

# Wenlong Liao

Phone: +86-17320211455 Email: wenlong.liao@epfl.ch

## APPOINTMENT

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### Postdoctoral Researcher

Aug. 2023 –Now

Wind Engineering and Renewable Energy Laboratory, École polytechnique fédérale de Lausanne (EPFL), Switzerland

Supervisor: Prof. Fernando Porté-Agel

## EDUCATION

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### Ph.D., Electrical Engineering

Oct. 2020 –Jun.2023

AAU Energy, Aalborg University, Denmark

Supervisor: Prof. Birgitte Bak-Jensen, Assoc. Prof. Jayakrishnan Radhakrishna Pillai

### Visiting Ph.D. Student

Sept. 2022 –Feb.2023

The Department of Electrical and Electronic Engineering, The University of Hong Kong, China

Supervisor: Asst. Prof. Yi Wang

### M.E., Electrical Engineering

Sept. 2017 – Jun. 2020

School of Electrical and Information Engineering, Tianjin University, China

Supervisor: Prof. Shouxiang Wang

### B.E., Electrical Engineering

Sept. 2013 – Jun. 2017

College of Information and Electrical Engineering, China Agricultural University, China

Supervisor: Assoc. Prof. Dechang Yang

### B.E., Mathematics and Applied Mathematics

Sept. 2015 – Jun. 2017

College of Science, China Agricultural University, China

Supervisor: Assoc. Prof. Zhecai Shen

## RESEARCH INTERESTS

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Data Analytics and Optimization

Artificial Intelligence

Renewable Energy Sources

Power Distribution Systems

## SKILLS

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| ● Deep neural networks    | e.g., LSTM, GAN, CNN, GNN, etc.                                |
| ● Machine learning tools  | e.g., PyTorch, Tensorflow, Python, Matlab, etc.                |
| ● Optimization algorithms | e.g., Genetic algorithm, artificial bee colony algorithm, etc. |

## ACADEMIC SERVICES

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### Peer Reviewer in Journals

- IEEE Transactions on Power Systems
- IEEE Transactions on Smart Grid
- Applied Energy
- CSEE Journal of Power and Energy Systems

- Electric Power Systems Research
- International Journal of Electrical Power & Energy Systems
- Energy Reports
- Journal of Modern Power System and Clean Energy
- Energy Engineering
- Intelligent Systems with Applications

#### Peer Reviewer in Conferences

- The Third International Conference on Artificial Intelligence, Information Processing and Cloud Computing
- The 8th Asia Conference on Power and Electrical Engineering (ACPEE 2023)

### TEACHING

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- **Modern power system analysis** (Shouxiang Wang, 32 hour), Teaching assistant, Tianjin University, 2018.
- **Artificial intelligence and its applications to power systems** (Shouxiang Wang, 32 hour), Teaching assistant, Tianjin University, 2018/2019.

### AWARDS

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- **Best Student Paper Award**  
Awarded by the 8th Asia Conference on Power and Electrical Engineering. Apr. 2023
- **The Excellent Young Scholar**  
Awarded by the Journal of Modern Power Systems and Clean Energy (indexed in SCIE, IF=6.3). Jan. 2023
- **The Research Fellowship of Stay Abroad**  
Awarded by the Otto Mønsted Foundation in Denmark Sept. 2022
- **The Stay Abroad Fellowship of Aalborg University**
- Awarded by the Doctoral School of Engineering and Science at Aalborg University Apr. 2022
- **Best Presentation Award**  
Awarded by the 2nd China International Youth Conference On Electrical Engineering Dec. 2021
- **Best Paper Award**  
Awarded by the 2nd China International Youth Conference On Electrical Engineering Dec. 2021
- **The Second Prize**, China Graduate Mathematics Competition of "Huawei Cup"  
Awarded by China Academic Degrees & Graduate Education Development Center Dec. 2017
- **Honorable Mention**, International Mathematical Contest in Modeling (MCM)  
Awarded by Mathematical Association of America (MAA) Apr. 2016
- **The First Prize**, Mathematical Modeling Competition in Beijing  
Awarded by Beijing Education Commission Nov. 2015
- **The Second Prize**, The "Minsheng Cup" Mathematical Modeling Competition  
Awarded by Chinese Society for Applied Mathematics in Agriculture Oct. 2015
- **The Second Prize**, Higher Mathematics Competition at China Agricultural University  
Awarded by China Agricultural University Aug. 2014
- **The Second Prize**, Physics Experiment Competition at China Agricultural University  
Awarded by China Agricultural University Jun. 2014

### RESEARCH PUBLICATIONS

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Google Citation  $\geq 636$ , h-index=10 ([Google Scholar](#))

