HANCHENG MIN

Postdoctoral Researcher ⋄ Center for Innovation in Data Engineering and Science (IDEAS)
Electrical and Systems Engineering ⋄ University of Pennsylvania
Email: hanchmin@seas.upenn.edu ⋄ **Web**: https://hanchmin.github.io/

Research Interests:

Deep Learning Theory; Foundations for Trustworthy AI; Network Dynamics and Control

EDUCATION

Johns Hopkins University, Baltimore, MD — *Sep. 2018 – Jul. 2023*
Ph.D., Electrical and Computer Engineering

University of Pennsylvania, Philadelphia, PA — *Sep. 2016 – May. 2018*
Master of Science in Engineering, Electrical and Systems Engineering

Tongji University, Shanghai, China — *Sep. 2012 – Jul. 2016*
Bachelor of Engineering, Automation

RESEARCH EXPERIENCE

Postdoctoral Researcher, Vidal-lab, University of Pennsylvania — *Aug. 2023 – Present*
Advisor: René Vidal

Graduate Research Assistant, NetD-lab, Johns Hopkins University — *Sep. 2018 – Jul. 2023*
Primary Advisor: Enrique Mallada; *Co-advisor*: René Vidal

Graduate Research Assistant, Kod*lab, University of Pennsylvania — *Jun. 2017 – May. 2018*
Mentor: Ömür Arslan

PUBLICATIONS

Preprint

[P3] **H. Min** and E. Mallada, "Learning dynamic clusters in weakly-connected coherent network systems," 2023, in preparation.

[P2] **H. Min**, S. Tarmoun, R. Vidal, and E. Mallada, "Convergence and implicit bias of gradient flow on overparametrized linear networks," 2023, in preparation.

[P1] Z. Xu, **H. Min**, S. Tarmoun, E. Mallada, and R. Vidal, "A local polyak-łojasiewicz and descent lemma of gradient descent for overparameterized linear models," 2023, in preparation for Transactions on Machine Learning Research (**TMLR**).

Journal

[J4] Y. Jiang, **H. Min**, and B. Zhang, "Oscillations-aware frequency security assessment via efficient worst-case frequency nadir computation," *Electric Power Systems Research (**EPSR**)*, vol. 234, p. 110 656, 2024, also in PSCC 2024.

[J3] **H. Min**, R. Pates, and E. Mallada, "A frequency domain analysis of slow coherency in networked systems," ***Automatica***, 2024, accepted.

[J2] A. Castellano, **H. Min**, J. Bazerque, and E. Mallada, "Learning to act safely with limited exposure and almost sure certainty," *IEEE Transaction on Automatic Control (**TAC**)*, vol. 68, no. 5, pp. 2979–2994, May 2023.

[J1] **H. Min**, F. Paganini, and E. Mallada, "Accurate reduced order models for coherent heterogeneous generators," *IEEE Control Systems Letters (**L-CSS**)*, vol. 5, no. 5, pp. 1741–1746, Nov. 2021, also in ACC 2021.

Conference

[C14] Y. Jiang, **H. Min**, and B. Zhang, "Oscillations-aware frequency security assessment via efficient worst-case frequency nadir computation," in *Power Systems Computation Conference (**PSCC**)*, Jun. 2024, pp 1–8.

[C13] **H. Min**, E. Mallada, and R. Vidal, "Early neuron alignment in two-layer relu networks with small initialization," in *International Conference on Learning Representations (**ICLR**)*, May 2024, pp. 1–8.

[C12] **H. Min** and R. Vidal, "Can implicit bias imply adversarial robustness?" In *Proceedings of the 41st International Conference on Machine Learning (**ICML**)*, ser. Proceedings of Machine Learning Research, vol. 235, PMLR, 21–27 Jul 2024, pp. 35 687–35 718.

[C11] A. Castellano, **H. Min**, J. A. Bazerque, and E. Mallada, "Learning safety critics via a non-contractive binary bellman operator," in *2023 57th Asilomar Conference on Signals, Systems, and Computers (**ACSSC**)*, 2023, pp. 814–821.

[C10] **H. Min** and E. Mallada, "Learning coherent clusters in weakly-connected network systems," in *Proceedings of The 5th Annual Learning for Dynamics and Control Conference (**L4DC**)*, vol. 211, PMLR, Jun. 2023, pp. 1167–1179.

[C9] **H. Min** and E. Mallada, "Spectral clustering and model reduction for weakly-connected coherent network systems," in *2023 American Control Conference (**ACC**)*, 2023, pp. 2957–2962.

