

Shimiao (Cindy) Li

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RESEARCH INTERESTS | [Google Scholar](#)

Power system, situational awareness, optimization, machine learning

My work explores "Physics-ML Synergy", a synergy of system modeling and ML tools to advance analytical tools in power system analysis.

EDUCATION

Carnegie Mellon University

Pittsburgh, USA

Ph.D. candidate in Electrical and Computer Engineering (ECE) GPA: 3.88/4.00

2018 – 2024

Advised by Prof. [Larry Pileggi](#)

Doctoral dissertation: "Exploiting sparse structures and synergy designs to advance situational awareness of electrical power grid"

Tianjin University

Tianjin, China

B.E. Electrical Engineering (EE); GPA: 3.90/4.0; Ranked top 1%

2014 – 2018

EMPLOYMENT

University at Buffalo (SUNY)

Buffalo, USA

*Tenure-track Assistant Professor
Department of Electrical Engineering*

Jan 2025 – present

Pacific Northwest National Laboratory (PNNL)

USA

*PhD intern in Optimization and Control group
PNNL collaborators: Jan Drgona, Aaron R. Tuor, and Draguna L. Vrabie*

Jun 2022 – Aug 2022

- Worked on developing homotopy-based meta-learning heuristics for training unsupervised neural networks to improve constraint satisfaction for heavily-constrained optimization problems. | [Preprint](#)
- Explored the use of Tx-stepping (which is a homotopy method in circuit simulation) in designing domain-specific heuristics for the equality constraints in power system optimization problems.

SELECTED PUBLICATIONS

Journals and Book Chapters

- **Shimiao Li**. (2024) Exploiting sparse structures and synergy designs to advance situational awareness of electrical power grid. (Doctoral dissertation, Carnegie Mellon University).
- **Shimiao Li**, Amritanshu Pandey, and Larry Pileggi. "Contingency analysis with warm starter using probabilistic graphical model." *Electric Power Systems Research* 234 (2024): 110737.
- **Shimiao Li**, Amritanshu Pandey, and Lawrence Pileggi. "A convex method of generalized state estimation using circuit-theoretic node-breaker model." *IEEE Transactions on Power Systems* (2023).
- Amritanshu Pandey, **Shimiao Li**, Larry Pileggi, Chapter 17 - Combined transmission and distribution state-estimation for future electric grids, *Power Systems Operation with 100% Renewable Energy Sources, Elsevier, 2024, Pages 299-315, ISBN 9780443155789, https://doi.org/10.1016/B978-0-443-15578-9.00015-7*.
- **Shimiao Li**, Amritanshu Pandey, Bryan Hooi, Christos Faloutsos, and Larry Pileggi. "Dynamic graph-based anomaly detection in the electrical grid." *IEEE Transactions on Power Systems* 37, no. 5 (2021): 3408-3422.

Conference proceedings

- **Shimiao Li**, Jan Drgona, Shirang Abhyankar, and Larry Pileggi. 2023. Power Grid Behavioral Patterns and Risks of Generalization in Applied Machine Learning. In Companion Proceedings of the 14th ACM International Conference on Future Energy Systems (e-Energy '23 Companion). Association for Computing Machinery, New York, NY, USA, 106–114. <https://doi.org/10.1145/3599733.3600257>
- Singer, Brian, Amritanshu Pandey, **Shimiao Li**, Lujo Bauer, Craig Miller, Lawrence Pileggi, and Vyas Sekar. "Shedding Light on Inconsistencies in Grid Cybersecurity: Disconnects and Recommendations." In 2023 IEEE Symposium on Security and Privacy (SP), pp. 554-571. IEEE Computer Society, 2022.

