

Rayan Saab

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(August 2024)

ACADEMIC POSITIONS	Professor Mathematics and Data Science, UCSD	July 2023 - Present
	Associate Professor Mathematics and Data Science, UCSD	July 2017 - June 2023
	Assistant Professor Department of Mathematics, UCSD	July 2013 - June 2017
	Visiting Assistant Professor Department of Mathematics, Duke University	February 2011 - June 2013
	Postdoctoral Fellow Department of Mathematics The University of British Columbia (UBC)	June 2010 - January 2011
EDUCATION	PhD, Electrical Engineering Affiliation: Institute of Applied Mathematics (IAM) University of British Columbia (UBC) Advisor: Özgür Yılmaz (Mathematics) Advisor: Rabab Ward (Electrical Engineering)	November 2010
	Master of Applied Science, Electrical Engineering University of British Columbia Advisor: Rafeef Abugharbieh (Electrical Engineering) & Martin McKeown (Neuroscience)	August 2005
	Bachelor of Engineering, Computer & Communications Engineering American University of Beirut (AUB), Beirut, Lebanon, July 2003	July 2003
RESEARCH INTERESTS	My research focuses on mathematical and algorithmic aspects of signal processing, data science, and machine learning. For example, I am interested in theory and algorithms pertaining to the acquisition, digitization, and processing of data as well as in mathematically rigorous algorithms for machine learning. In my research, I develop and use tools from various areas of mathematics, including probability and analysis.	
SELECTED AWARDS, HONORS, AND FELLOWSHIPS	NSF Grant DMS 2410717 (2024-2027), Simons Fellowship (2022-2023), NSF Grant DMS 2012546 (2020-2024), Simons Collaboration Grant (declined, 2020 & 2015), MERL Gift Grant (2018), Inst. for Mathematics and its Apps. Focused Research Initiative (2017), August-Wilhelm Scheer Visiting Prof., Technische Universität München (2017), UCSD Academic Senate Research Awards (2024, 2020/2021, 2017, 2015/2016), NSF Grant DMS 1517204 (2015 – 2019), Hellman Fellowship (2015/2016), Mercator Fellowship German Science Foundation (2014 - 2017), Banting Postdoctoral Fellowship (2011 - 2013) NSERC Postdoctoral Fellowship – declined (2011).	
ACADEMIC SUPERVISION	Graduate Students (UCSD): Brian Preskitt, PhD 2018, Aaron Nelson, PhD 2019, Jingwen Liang, PhD 2020, Eric Lybrand, PhD 2021, Jinjie Zhang, PhD 2023. Haoyu Zhang (current), Shihao Zhang (current), Yuan Hui (current). Postdocs: Rishabh Dixit SEW Visiting Assistant Prof. (2024 - present), Thang Huynh, SEW Instructor (2016 – 2019, next position at RWTH Aachen), Anna Ma, Chancellor’s Postdoctoral Fellow (2018 – 2019, currently Asst. Prof. at UCI).	

PhD committees: served on numerous PhD committees both at UCSD and as an external examiner at other universities.

PROFESSIONAL ACTIVITIES Organizer (selected, since 2019) Mathematics of Information Special Session at PRIMA congress, Vancouver, Dec. 2022, One World Mathematics of Information, Data, and Signals (1W-Minds) online seminar, founder and organizer (Apr. 2020 – Sept. 2022), Invited session organizer, Sampling Theory and Applications (SampTA), July 2019, Session organizer, Information Theory and Applications Workshop, San Diego: 2016-2019,

Editor Assoc. editor for *Applied and Computational Harmonic Analysis* and for *Information and Inference*, Guest editor for *Sampling Theory, Signal Processing, and Data Analysis*.

Reviewer (selected) Applied and Computational Harmonic Analysis, Communications on Pure and Applied Mathematics, Constructive Approximation, Discrete and Computational Geometry, IEEE Journal of Selected Topics in Signal Processing, IEEE Transactions on Audio, Speech and Language Processing, IEEE Transactions on Computational Imaging, IEEE Transactions on Information Theory, IEEE Transactions on Signal Processing, Journal of Approximation Theory, Journal of Fourier Analysis and Applications, Linear Algebra and its Applications, Mathematical Programming Computation, SIAM Journal on Matrix Analysis and Applications, IEEE Signal Processing Letters.

Selected recent publications

1. J. Zhang, H. Kannan, A. Cloninger, R. Saab, “Sigma-delta and distributed noise-shaping quantization methods for random Fourier features”, *Information and Inference: A Journal of the IMA* 13 (1), iaad052, 2024
2. J. Zhang, Y. Zhou, R. Saab, “Post-training quantization for neural networks with provable guarantees”, *SIAM J. Math. Data Sci. (SIMODS)*, 5(2), 373–399, 2023.
3. J. Maly, R. Saab. ”A simple approach for quantizing neural networks.” *Appl Comput Harmon Anal*, 66, 138-150, 2023.
4. E. Lybrand, A. Ma, R. Saab, “On the number of faces and radii of cells induced by Gaussian spherical tessellations”, *Appl Comput Harmon Anal*, 56, 176-188, 2022.
5. T. Faust, M. Iwen, R. Saab, R. Wang, “On the ℓ^∞ -norms of the Singular Vectors of Arbitrary Powers of a Difference Matrix with Applications to Sigma-Delta Quantization”, *Linear Algebra and its Applications*, 2021
6. J. Zhang, R. Saab, “Faster Binary Embeddings for Preserving Euclidean Distances”, International Conference on Learning Representations (ICLR), 2021
7. E. Lybrand, R. Saab, “A greedy algorithm for quantizing neural networks”, *Journal of Machine Learning Research*, vol. 22, no. 156, pp 1–38, 2021
8. B. Preskitt, R. Saab, “Admissible Measurements and Robust Algorithms for Ptychography”, *Journal of Fourier Analysis and Applications* 27 (2), 1-39, 2021.

SELECTED PUBLICATIONS

9. T. Huynh, R. Saab, “Fast binary embeddings, and quantized compressed sensing with structured matrices”, *Commun. Pure Appl. Math.*, vol. 73, no. 1, pp. 110-149, 2020
10. M. Iwen, B. Preskitt, R. Saab, A. Viswanathan, “Phase Retrieval from Local Measurements: Improved Robustness via Eigenvector-Based Angular Synchronization”, *Appl Comput Harmon Anal*, vol. 48, no. 1, pp. 415-444, 2020.
11. K. Knudsen, R. Saab, R. Ward, “One-bit compressive sensing with norm estimation”, *IEEE Transactions on Information Theory*, vol. 62, no. 5, 2016
12. I. Daubechies, R. Saab, “Near optimal encoding of bandlimited functions ”, *IEEE Signal Processing Letters*, vol. 22, no. 11, 2015.
13. S. Gunturk, M. Lammers, A. Powell, R. Saab, Ö. Yilmaz, “Sobolev duals for random frames and Sigma-Delta quantization of compressed sensing measurements”, *Foundations of Computational Mathematics*, vol. 13, no. 1, pp 1 – 36, 2013.