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Objective-based AI for Optimization and Control in Energy Systems



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Abstract: The decarbonization of energy systems has posed unprecedented challenges in system complexity and operational uncertainty that render it imperative to exploit cutting-edge big data analytics and artificial intelligence (AI) technologies to realize cost-effective, real-time, autonomous decision-making. Traditionally, AI models and their downstream decision-making models are independent. The objective of AI is generally based on statistical metrics while decision-making models usually aim at lower cost and higher reliability. An underlying assumption here is that a more statistically accurate result generated by AI will guarantee more effective decision-making. However, recent research shows different results. For example, the forecasting error might have an asymmetric impact on the system operational cost. The clustering error may have a distributional influence on network expansion decisions. Therefore, it is imperative to investigate and develop novel objective-based AI techniques by fully considering the “objective” of the downstream applications in energy systems such as planning, operation, and control, which will be introduced and discussed in this presentation.

Short Bio: Dr Mingyang Sun is currently a Professor at Zhejiang University and an Honorary Lecturer at Imperial College London. He received his MSc and Ph.D. in Electrical and Electronic Engineering in the Control and Power group at Imperial College London, UK, in 2012 and 2017, respectively. His research interests include trustworthy artificial intelligence, objective-based big data analytics, cyber-physical security, and their applications in energy systems optimization and control. He has authored about 80 scientific publications in Nature Communications, leading power system journals, and top AI and security conferences, including IEEE PES Trans., Applied Energy, AAAI, IJCAI, USENIX Security, and NDSS. Three of the conference papers have been awarded the Best Papers for IEEE PES GM 2016, PMAPS 2016, and IEEE TrustCom 2022, respectively. Also, he was awarded the NSFC Excellent Young Scholars Fund (Overseas), the World's Top 2% Scientists, 3 ESI highly cited papers, and the Highly Cited Paper Awards 2019 of Applied Energy. He is currently the Associate Editor, Leading Guest Editor, and Guest Editor of international journals, including IEEE Trans. on Industrial Informatics, Applied Energy, Advances in Applied Energy, and IET Smart Grid. He is the PI/CO-PI for a series of key projects funded by the NSFC, the National Key R&D Program of China, The Royal Society(UK), and industries.

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