Yinyan Liu

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Professional Summary

I am a Ph.D. candidate supervised by Prof. Jin Ma at the School of Electrical Information Engineering and Centre for Future Energy Networks, the University of Sydney (USYD). My research interests include energy management, energy efficiency for consumers with renewable energy, pricing and scheduling of shared energy storage, Internet-of-things with the understanding of human factors, and artificial intelligence applications in smart grids.

Education

Ph.D., Electrical & Information Engineering Oct. 2019 – Dec. 2022
School of Electrical & Information Engineering, The University of Sydney, Australia, **Supervisor**: Prof. Jin Ma
University of Sydney International Scholarship (USydIS) and Top-up Scholarship

M.E., Control Engineering Aug. 2015 – Jul. 2018
Department of Automation, Tsinghua University, China **Supervisor**: Prof. Yi Li
National Scholarship, Ministry of Education, China, Top 2%

B.E., Measuring & controlling Technology and Instrument Sep. 2007 – Jul. 2011
Department of Automation, North China Electric Power University, China **Instructor**: Prof. Xiyun Yang
National Encouragement Scholarship over 3 years
NCEPU Studies Excellent Scholarship for Undergraduate, three times

Research Experience

Business Models for Shared Energy Storage **Dec. 2021 – Present**

- Develop a business model under the sharing storage to reduce the energy cost for consumers with renewable resources.
- Propose a privacy-preserving collaborative system to interact with the sharing storage competitively and cooperatively without direct data sharing and central data storage.
- Propose a method to process the uncertainty of the user behavior in a community energy cooperation with shared energy storage.

Home Energy Management Sytems **Apr. 2021 – Present**

- Develop a cooperative multi-agent reinforcement learning approach for the energy management of multiple smart homes with renewable resources. Each user's comfort and privacy have been considered. (Refer to journal paper 7)
- Design a home energy management algorithm with understanding and quantitatively defining different consumer/prosumer preference levels with non-intrusive load monitoring. (Refer to journal paper 2)

Understanding User's Energy Consumption Behavior **Oct. 2019 – Apr. 2021**

- Develop a quantitative method for consumer/prosumer's energy consumption behavior with non-intrusive load monitoring. (Refer to journal paper 2)
- Apply the user's energy consumption behavior to the home energy management system to reduce the user's energy cost while keeping the user's preference of electric appliances usage habits in life. (Refer to journal paper 2)

Non-Intrusive Load Monitoring **Oct. 2019 – Mar. 2022**

- Develop a multi-task learning algorithm with a temporal convolutional network and multi-head attention mechanism for non-intrusive energy disaggregation (Refer to journal paper 3: IEEE Transactions on Smart Grid)
- Design a single-to-multi energy disaggregation network with deep encoder-decoder architecture to remove unrealistic assumptions, reduce the model size, and achieve latency-free NILM. (Refer to journal paper 4)
- Propose an algorithm based on the adversarial and joint adaptation network for energy disaggregation to improve the model's generalization ability. (Refer to journal paper 5)
- Propose a multi-layer momentum contrast algorithm for unsupervised feature representation learning for non-intrusive load monitoring. (Refer to journal paper 1)

Projects Participation

I participated in six Australian Research Council Projects, one Australia-China Science and Research Project for Energy Informatics and Demand Response Technologies, one Hong Kong University of Science and Technology Project, and one UK-Australia Project for supporting electric Vehicle Infrastructure at the "Edge of the Grid" in the past three years. During the collaboration with senior researchers worldwide, I was exposed to many advanced research methodologies and got professional growth, such as critical thinking, dialectical thinking, and project management. In addition, as a result of these collaborated projects, I gained strong communication, question formulation, team collaboration, and team management skills. Furthermore, I also have participated in an industry project for peak price forecasting.

Peak Price Forecasting | *Python, GTL Renewable Pty Ltd, Australia* **Jun. 2020 – Mar. 2021**

- Develop algorithm based on long short-term memory and empirical mode decomposition for peak price forecasting with historical demand, price, weekday, time slots of a day, and temperature.
- Provide algorithms such as light gradient boosting machine and model predictive control for spike price forecasting.
- Develop a Battery Energy Storage Systems (BESS) optimization algorithm for the company for day-ahead charging/discharging scheduling of the BESS.

Publications

Published Journal Papers

PJ1. **Yinyan Liu**, Jin Ma, Xinjie Xing, Xinglu Liu, and Wei Wang. A Home Energy Management Incorporating Data-Driven Uncertainty-Aware User Preference. *Applied Energy*, 2022.

PJ2. **Yinyan Liu**, Qiu Jing, and Jin Ma. SAMNet: Towards Latency-Free Non-Intrusive Load Monitoring Via Multi-Task Deep Learning. *IEEE Transactions on Smart Grid* (**TSG**), vol. 13, no. 3, pp. 2412-2424, May 2022.

PJ3. **Yinyan Liu**, Qiu Jing, Junda Lu, Wei Wang, and Jin Ma. A Single-to-Multi Network for Latency-Free Non-Intrusive Load Monitoring. *IEEE Transactions on Network Science and Engineering* (**TNSE**), vol. 9, no. 2, pp. 755-768, 1 March-April 2022.