[C8] **H. Min**, R. Vidal, and E. Mallada, "On the convergence of gradient flow on multi-layer linear models," in *Proceedings of the 40th International Conference on Machine Learning (**ICML**)*, vol. 202, PMLR, Jun. 2023, pp. 24 850–24 887.

[C7] Z. Xu, **H. Min**, S. Tarmoun, E. Mallada, and R. Vidal, "Linear convergence of gradient descent for finite width over-parametrized linear networks with general initialization," in *Proceedings of The 26th International Conference on Artificial Intelligence and Statistics (**AISTATS**)*, vol. 206, PMLR, Apr. 2023, pp. 2262–2284.

[C6] A. Castellano, **H. Min**, J. A. Bazerque, and E. Mallada, "Reinforcement learning with almost sure constraints," in *The 4th Annual Learning for Dynamics and Control Conference (**L4DC**)*, vol. 168, PMLR, Jun. 2022, pp. 559–570.

[C5] **H. Min**, F. Paganini, and E. Mallada, "Accurate reduced-order models for heterogeneous coherent generators," in *2021 American Control Conference (**ACC**)*, 2021, pp. 570–575.

[C4] **H. Min**, S. Tarmoun, R. Vidal, and E. Mallada, "On the explicit role of initialization on the convergence and implicit bias of overparametrized linear networks," in *The 38th International Conference on Machine Learning (**ICML**)*, vol. 139, PMLR, Jul. 2021, pp. 7760–7768.

[C3] **H. Min** and E. Mallada, "Dynamics concentration of tightly-connected large-scale networks," in *58th IEEE Conference on Decision and Control (**CDC**)*, Dec. 2019, pp. 758–763.

[C2] **H. Min**, F. Paganini, and E. Mallada, "Accurate reduced order models for coherent synchronous generators," in *2019 57th Annual Allerton Conference on Communication, Control, and Computing (**Allerton**)*, 2019, pp. 316–317.

[C1] O. Arslan, **H. Min**, and D. E. Koditschek, "Voronoi-based coverage control of pan/tilt/zoom camera networks," in *2018 IEEE International Conference on Robotics and Automation (**ICRA**)*, May 2018, pp. 5062–5069.

Thesis

[T2] **H. Min**, "Exploiting structural properties in the analysis of high-dimensional dynamical systems," Ph.D. Thesis, Johns Hopkins University, 2023.

[T1] **H. Min**, "On balancing event and area coverage in mobile sensor networks," Master's Thesis, University of Pennsylvania, 2018.

PRESENTATIONS

Talks

- **Seminar Talk**: Learning Dynamics, Implicit Bias, and Robustness of Shallow ReLU Networks. *"AI + MATH" Colloquia, Virtual, Shanghai Jiaotong University. Host: Zhiqin Xu. Oct. 2024*
- **Conference Talk**: Early Neuron Alignment in Two-layer ReLU Networks with Small Initialization. *DeepMath 2023, Johns Hopkins University. Nov. 2023*
- **Conference Talk**: Spectral Clustering and Model Reduction for Weakly-Connected Coherent Network Systems. *American Control Conference 2023, San Diego, CA. Jun. 2023*
- **Invited Talk**: Exploiting Structural Properties in the Analysis of High-dimensional Dynamical Systems. *University of Michigan. Host: Necmiye Ozay. Jan. 2023*
- **Conference Talk**: Learning Coherent Clusters in Weakly-Connected Network Systems. *ROSEI Summit, Johns Hopkins University. Jan. 2023*
- **Seminar Talk**: Convergence and Implicit Bias of Gradient Flow on Overparametrized Linear Networks. *RSRG Seminar, California Institute of Technology. Hosts: Adam Wierman, Steven Low. Jun. 2022*
- **Seminar Talk**: Convergence and Implicit Bias of Gradient Flow on Overparametrized Linear Networks. *Semiautonomous seminar, UCBerkeley. Hosts: Chinmay Maheshwari, Shankar Sastry. Jun. 2022*
- **Research Talk**: Convergence and Implicit Bias of Gradient Flow on Overparametrized Linear Networks. *MINDS Retreat, Johns Hopkins University. Mar. 2022*
- **Workshop Talk**: Convergence and Implicit Bias of Gradient Flow on Overparametrized Linear Networks. *2022 TRIPODS Winter School on Interplay between AI and Dyn. Sys., Virtual. Jan. 2022*
- **Conference Talk**: Accurate Reduced Order Models for Coherent Heterogeneous Generators. *American Control Conference 2021, Virtual. May. 2021*
- **Conference Talk**: Dynamics Concentration of Tightly-Connected Large-Scale Networks. *58th Conference on Decision and Control, Nice, France. Dec. 2019*