- EJ1 **W. Liao**, Z. Yang\*, X. Chen, and Y. Li, "WindGMMN: Scenario Forecasting for Wind Power Using Generative Moment Matching Networks," *IEEE Transactions on Artificial Intelligence*, vol. 3, no. 5, pp. 843-850, Oct. 2022, doi: 10.1109/TAI.2021.3128368.
- EJ2 **W. Liao**, Z. Yang\*, K. Liu, B. Zhang, X. Chen, and R. Song, "Electricity Theft Detection Using Euclidean and Graph Convolutional Neural Networks," *IEEE Transactions on Power Systems*, Early Access, Aug. 2022, doi: 10.1109/TPWRS.2022.3196403.
- EJ3 **W. Liao**, B. Bak-Jensen, J. R. Pillai, Y. Wang, and Y. Wang\*, "A Review of Graph Neural Networks and Their Applications in Power Systems," *Journal of Modern Power Systems and Clean Energy*, vol. 10, no. 2, pp. 345-360, Mar. 2022, doi: 10.35833/MPCE.2021.000058.
- EJ4 **W. Liao**, Z. Yang, B. B. Jensen, J. R. Pillai, L. V. Krannichfeldt, Y. Wang, and D. Yang\*, "Simple Data Augmentation Tricks for Boosting Performance on Electricity Theft Detection Tasks", *IEEE Transactions on Industry Applications*, Accepted, doi: 10.1109/TIA.2023.3262232.
- EJ5 **W. Liao**, S. Wang, B. B. Jensen, J. R. Pillai, and Z. Yang\*, "Bootstrap-Based Prediction Error Estimation for Robust Reactive Power Scheduling of Distribution Networks", *Journal of Modern Power Systems and Clean Energy*, Accepted, doi: 10.35833/MPCE.2022.000850
- EJ6 **W. Liao**, S. Wang, B. B. Jensen, J. R. Pillai, Z. Yang\*, and K. Liu, "Ultra-short-term Interval Prediction of Wind Power Based on Graph Neural Network and Improved Bootstrap Technique", *Journal of Modern Power Systems and Clean Energy*, Accepted. doi: 10.35833/MPCE.2022.000632.
- EJ7 **W. Liao**, B. Bak-Jensen, J. R. Pillai, Z. Yang\*, and K. Liu, "Short-Term Power Prediction for Renewable Energy Using Hybrid Graph Convolutional Network and Long Short-Term Memory Approach," *Electric Power Systems Research*, vol. 211, pp. 1-7, Oct. 2022, doi: 10.1016/j.epsr.2022.108614.
- EJ8 **W. Liao**, Y. Wang, Y. Wang, K. Powell, Q. Liu\*, and Z. Yang, "Scenario Generation for Cooling, Heating, and Power Loads Using Generative Moment Matching Networks," *CSEE Journal of Power and Energy Systems*, vol. 8, no. 6, pp. 1730-1740, Nov. 2022, doi: 10.17775/CSEEJPES.2021.00680.
- EJ9 **W. Liao**, L. Ge, B. Bak-Jensen, J. R. Pillai, and Z. Yang\*, "Scenario prediction for power loads using a pixel convolutional neural network and an optimization strategy," *Energy Reports*, vol. 8, pp. 6659-6671, Nov. 2022, doi: 10.1016/j.egy.2022.05.028.
- EJ10 **W. Liao**, B. Bak-Jensen, J. R. Pillai, Z. Yang\*, Y. Wang, and K. Liu, "Scenario Generations for Renewable Energy Sources and Loads Based on Implicit Maximum Likelihood Estimations," *Journal of Modern Power Systems and Clean Energy*, vol. 10, no. 6, pp. 1563-1575, Nov. 2022, doi: 10.35833/MPCE.2022.000108.
- EJ11 **W. Liao**, J. Chen, Q. Liu, R. Zhu, L. Song, and Z. Yang, "Data-driven Reactive Power Optimization for Distribution Networks Using Capsule Networks," *Journal of Modern Power Systems and Clean Energy*, vol. 10, no. 5, pp. 1274-1287, Sept. 2022, doi: 10.35833/MPCE.2021.000033.
- EJ12 **W. Liao**, B. Bak-Jensen, J. R. Pillai, D. Yang\*, and Y. Wang, "Data-driven Missing Data Imputation for Wind Farms Using Context Encoder," *Journal of Modern Power Systems and Clean Energy*, vol. 10, no. 4, pp. 964-976, Jul. 2022, doi: 10.35833/MPCE.2020.000894.