PJ4. **Yinyan Liu**, Li Zhong, Jing Qiu, Junda Lu, and Wei Wang. Unsupervised Domain Adaptation for Non-Intrusive Load Monitoring Via Adversarial and Joint Adaptation Network. *IEEE Transactions on Industrial Informatics* (**TII**), vol. 18, no. 1, pp. 266-277, 2021.

PJ5. **Yinyan Liu**, Yuchi Deng, Maomao Zhang, Peining Yu, and Yi Li. Experimental measurement of oil-water two-phase flow by data fusion of electrical tomography sensors and venturi tube. *Measurement Science and Technology* (**MST**), 2017, 25(9).

PJ6. Shuying Lai, Jing Qiu, Yuechuan Tao, and **Yinyan Liu**. Risk hedging strategies for electricity retailers using insurance and strangle weather derivatives. *International Journal of Electrical Power & Energy Systems*, 2022.

PJ7. Delin Hu, Jinku Li, **Yinyan Liu** and Yi Li. Flow Adversarial Networks: Flowrate Prediction for Gas–Liquid Multiphase Flows Across Different Domains. *IEEE Transactions on Neural Networks and Learning Systems* (**TNNLS**), vol. 31, no. 2, pp. 475-487, Feb. 2020,.

PJ8. Jiaoxuan Chen, Maomao Zhang, **Yinyan Liu**, Jiaoliao Chen, and Yi Li. Image reconstruction algorithms for electrical capacitance tomography based on ROF model using new numerical techniques. *Measurement Science and Technology* (**MST**), 2017, 28(3): 035404.

Submitted Journal Papers

SJ1. **Yinyan Liu**, Jin Ma, and Lei Bai. Low-Carbon Community Energy Management Incorporating Data-Driven Customer Segmentation. *IEEE Transactions on Smart Grid*, 2022. Ready to Submit

SJ2. **Yinyan Liu**, Lei Bai, Jin Ma, Wei Wang and Wanli Ouyang. Unsupervised Feature Representation Learning for Non-Intrusive Load Monitoring. *IEEE Transactions on Smart Grid*, 2022. First Review

SJ3. Jun Lin, Jin Ma, **Yinyan Liu**, and Jianguo Zhu. A Cooperative Multi-Agent Reinforcement Learning Method for Energy Management. *IEEE Transactions on Sustainable Energy*, 2022. Second Review

Published Conference Papers

PC1. **Yinyan Liu**, Haoning Xi, Yunqi Wang, Jun Lin, and Jin Ma. Community Energy Cooperation with Shared Energy Storage for Economic-Environment Benefits. 11th International Conference on Innovative Smart Grid Technologies (ISGT-Asia 2022), 2022.

PC2. **Yinyan Liu**, Yuchi Deng, and Yi Li. Experimental investigation of gas-oil two-phase flow using electrical capacitance tomography. *IEEE International Conference on Imaging Systems and Techniques* (**IST**), 2017 (**Oral Presentation**).

PC3. Yuchi Deng, **Yinyan Liu**, and Yi Li. The GVF measurement and flow regime study of gas-water flows by ERT sensor. *IEEE International Conference on Imaging Systems and Techniques* (**IST**), 2017 (**Oral Presentation**).

Work Experience

Algorithmic Engineer, Rokid A-Lab, Beijing Haishi Technology Co. Ltd, Beijing, China **Jul. 2018 – Oct.2019**

- Develop algorithms for time-series problems, including speech enhancement, speech separation, and automatic speech recognition with deep learning methods.
- Learn the Kaldi with hmm-gmm and neural network and study in-depth using various deep learning frameworks, including Tensorflow and Pytorch for time-series problems

Control Engineer, Shanxi Zhangze Power Co., LTD, Shanxi, China **Jul. 2011 – Jun. 2015**

- Develop a management system to automatically perform a set of unit tasks daily to decrease the time needed for team members to identify and clarify proxy tasks for different roles in the company.
- Familiar with and maintaining the Distributed Control System(DCS) and Programmable Logic Controller (PLC) to ensure the complex control systems work well.

Academic Services

Peer Reviewer in Journals

- IEEE Transactions on Smart Grid
- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Network Science and Engineering
- IEEE Transactions on Neural Networks and Learning Systems
- IET Generation, Transmission & Distribution
- International Journal of Electrical Power & Energy Systems

Teaching

- OLEO1602-OLET1603 Analysing and Plotting Data: Python
- Operational Research

Mentoring

- ENGO Peer Mentoring Program to assist first-year Ph.D. students to build social and academic networks.

Awards

- Postgraduate Research Support Scheme (PRSS) Funding, University of Sydney, Australia (AU$3500) 2022
- Postgraduate Research Support Scheme (PRSS) Funding, University of Sydney, Australia (AU$3500) 2021
- Top-Up Scholarship, University of Sydney, Australia (AU$8,000) 2020
- University of Sydney International Scholarship, University of Sydney, Australia (AU$280,000) 2019
- National Scholarship, Tshinghua University (Ministry of Education), China, Top 2% 2017
- National Encouragement Scholarship, North China Electric Power University 2008-2010
- The third prize of eleventh "Challenge Cup" National College Student Curricular Academic Science and Technology Works Competition 2009
- Merit Student, North China Electric Power University 2009