Randall Balestriero, Ph.D.

Meta/Facebook AI Research

✉ *randallbalestriero@gmail.com*
Linkedin
Twitter
Github
Google Scholar

Research Interests

I am in the pursuit of deriving theoretical results to build-up our understanding, guide practitioners, and increase our confidence in using deep networks in the wild.

Education

2021– **Postdoc with Prof. Y. LeCun**, "Bridging the gap between practices and theories in Deep Learning".
Meta/Facebook AI Research, NYC, USA

2016–2021 **PhD with Prof. R. Baraniuk**, "A spline theory of Deep Learning".
ECE Department, Rice University, Houston, USA

2015–2016 **Master**, *Applied Mathematics, MVA (Learning, Vision, Signal Processing)*, "Non-Greedy Optimization of Decision Trees via Differentiable Partitions".
Ecole Normale Superieure, Paris, France

2014–2015 **Master**, *Applied Mathematics, summa cum laude*.
Pierre et Marie Curie University, Paris, France

2011–2014 **Bachelor**, *Applied Mathematics and Economics, summa cum laude*.
Toulon University, La Garde, France

relevant past/side projects

Deep Q-Network extension for sparse reward signals with Prof. Iasonas Kokinos and Alessandro Lazaric.
Deep Scattering Network for large-scale bioacoustic datasets with Prof. Stephane Mallat and Herve Glotin.
Stock market volume prediction, CFM Hedge Fund Challenge, 2nd Place.
Full Stack (React, Python/Node.js/Express) extracting sentiments from users' inputs (url)
Front End (React/Plotly) for real-time visualization of Deep Networks
Full Stack (JavaScript/jQuery, Python/Flask/mySQL) marketplace for research projects

Conferences/Journals

2022

ICLR *MaGNET: Uniform Sampling from Deep Generative Network Manifolds Without Retraining* (pdf)
Ahmed Imtiaz Humayun, **Randall Balestriero** and Richard Baraniuk

ICASSP *DeepHull: Fast Convex Hull Approximation in High Dimensions* (pdf)
Randall Balestriero, Zichao Wang (co-first author) and Richard Baraniuk

ICASSP *No More Than 6ft. Apart: Robust K-Means Via Radius Upper Bound* (pdf)
Ahmed Imtiaz Humayun, **Randall Balestriero**, Anastasios Kyrillidis and Richard Baraniuk

2021

IEEE TGRS *Recurrent Scattering Network Detects Metastable Behavior in Polyphonic Seismo-Volcanic Signals for Volcano Eruption Forecasting* (pdf)
Angel Bueno, **Randall Balestriero** et al.

BSSA *Anatomy of Continuous Mars SEIS and Pressure Data From Unsupervised Learning* (pdf)
[...], **Randall Balestriero**, [...]

MSML *Interpretable and Learnable Super-Resolution Time-Frequency Representation* (pdf)
Randall Balestriero, Herve Glotin and Richard Baraniuk

MSML *Deep Autoencoders: From Understanding to Generalization Guarantees* (pdf)
Romain Cosentino, **Randall Balestriero**, Richard Baraniuk and Behnaam Aazhang

ICLR *The Recurrent Neural Tangent Kernel* (pdf)
Sina Alemohammad, Zichao Wang, **Randall Balestriero** and Richard Baraniuk

EGU *Observing Seismic Signatures of Slow Slip Events with Unsupervised Learning* (pdf)
Leonard Seydoux, Michel Campillo, Rene Steinmann, **Randall Balestriero** and Maarten de Hoop

IEEE ICASSP *Wearing a MASK: Compressed Representations of Variable-Length Sequences Using Recurrent Neural Tangent Kernels* (pdf)
Sina Alemohammad, Hossein Babaei, **Randall Balestriero** et al.

