EUSIPCO), ACS Synthetic Biology, Journal of Theoretical Biology.

**Member:** Institute of Electrical and Electronics Engineers (IEEE), Society for Biological Engineering (SBE), International Society for Computational Biology (*iSCB*).

**Administrator:** Rice compressive sensing website <http://dsp.rice.edu/cs/> (2012-2016).

**Organizer:** Stanford Disease Trajectory Hackathon (2018).

## TEACHING AND MENTORING EXPERIENCES

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**Information Theory and Coding (EE 229A):** UC Berkeley *Teaching Assistant*

**Fundamentals of Electrical Engineering (ELEC 241):** Rice University *Teaching Assistant*

**Computer System Architecture (ELEC 425):** Rice University *Teaching Assistant*

**Advanced DSP (ELEC 544):** Rice University *Teaching Assistant*

**Seminar Course on Topics in Advanced Signal Processing (ELEC 631):** Rice University *Teaching Assistant*

**Undergraduate Mentoring:** Alex DeWeese (EECS Undergrad at UC Berkeley), Yijie Huang (EECS Undergrad at UC Berkeley)

## PRESS

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**Stanford University:** CRISPR algorithm predicts how well gene editing will work, 7/29/19.

**The Pharmaceutical Journal:** Scientists Create Universal Microbial Screening Method, 11/1/16.

**BioCentury Innovations:** Random Math, 10/27/16.

**Labroots:** New Technology Easily Identifies Bacterial Pathogens, 9/30/16.

**Phys.org:** Researchers find way to ID many pathogens with few DNA probes, 9/29/16.

**Rice University:** Random DNA + high-tech math = “universal microbial diagnostic”, 9/28/16.

**Houston Chronicle:** Rice and Baylor team to slow the spread of “superbugs”, 9/28/16.

**GenomeWeb:** Universal Microbial Diagnostics Promises Rapid Pathogen ID, 9/28/16.

## REFERENCES

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**Kannan Ramchandran:** Professor of EECS at University of California, Berkeley.

**Richard Baraniuk:** Victor E. Cameron Professor of ECE at Rice University.

**Jennifer Listgarten:** Professor of EECS at University of California, Berkeley.

**David Tse:** Thomas Kailath and Guanghan Xu Professor of EE at Stanford University.

**Anshumali Shrivastava:** Assistant Professor of CS at Rice University.