- EJ13 **W. Liao**, D. Yang\*, Y. Wang, and X. Ren, "Fault diagnosis of power transformers using graph convolutional network," *CSEE Journal of Power and Energy Systems*, vol. 7, no. 2, pp. 241-249, Mar. 2021, doi: 10.17775/CSEEJPES.2020.04120.
- EJ14 Z. Yang, Q. Zhang, **W. Liao\***, C. L. Bak, and Z. Chen, "Harmonic Injection Based Distance Protection for Line With Converter-Interfaced Sources," *IEEE Transactions on Industrial Electronics*, vol. 70, no. 2, pp. 1553-1564, Feb. 2023, doi: 10.1109/TIE.2022.3159971.
- E15 Z. Yang, **W. Liao\***, C. L. Bak and Z. Chen, "Active Control Based Three-phase Reclosing Scheme for Single Transmission Line with PMSGs," *IEEE Transactions on Industrial Electronics*, Accepted, doi: 10.1109/TIE.2023.3283709.
- EJ16 Z. Yang, **W. Liao\***, H. Wang, C. L. Bak, and Z. Chen, "Improved Euclidean Distance Based Pilot Protection for Lines With Renewable Energy Sources," *IEEE Transactions on Industrial Informatics*, vol. 18, no. 12, pp. 8551-8562, Dec. 2022, doi: 10.1109/TII.2022.3148318.
- EJ17 Z. Yang, **W. Liao\***, C. L. Bak, and Z. Chen, "Comprehensive current amplitude ratio based pilot protection for line with converter-interfaced sources," *Energy Reports*, vol. 8, sup. 10, pp. 420-430, Nov. 2022, doi: 10.1016/j.egyr.2022.05.170.
- EJ18 Z. Yang, **W. Liao\***, C. L. Bak, and Z. Chen, "Fault coordination control for converter-interfaced sources compatible with differential protection during asymmetrical faults," *Energy Reports*, vol. 8, sup. 13, pp. 249-258, Nov. 2022, doi: 10.1016/j.egyr.2022.08.045.
- EJ19 R. Zhu, **W. Liao\***, and X. Ren, "Quantification of distribution network security with high penetration of distributed generators," *Energy Reports*, vol. 6, sup. 9, pp. 1604-1610, Dec. 2020, doi: 10.1016/j.egyr.2020.12.029.
- EJ20 R. Zhu, **W. Liao\***, and Y. Wang, "Short-term prediction for wind power based on temporal convolutional network," *Energy Reports*, vol. 6, sup. 9, pp. 424-429, Dec. 2020, doi: 10.1016/j.egyr.2020.11.219.
- EJ21 Q. Zhao, **W. Liao\***, S. Wang, and J. R. Pillai, "Robust Voltage Control Considering Uncertainties of Renewable Energies and Loads via Improved Generative Adversarial Network," *Journal of Modern Power Systems and Clean Energy*, vol. 8, no. 6, pp. 1104-1114, Nov. 2020, doi: 10.35833/MPCE.2020.000210.
- EJ22 Z. Pan, J. Wang, **W. Liao\***, H. Chen, D. Yuan, W. Zhu, X. Fang, and Z. Zhu, "Data-Driven EV Load Profiles Generation Using a Variational Auto-Encoder," *Energies*, vol. 12, no. 5, pp. 1-15, Mar. 2019, doi: 10.3390/en12050849.
- EJ23 L. Ge, **W. Liao\***, S. Wang, B. Bak-Jensen, and J. R. Pillai, "Modeling Daily Load Profiles of Distribution Network for Scenario Generation Using Flow-Based Generative Network," *IEEE Access*, vol. 8, pp. 77587-77597, Apr. 2020, doi: 10.1109/ACCESS.2020.2989350.
- EJ24 X. Gong, B. Tang, R. Zhu, **W. Liao\***, and L. Song, "Data Augmentation for Electricity Theft Detection Using Conditional Variational Auto-Encoder," *Energies*, vol. 13, no. 17, pp. 1-14, Aug. 2020, doi: 10.3390/en13174291.

