
JULIA B. NAKHLEH

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EDUCATION

University of Wisconsin-Madison

Ph.D. in Computer Sciences; advisor: Robert D. Nowak

September 2021 - June 2027 (expected)

University of Wisconsin-Madison

M.A. in Mathematics

September 2022 - May 2024

Arizona State University

B.S. in Computer Science, B.A. in Spanish (Summa Cum Laude, GPA 4.0)

August 2015 - May 2019

RESEARCH INTERESTS

Mathematical foundations of deep learning; neural network function spaces; regularization, sparsity, and implicit bias; connections with harmonic analysis, nonparametric estimation, and compressed sensing.

PUBLICATIONS AND PREPRINTS

- [1] **Deep Neural Variation Spaces: A Unifying Perspective on Depth and Complexity**
Julia B. Nakhleh, Robert D. Nowak
Preprint [\[arXiv\]](#)
- [2] **Global Minimizers of ℓ^p -Regularized Objectives Yield the Sparsest ReLU Networks**
Julia B. Nakhleh, Robert D. Nowak
NeurIPS 2025 [\[proceedings\]](#) [\[arXiv\]](#)
- [3] **A New Neural Kernel Regime: The Inductive Bias of Multi-Task Learning**
Julia B. Nakhleh, Joseph Shenouda, Robert D. Nowak
NeurIPS 2024 [\[proceedings\]](#) [\[arXiv\]](#)
- [4] **Training OOD Detectors in their Natural Habitats**
Julian J. Katz-Samuels*, Julia B. Nakhleh*, Robert D. Nowak, Yixuan Li (*equal contribution)
ICML 2022 [\[proceedings\]](#) [\[arXiv\]](#)
- [5] **Identifying Entangled Physics Relationships through Sparse Matrix Decomposition to Inform Plasma Fusion Design**
M. Giselle Fernández-Godino, Michael J. Grosskopf, Julia B. Nakhleh, Brandon M. Wilson, John L. Kline, Gowri Srinivasan
IEEE Transactions on Plasma Science 2021 [\[IEEEExplore\]](#) [\[arXiv\]](#)
- [6] **Exploring Sensitivity of ICF Outputs to Design Parameters in Experiments using Machine Learning**
Julia B. Nakhleh, M. Giselle Fernández-Godino, Michael J. Grosskopf, Brandon M. Wilson, John L. Kline, Gowri Srinivasan
IEEE Transactions on Plasma Science 2021 [\[IEEEExplore\]](#) [\[arXiv\]](#)

RESEARCH EXPERIENCE

Graduate student researcher, University of Wisconsin-Madison

September 2021 - present

- Developed a function-space theory of deep networks with general activations; derived novel structural results and complexity bounds [\[1\]](#).
- Proved sparsity guarantees and studied functional structure of shallow ℓ^p -regularized ReLU networks [\[2\]](#).
- Characterized the implicit bias of multi-task ReLU networks and relationship to kernel methods [\[3\]](#).
- Earlier work developed algorithms for out-of-distribution detection with unlabeled auxiliary data [\[4\]](#).

Post-baccalaureate researcher, Los Alamos National Laboratory

November 2019 - August 2021

Applied sparse matrix decomposition and feature-importance methods to analyze physical relationships in nuclear fusion experiments [\[5\]](#), [\[6\]](#).

Undergraduate researcher, Arizona State University (AAIR Lab)

August 2018 - May 2019

Studied the ability of neural networks to learn abstract state representations for classical planning problems.

Undergraduate researcher, Los Alamos National Laboratory

May 2016 - August 2017

Applied neural sparse coding methods to denoise, reconstruct, and classify Electroencephalography (EEG) signals.

SELECTED TALKS

- **Global Minimizers of ℓ^p Regularized Objectives Yield the Sparsest ReLU Networks**
SIAM Conference on Optimization (OP26), minisymposium on Global Optimization for Neural Networks. Edinburgh, UK (2026).
- **Sparsest ReLU Neural Networks via ℓ^p Regularization for $0 < p \leq 1$**
IFDS Workshop on Theoretical Foundations of Applied AI. Seattle, Washington (2025).
- **A New Neural Kernel Regime: the Inductive Bias of Multi-Task Learning**
ONR MURI review (2025).

TEACHING AND GRADING EXPERIENCE

TA for ECE/CS 532 (Matrix Methods in Machine Learning), UW Madison	<i>Spring 2026</i>
Grader for CS/ECE/STAT 861 (Theoretical Foundations of Machine Learning), UW Madison	<i>Fall 2025</i>
TA for MATH/STAT/ECE 888 (Nonparametric Methods in Data Science), UW Madison	<i>Spring 2025</i>
Grader for MATH 718 (Randomized Numerical Linear Algebra), UW Madison	<i>Fall 2024</i>
Undergraduate TA for CSE 310 (Data Structures & Algorithms), ASU	<i>Fall 2018</i>
Undergraduate TA for CSE 100 (Intro to C++), ASU	<i>Spring 2018</i>
Math tutor (calculus I-III, linear algebra, discrete math, statistics), ASU	<i>Fall 2016</i>

ACADEMIC SERVICE

Reviewer: JMLR (2025), NeurIPS (2025), IEEE Transactions on Information Theory (2025)

AWARDS & SCHOLARSHIPS

SIAM Student Travel Award, OP26 conference	<i>2026</i>
NSF IFDS Research Assistantship	<i>2025</i>
NSF Graduate Research Fellowship Program (GRFP), Honorable Mention	<i>2021</i>
ASME Student Presentation Award Winner, 2 nd place	<i>2020</i>
Phi Beta Kappa Honor Society	<i>2019</i>
Fulbright Scholarship (Spain - Study/Research), Semi-Finalist	<i>2019</i>
Marshall Scholarship, Finalist	<i>2018</i>
Undergraduate merit scholarships: National Merit Scholar; New American University Scholar, ASU	<i>2015 - 2019</i>