- **Shimiao Li**, Amritanshu Pandey, and Larry Pileggi. "A wlav-based robust hybrid state estimation using circuit-theoretic approach." In 2020 IEEE Power & Energy Society General Meeting (PESGM), IEEE, 2021 (**Best Paper Award**)
- **Shimiao Li**, Amritanshu Pandey, Soumya Kar, and Larry Pileggi. "A circuit-theoretic approach to state estimation." In 2020 IEEE PES Innovative Smart Grid Technologies Europe (ISGT-Europe), pp. 1126-1130. IEEE, 2020.
- **Shimiao Li**, Amritanshu Pandey, Aayushya Agarwal, Marko Jereminov, and Larry Pileggi. "A LASSO-Inspired Approach for Localizing Power System Infeasibility." In 2020 IEEE Power & Energy Society General Meeting (PESGM), pp. 1-5. IEEE, 2020.
- **Shimiao Li**, Tong Guo, Lin Yuan, and Jinping Chen. "A method for surface topography measurement using a new focus function based on dual-tree complex wavelet transform." In 2017 International Conference on Optical Instruments and Technology: Optoelectronic Measurement Technology and Systems, vol. 10621, p. 1062112. International Society for Optics and Photonics, 2018.
- **Shimiao Li**. "A review of feature detection and match algorithms for localization and mapping." In IOP Conference Series: Materials Science and Engineering, vol. 231, no. 1, p. 012003. IOP Publishing, 2017.

HONORS & ACHIEVEMENTS

- Microsoft Accelerate Foundation Models Research Initiative Award (on my work of physics-ML synergy)
- Best Paper Award in 2021 IEEE PES General Meeting.
- 3rd place in 7-day NLP Hackathon held by TAL company, 2020.
- 2019 Carnegie Institute of Technology (CIT) Dean's Fellowship.
- 2016 Chinese National Scholarship.
- 2015 Chinese National Scholarship.
- First Prize in 2015 National Mathematics Contest, Tianjin local region.

TEACHING

Carnegie Mellon University: Teaching Assistant

- 18202, Mathematical Foundations of Electrical Engineering (undergrade-level), Fall 2022;
- 18661, Intro to ML for Engineers (graduate-level), Fall 2021;

Enrolled in Future Faculty Program at CMU, 2023

SERVICE AND MEMBERSHIP

- Technical Program Committee Member: AMLIES 2023, DAC 2025
- Reviewer: IEEE Transactions on Smart Grid, IEEE Transactions on Sustainable Energy, IEEE Transactions on Information Forensics & Security, IEEE PES General Meeting 2020, 2021, 2022, 2023
- Photographer in the 2023 Pittsburgh Women in Mathematics and Computing Symposium (WMCS)

SELECTED TALKS

Physics-based tool meets AI: advanced simulation for proactive defense

2024 CEIC Advisory Committee Meeting, CMU

Oct 16, 2024

Physics-ML Synergy for power grid situation awareness

PES Oregon Chapter Meeting

Sep 18, 2024

Physics-ML synergy toward maximal situation awareness

2022 CEIC Advisory Committee Meeting, CMU

Oct 19, 2023

Dynamic graph-based anomaly detection in the electrical grid

2023 IEEE PES general meeting (PESGM), Orlando, USA

Jul 17, 2023

2022 C3.AI symposium, Miami, USA

Mar 22-24, 2022

Power grid behavioral patterns and generalization risks on applied ML

2023 AMLIES workshop, Orlando, USA

Jun 20, 2023

Threat detection and estimation from temporal-spatial data patterns

2022 CEIC Advisory Committee Meeting, CMU

Oct 19, 2022

Generalized state estimation using node breaker model

2021 CEIC Advisory Committee Meeting, online

Oct 20, 2021

A WLAV-based robust hybrid state estimation using circuit-theoretic approach

Best paper session, IEEE PES general meeting (PESGM), online

Aug 3, 2021

A circuit-theoretic approach to state estimation

2020 IEEE PES Innovative Smart Grid Technologies Europe (ISGT-Europe), online

Oct 26, 2020

Improved-accuracy state estimation with guaranteed convergence

2020 CEIC Advisory Committee Meeting, online

Oct 15, 2020

A LASSO-Inspired Approach for Localizing Power System Infeasibility

IEEE PES general meeting (PESGM), online

Aug 3, 2020