2020

IEEE Proc. *Mad Max: Affine Spline Insights Into Deep Learning* (pdf)
Randall Balestriero and Richard Baraniuk

NeurIPS *Analytical Probability Distributions and Expectation-Maximization Learning for Deep Generative Networks* (pdf)
Randall Balestriero, Sebastien Paris and Richard Baraniuk

Nature Comm. *Clustering Earthquake Signals and Background Noises in Continuous Seismic Data with Unsupervised Deep Learning* (pdf)
Leonard Seydoux, **Randall Balestriero**, Piero Poli, Maarten de Hoop, Michel Campillo, Richard Baraniuk

IEEE SP Letters *Universal Frame Thresholding* (pdf)
Romain Cosentino, **Randall Balestriero**, Richard Baraniuk and Behnaam Aazhang

2019

NeurIPS *The Geometry of Deep Networks: Power Diagram Subdivision* (pdf)
Randall Balestriero, Romain Cosentino, Behnaam Aazhang and Richard Baraniuk

ICLR *From Hard to Soft: Understanding Deep Network Nonlinearities via Vector Quantization and Statistical Inference* (pdf)
Randall Balestriero and Richard Baraniuk

ICLR *A Max-Affine Spline Perspective of Recurrent Neural Networks* (pdf)
Zichao Wang, **Randall Balestriero** and Richard Baraniuk

AGU *Seismic Signals and Noises Clustering with Unsupervised Deep Representation Learning* (pdf)
Leonard Seydoux, **Randall Balestriero**, Pierro Poli, Maarten de Hoop, Richard Baraniuk, Michelle Campillo

IEEE Oceans *Wavelet Learning by Adaptive Hermite Cubic Splines applied to Bioacoustic Chirps* (pdf)
Randall Balestriero and Herve Glotin

2018

ICML *A Spline Theory of Deep Networks* (pdf)
Randall Balestriero and Richard Baraniuk

ICML *Spline Filters For End-to-End Deep Learning* (pdf)
Randall Balestriero, Romain Cosentino, Herve Glotin and Richard Baraniuk

2014-2017

ICLRW *Fast Chirplet Transform to Enhance CNN Machine Listening-Validation on Animal Calls and Speech* (pdf)
Herve Glotin, Julien Ricard and **Randall Balestriero**

IEEE GlobalSIP *Best Basis Selection Using Sparsity Driven Multi-Family Wavelet Transform* (pdf)
Romain Cosentino, **Randall Balestriero** and Behnaam Aazhang

ICDMW *Scattering Decomposition for Massive Signal Classification: From Theory to Fast Algorithm and Implementation with Validation on International Bioacoustic Benchmark* (pdf)
Randall Balestriero and Herve Glotin

ASA *Enhanced Feature Extraction using the Morlet Transform on 1 MHz Recordings Reveals the Complex Nature of Amazon River Dolphin (Inia Geoffrensis) Clicks* (pdf)
Marie Trone, Herve Glotin, **Randall Balestriero** et al.

ASA *All Clicks are not Created Equally: Variations in High-Frequency Acoustic Signal Parameters of the Amazon River Dolphin (Inia Geoffrensis)* (pdf)
Marie Trone, **Randall Balestriero** et al.

ASA *Heterogeneity of Amazon River Dolphin High-Frequency Clicks: Current Odontoceti Bioacoustic Terminology in Need of Standardization* (pdf)
Marie Trone, Herve Glotin, **Randall Balestriero** et al.

