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IEEE BDA Tutorial Series: Big Data & Analytics for Power Systems

Machine Learning for Power Systems: Physics-Informed Neural Networks and Verification

Prof. Spyros Chatzivasileiadis
Technical University of Denmark

11:00 am-12:30 pm, Wednesday, Apr. 22, 2020, Pacific Time
(8:00 pm - 9:30 pm, Wednesday, Apr. 22, 2020, Central European Time)
(2:00 am – 3:30 am, Thursday, Apr. 23, 2020, China Standard Time)

Abstract: In this tutorial, we introduce methods that remove the barrier for applying neural networks in real-life power systems, and unlock a series of new applications. First, we introduce a framework for verifying neural network behavior in power systems. Up to this moment, neural networks have been applied in power systems as a black-box; this has presented a major barrier for their adoption in practice. Using a rigorous framework based on mixed integer linear programming, our methods have the potential to build the missing trust of power system operators in neural networks. Second, we present a framework for physics-informed neural networks in power system applications. Exploiting the underlying physical laws governing power systems, and inspired by recent developments in the field of machine learning, we propose a neural network training procedure that can make use of the wide range of mathematical models describing power system behavior. Methods such as the ones we will discuss in this talk unlock the potential of neural networks to perform power system tasks at extremely fast computing times while maintaining verified accuracy.

Bio: Spyros Chatzivasileiadis (S'04, M'14, SM'18) is an Associate Professor at the Technical University of Denmark (DTU). Before that he was a postdoctoral researcher at the Massachusetts Institute of Technology (MIT), USA and at Lawrence Berkeley National Laboratory, USA. Spyros holds a PhD from ETH Zurich, Switzerland (2013) and a Diploma in Electrical and Computer Engineering from the National Technical University of Athens (NTUA), Greece (2007). In March 2016, he joined the Center for Electric Power and Energy at DTU. He is currently working on power system optimization and control of AC and HVDC grids, and machine learning applications for power systems.

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