

# RENZHI LU

Assistant Professor

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## EXPERIENCE

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**Assistant Professor** 2019.11 -

School of Artificial Intelligence and Automation, Huazhong University of Science and Technology

- Colleagues: Hai-Tao Zhang, Ye Yuan, Lijun Zhu, Cheng Cheng, Zuogong Yue

**Researcher** 2019.07 - 2019.11

School of Artificial Intelligence and Automation, Huazhong University of Science and Technology

- Intelligent Manufacturing and Data Science Laboratory

## EDUCATION

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**Hanyang University (South Korea), Ph.D. degree** 2014.09 - 2019.06

- **Major:** Electronic Systems Engineering
- **Thesis:** Artificial Intelligence based Energy Management in Demand Response Market and Home
- **Adviser:** Prof. Seung Ho Hong

**Wuhan University of Science and Technology (China), B.S. degree** 2010.09 - 2014.06

- **Major:** Electronic Information Engineering
- **Thesis:** CPC (center position control) Automatic Control System
- **Project Adviser:** Prof. Guofa Hao
- **Thesis Adviser:** Prof. Jun Yang

## RESEARCH INTERESTS

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### Artificial Intelligence/Deep Reinforcement Learning

focus on learning algorithm and its application in smart grid and smart manufacturing

- Reinforcement Learning/Deep Reinforcement Learning for Home/Commercial/Industrial Energy Management
- Deep Learning for Load and Price Forecasting
- Multi-Agent Reinforcement Learning for Cooperative/Competitive/Mixed Cooperative-Competitive Energy Management System

### Smart Grid/Power System

focus on optimal use of energy resources, analysis and optimization of energy processes

- Demand Response, Energy Management
- Load Forecasting, Price Forecasting
- Design, Implementation and Evaluation of Power Systems

### Smart Manufacturing/Industrial 4.0

focus on systems design and implementation

- Cyber Physical System (CPS), Digital Twin (DT)
- Administration Shell (AAS), OPC Unified Architecture (OPC UA), AutomationML (AML)

## PROJECTS

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1. **National Natural Science Foundation of China**, 62003143, 2021-2023, PI
2. **Fundamental Research Funds for the Central Universities**, HUST2020kfyXJJS084, 2020-2022, PI
3. **State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources**, LAPS21006, 2021-2022, PI
4. **State Key Laboratory of Industrial Control Technology**, ICT2021B32, 2021, PI
5. **Key Laboratory of Industrial Internet of Things and Networked Control**, 2020FF02, 2021-2023, PI
6. **National Natural Science Foundation of China**, 62173155, 2022-2025, Participator
7. **National Natural Science Foundation of China**, 62073148, 2021-2024, Participator
8. **National Research Foundation of Korea through the Framework of International Cooperation Programs (Korea–China)**, NRF-2018K1A3A1A61026320, 2018-2020, Participator
9. **National Research Foundation of Korea through the Framework of International Cooperation Programs (Korea–China)**, NRF-2016K2A9A2A11938310, 2016-2018, Participator

## HONORS & AWARDS

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- 2020 ESI, **Highly Cited Papers**
- 2020 Fondazione Eni Enrico Mattei, **Eni Award Energy Frontiers Candidate**
- 2020 Samsung, **AI Researcher of the Year Candidate**
- 2020 Applied Energy, **Highly Cited Paper Awards**
- 2019 Hanyang University, **Excellent Doctoral Thesis**
- 2018 Education Office of the Embassy of the People's republic of China in Korea, **Outstanding Student**
- 2014 Wuhan University of Science and Technology, **Outstanding Graduate Student**
- 2014 Wuhan University of Science and Technology, **Outstanding Undergraduate Thesis**
- 2013 Wuhan University of Science and Technology, **Outstanding student**
- 2013 Hubei Province, **The First Prize of National Undergraduate Electronic Design Contest**
- 2013 Wuhan University of Science and Technology, **The First Prize of Second Annual School Undergraduate Electronic Design Contest**
- 2016-2019 China Scholarship Council, **Chinese Government Graduate Student Overseas Study Program**
- 2015-2018 BK21 PLUS, **Brain Korea 21 Program for Leading Universities & Students**
- 2016 Hanyang University, **Learning Community Scholarship**
- 2015 Hanyang University, **Research Support Special Scholarship**
- 2014-2017 Hanyang University, **Scholarship for Combined M.S. & Ph.D. Program in Engineering and Science**
- 2012-2013 Wuhan University of Science and Technology, **Third Scholarship**