Relevant Preprints

2021 *Max-Affine Spline Insights Into Deep Network Pruning (submitted)* (pdf)
Randall Balestriero, Haoran You, Zhihan Lu, Yutong Kou, Yingyan Lin and Richard Baraniuk

2020 *Ensembles of Generative Adversarial Networks for Disconnected Data* (pdf)
Lorenzo Luzi, **Randall Balestriero** and Richard Baraniuk

2020 *Max-Affine Spline Insights into Deep Generative Networks* (pdf)
Randall Balestriero, Sebastien Paris and Richard Baraniuk

2020 *Interpretable Image Clustering via Diffeomorphism-Aware K-Means* (pdf)
Romain Cosentino, **Randall Balestriero**, Yanis Bahroun, Anirvan Sengupta, Richard Baraniuk and Behnaam Aazhang

2017 *Neural Decision Trees* (pdf)
Randall Balestriero

Leadership Experience

Co-Advisor **PhD student Ahmed Imtiaz Humayun**, *leading to the publication of* 3 *papers in top conferences (ICLR/CVPR/ICASSP)*

Project Manager **Beat-to-beat classification of unlabeled ECGs**, *Research project manager of a team of* 4 *with final competition rank #1 among* 12 *teams (youtube presentation)*
Rice University

Software

Python3 **Numpy-datasets**, *Machine learning/deep learning dataset in Python3 with all the utilities needed for research/data science* (Github)

Python3/XLA **SymJAX**, *Symbolic programming with JAX for fast CPU/GPU/TPU algebra and deep learning applications combining XLA and Autograd* (Github)

C++/OpenGL **CIGAL**, *GUI for automatic approximation and real time visualization of Partial Differential Equations using Finite Element Method* (Github)

Computing Skills

Programming: Python, C++, OpenGL, Qt, Bash, Tex, R, Julia
GPU: PyTorch, TensorFlow, Jax, Theano
Web Dev.: HTML, CSS, JavaScript, React, NodeJS/Express, Flask, Plotly

Invited Talks/Posters

2021

SIAM Optimization **Talk**, *Max-Affine Spline Insights into Deep Networks*
Washington DC

Joint Math. Meetings **Talk**, *The Geometry of Deep Networks: Power Diagram Subdivision*
Online

2020

DeepMath **Poster**, *The Recurrent Neural Tangent Kernel*
Online

UCLA Seminar — **Talk**, *Max-Affine Spline Insights into Deep Networks,* Mathematical Machine Learning Seminar (invited by Prof. Guido Montufar)
Max-Planck Institute + UCLA

MATH+X — **Talk**, *Learnable Spline Wavelets for Geophysical Data Analysis,* Symposium on Inverse Problems and Deep Learning, Mitigating Natural Hazards
Las Catalinas, Costa Rica

Info. Theory and App. — **Poster**, *Max-Affine Spline Insights into Deep Learning*
San Diego, CA, USA

2019

NAS — **Poster**, *Max-Affine Spline Insights into Deep Learning,* session: The Science of Deep Learning
National Academy of Sciences, Washington, D.C., USA

DeepMath — **Poster**, *Max-Affine Spline Insights into Deep Learning*
Princeton Club, NYC, USA

Asilomar — **Talk**, *Max-Affine Spline Insights into Deep Learning,* session: Theory of Deep Learning
Asilomar, CA, USA

Event — **Poster**, *The Geometry of Deep Networks: Power Diagram Subdivision,* A celebration for Alexandre Grossmann and Yves Meyer
Paris, France

Teaching

Guest Lecturer — **ELEC/COMP576**, *Graduate level class at Rice University on Deep Learning; lecture title: "Deep Networks and Splines"*

Guest Lecturer — **Signal Processing and Machine Learning**, *Graduate level class at Toulon University on learnable Time-Frequency representation; lecture title: "From spectrograms to Learnable Wigner-Ville Distributions for Adaptive Time-Frequency Representations"*

Tutor — **ELEC/COMP549**, *Graduate level class at Rice University; tutoring a team of 4 students to solve an applied machine learning problem through the semester. Subject: anomaly detection of abnormal heartbeats in ECG recordings. Our pipeline and results were elected #1 by an external jury among 18 teams*

Reviewing

NeurIPS, ICML, ICLR, CVPR, IEEE Trans. PAMI, IEEE Signal Processing

Languages

French — Native
English — Fluent — *ESL Program at Rice University, Houston TX, TOEFL (610), GRE*
Spanish — Basic