- EJ25 D. Yang, **W. Liao\***, Y. Wang, K. Zeng, Q. Chen, and D. Li, "Data-Driven Optimization Control for Dynamic Reconfiguration of Distribution Network," *Energies*, vol. 11, no. 10, pp. 1-18, Oct. 2018, doi: 10.3390/en11102628.
- EJ26 Y. Wang, **W. Liao\***, and Y. Chang, "Gated recurrent unit network-based short-term photovoltaic forecasting," *Energies*, vol. 11, no. 8, pp. 1-14, Aug. 2018, doi: 10.3390/en11082163.
- EJ27 B. Sun, J. Chen, L. Ge\*, Y. Zeng, G. Liang, and **W. Liao**, "A fast island partition method of distribution network with energy storage based on electricity sufficiency and power balance information", *CSEE Journal of Power and Energy Systems*, Accepted.
- EJ28 W. Wang, B. Feng\*, G. Huang, C. Guo, **W. Liao**, and Z. Chen, "Conformal Asymmetric Multi-Quantile Generative Transformer for Day-Ahead Wind Power Interval Prediction", *Applied Energy*, Vol. 333, pp.1-15, Mar. 2023, doi: 10.1016/j.apenergy.2022.120634.
- EJ29 Z. Yang\*, **W. Liao**, Q. Zhang, C. Leth Bak, and Z. Chen, "Fault Coordination Control for Converter-interfaced Sources Compatible with Distance Protection during Asymmetrical Faults," *IEEE Transactions on Industrial Electronics*, Early Access, Sept. 2022, doi: 10.1109/TIE.2022.3204946.

### Conference Papers With Peer Review Process

- C1 **W. Liao**, B. B. Jensen, J. R. Pillai, Z. Yang, Z. Li, and D. Yang\*, "Stochastic Day-ahead Optimal Scheduling of Active Distribution Networks with Renewable Energy Sources and Electric Vehicles," *in 8th Asia Conference on Power and Electrical Engineering (ACPEE)*, Apr. 2023, pp. 564-571, doi: 10.1109/ACPEE56931.2023.10135695.
- C2 **W. Liao**, B. Bak-Jensen, J. R. Pillai, Z. Yang\*, and Y. Wang, "An Open-Source Toolbox with Classical Classifiers for Electricity Theft Detection," *in IEEE 2nd China International Youth Conference on Electrical Engineering (CIYCEE)*, Dec. 2021, pp. 1-7, doi: 10.1109/CIYCEE53554.2021.9676911.
- C3 **W. Liao\***, B. Bak-Jensen, J. R. Pillai, R. Zhu, and L. Song, "Data-Driven Scenarios Generation for Wind Power Profiles Using Implicit Maximum Likelihood Estimation," *in Proceedings of 12th International Conference on Applied Energy (ICAE2020)*, Dec. 2020. pp. 1-5, doi: 10.46855/energy-proceedings-7118.
- C4 **W. Liao\***, S. Wang, Q. Liu, and X. Su, "Reactive Power Optimization of Distribution Network Based on Case-Based Reasoning," *in IEEE Power & Energy Society General Meeting (PESGM)*, Aug. 2018, pp. 1-5, doi: 10.1109/PESGM.2018.8586373.
- C5 J. Li\*, **W. Liao**, R. Yang, and Z. Chen, "A Data Augmentation Method for Distributed Photovoltaic Electricity Theft Using Wasserstein Generative Adversarial Network," *in IEEE 5th Conference on Energy Internet and Energy System Integration (EI2)*, Oct. 2021, pp. 3132-3137, doi: 10.1109/EI252483.2021.9712854.
- C6 W. Wu, **W. Liao**, J. Miao\*, and G. Du, "Using Gated Recurrent Unit Network to Forecast Short-Term Load Considering Impact of Electricity Price," *in Proceedings of 10th International Conference on Applied Energy (ICAE2018)*, Aug. 2018, doi: 10.1016/j.egypro.2019.01.950.

### Submitted Papers

- S1 **W. Liao**, R. Zhu, Z. Yang\*, K. Liu, B. Zhang, S. Zhu, and B. Feng, "Electricity Theft Detection Using Dynamic Graph Construction and Graph Attention Network", *IEEE Transactions on Industrial Informatics*, Under Review.

- S2 **W. Liao**, I. Muhammad, M. Tariq, G. Ruan, X. Cui, and Z. Yang\*, "Transfer Learning-Driven Electricity Theft Detection in Small Sample Cases", *IEEE Transactions on Industrial Informatics*, Under Review.
- S3 **W. Liao**, B. B. Jensen, J. R. Pillai, X. Xia, G. Ruan, and Z. Yang\*, "Reducing Annotation Efforts in Electricity Theft Detection through Optimal Sample Selection", *IEEE Transactions on Power Systems*, Under Review.

## REFERENCES

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- R1 Prof. Birgitte Bak-Jensen, AAU Energy, Aalborg University.  
Email: bbj@energy.aau.dk
- R2 Asst. Prof. Yi Wang, the Department of Electrical and Electronic Engineering, The University of Hong Kong. Email: yiwang@eee.hku.hk
- R3 Prof. Shouxian Wang, School of Electrical and Information Engineering, Tianjin University.  
Email: sxwang@tju.edu.cn