Posters

- **Research Poster**: Can Implicit Bias Imply Adversarial Robustness? *2024 Mathematical and Scientific Foundations of Deep Learning Annual Meeting, NYC. Sep. 2024*
- **Conference Poster**: Can Implicit Bias Imply Adversarial Robustness? *The 41st International Conference on Machine Learning. Jul. 2024*
- **Conference Poster**: Early Neuron Alignment in Two-layer ReLU Networks with Small Initialization. *The 12th International Conference on Learning Representations. May. 2024*

- **Conference Poster**: On the Convergence of Gradient Flow on Multi-layer Linear Models. *The 40th International Conference on Machine Learning. Aug. 2023*
- **Conference Poster**: Learning Coherent Clusters in Weakly-Connected Network Systems. *The 5th Annual Learning for Dynamics & Control Conference, Philadephia, PA. Jul. 2023*
- **Research Poster**: On the Explicit Role of Initialization on the Convergence and Implicit Bias of Overparametrized Linear Networks. *2021 Mathematical and Scientific Foundations of Deep Learning Annual Meeting, NYC. Sep. 2021*

PROFESSIONAL SERVICES

Technical Reviewer

- *Journals*: Transactions on Pattern Analysis and Machine Intelligence (TPAMI); Transaction on Machine Learning Research (TMLR); Transaction on Automatic Control (TAC); Automatica; Control System Letter (L-CSS)
- *Conferences*: International Conference on Machine Learning (ICML); Conference on Neural Information Processing Systems (NeurIPS); International Conference on Learning Representations (ICLR); Conference on Decision and Control (CDC); American Control Conference (ACC); Conference on Information Sciences and Systems (CISS)

University Service

- Pre-evaluation Admission Committee Member: UPenn ESE PhD Student Search *Dec. 2023*

AWARDS AND HONORS

MINDS Data Science Spring Fellowship 2021 *Jan. 2021*
MINDS Data Science Fellowship 2019/2020 *Nov. 2019*
ICRA 2018 Best Paper in Multirobot Nominee *Mar. 2018*
Tongji Scholarship of Excellence *2013-2015*
Chinese Mathematics Competition (Shanghai Preliminary) *Nov. 2013*

TEACHING EXPERIENCE

Teaching Assistant

- *Foundations of Reinforcement Learning* (Fall 2020, Fall 2021, Fall 2022), Johns Hopkins University
- *Control Systems*, (Spring 2022), Johns Hopkins University
- *Networked Dynamical Systems*, (Fall 2019), Johns Hopkins University
- *edX Course: Robotics: Locomotion and Engineering* (Spring 2018), Penn Engineering Online Learning

Internship Mentor

- *Army Educational Outreach Program (AEOP) High School Internship Mentor* (June-Aug 2024), University of Pennsylvania

ADVISING AND MENTORING

Mentoring

Prisha Shroff *High School Intern, Hamilton High School*
Army Educational Outreach Program (AEOP) High School Intern at University of Pennsylvania
Research Project: Orthogonal matching pursuit for interpretable image classification

Vijay Giri *Ph.D. Student, University of Pennsylvania*
Department of Computer and Information Science. Advisor: René Vidal
Research Project: Learning Boolean unctions with multi-head transformer

Kyle Poe *Ph.D. Student, University of Pennsylvania*
Department of Mathematics. Advisor: René Vidal
Research Projects: Sparse inputs recovery for LTI systems; Invertibility of LTI systems under sparse inputs

Salma Tarmoun *Ph.D. Student, University of Pennsylvania*
Department of Mathematics. Advisor: René Vidal
Research Projects: Gradient descent dynamics in attention models

Ziqing Xu *Ph.D. Student, University of Pennsylvania*
Wharton Statistics and Data Science. Advisor: René Vidal
Research Projects: Convergence of gradient descent on linear networks; Convergence analysis of LoRA

Agustin Castellano *Ph.D. Student, Johns Hopkins University*
Department of Electrical and Computer Engineering. Advisor: Enrique Mallada
Research Project: Reinforcement learning with almost sure safety

REFERENCES

Enrique Mallada *Ph.D. Advisor*
Associate Professor, Electrical and Computer Engineering
Johns Hopkins University, Baltimore, MD

René Vidal *Postdoc Advisor*
Rachleff University Professor, Electrical and Systems Engineering
University of Pennsylvania, Philadelphia, PA

Fernando Paganini
Professor, Electrical and Telecommunications Engineering
Universidad ORT Uruguay, Montevideo, Uruguay

Juan Bazerque
Assistant Professor
University of Pittsburgh, Pittsburgh, PA