## PUBLICATIONS

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### Journals

1. **Lu, R.**, Bai, R., Ding, Y., Wei, M., Jiang, J., Sun, M., Xiao, F., & Zhang, H. T. (2021). A hybrid deep learning-based online energy management scheme for industrial microgrid. **Applied Energy**, 304, 117857. (IF: 9.746)
2. **Lu, R.**, Bai, R., Luo, Z., Jiang, J., Sun, M., & Zhang, H. T. (2021). Deep Reinforcement Learning-based Demand Response for Smart Facilities Energy Management. **IEEE Transactions on Industrial Electronics**. (IF: 8.236)
3. Zhang, X., **Lu, R.** (Equal Contribution), Jiang, J., Hong, S. H., & Song, W. S. (2021). Testbed implementation of reinforcement learning-based demand response energy management system. **Applied Energy**, 297, 117131. (IF: 9.746)
4. **Lu, R.**, Bai, R., Huang, Y., Li, Y., Jiang, J., & Ding, Y. (2021). Data-driven real-time price-based demand response for industrial facilities energy management. **Applied Energy**, 283, 116291. (IF: 9.746)
5. Li, Z., Li, Y., Liu, Y., Wang, P., **Lu, R.**, & Gooi, H. B. (2021). Deep learning based densely connected network for load forecasting. **IEEE Transactions on Power Systems**, 36(4), 2829-2840. (IF: 6.663)
6. **Lu, R.**, Li, Y. C., Li, Y., Jiang, J., & Ding, Y. (2020). Multi-agent deep reinforcement learning based demand response for discrete manufacturing systems energy management. **Applied Energy**, 276, 115473. (IF: 8.848)

7. Zhong, T., Zhang, H. T., Li, Y., Liu, L., & **Lu, R.** (2020). Bayesian Learning-Based Multi-Objective Distribution Power Network Reconfiguration. **IEEE Transactions on Smart Grid**, 12(2), 1174-1184. (IF: 10.486)
8. **Lu, R.**, Hong, S. H., & Yu, M. (2019). Demand response for home energy management using reinforcement learning and artificial neural network. **IEEE Transactions on Smart Grid**, 10(6), 6629-6639. (IF: 10.486)
9. **Lu, R.**, & Hong, S. H. (2019). Incentive-based demand response for smart grid with reinforcement learning and deep neural network. **Applied Energy**, 236, 937-949. (IF: 8.426, ESI Highly Cited)
10. **Lu, R.**, Hong, S. H., & Zhang, X. (2018). A dynamic pricing demand response algorithm for smart grid: reinforcement learning approach. **Applied Energy**, 220, 220-230. (IF: 7.900, ESI Highly Cited)
11. Yu, M., **Lu, R.**, & Hong, S. H. (2016). A real-time decision model for industrial load management in a smart grid. **Applied Energy**, 183, 1488-1497. (IF: 7.182)

### Conferences

1. **Lu, R.**, Hong, S. H., Zhang, X., Ye, X., & Song, W. S. (2017, December). A perspective on reinforcement learning in price-based demand response for smart grid. In 2017 International Conference on Computational Science and Computational Intelligence (CSCI) (pp. 1822-1823). IEEE.
2. Luo, Z., Hong, S., **Lu, R.**, Li, Y., Zhang, X., Kim, J., ... & Liang, W. (2017, September). OPC UA-based smart manufacturing: system architecture, implementation, and execution. In 2017 5th international conference on enterprise systems (es) (pp. 281-286). IEEE.
3. Ding, Y., Hong, S. H., **Lu, R.**, Kim, J., Lee, Y. H., Xu, A., & Xiaobing, L. (2015, August). Experimental investigation of the packet loss rate of wireless industrial networks in real industrial environments. In 2015 IEEE International Conference on Information and Automation (pp. 1048-1053). IEEE.

### PROFESSIONAL SERVICES

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- 2020- Member, Chinese Association of Automation (CAA)
- 2020- Member, China Computer Federation (CCF)
- 2020- Member, Chinese Society For Electrical Engineering (CSEE)
- 2018- Member, IEEE Membership
- 2018- Member, IEEE Computational Intelligence Society Membership
- 2018- Member, IEEE Industrial Electronics Society Membership
- 2018- Member, IEEE Power & Energy Society Membership
- 2020- Member, IEEE Control Systems Society Membership
- 2015- Reviewer, IEEE Transactions on Industrial Electronics
- 2015- Reviewer, Applied Energy
- 2016- Reviewer, IEEE Transactions on Smart Grid
- 2016- Reviewer, IEEE Transactions on Industrial Informatics
- 2018- Reviewer, IET Renewable Power Generation
- 2019- Reviewer, IEEE Transactions on Neural Networks and Learning Systems
- 2020- Reviewer, International Journal of Production Research

### TALKS

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- Deep reinforcement learning, Huazhong University of Science and Technology, October 29, 2019
- Artificial intelligence based demand response for home energy management, Tianjin University of Technology, February 26-28, 2019
- Demand response using artificial intelligence, Hanyang University, January 24-25, 2019
- Reinforcement learning and its application in demand response, Tianjin University of Technology, September 25-28, 2017
- Implementation of OpenADR and SEP2.0 for energy management, Shenyang Institute of Automation, March 15-18, 2017

### OTHERS

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#### Programming Skills

- Python, Java, Nginx, Lua, OpenResty, C, C#, Matlab, MySQL, Linux, ExtJS

## **Hardware Experience**

- Circuit Design, Signal Amplification and Waveform Shaping, Altium Designer