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SenSIP Seminar Series

Fault Detection and Classification using Real-Time Data from the MTW PV Testbed

Presenter: Sunil Rao
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Abstract

The efficiency of solar energy farms requires detailed analytics and information on each panel regarding voltage, current, temperature, and irradiance. Monitoring utility-scale solar arrays was shown to minimize the cost of maintenance and help optimize the performance of the photovoltaic (PV) arrays under various conditions. We describe a system that includes development of neural network algorithms along with a solar array testbed for the purpose of PV monitoring and control. The 18kW PV array testbed consists of 104 panels fitted with smart monitoring devices. Each of these devices embeds sensors, a wireless transceiver, and relays that enable continuous monitoring, fault detection, and real-time connection topology changes. We obtain data in real-time for multiple fault classes using the SenSIP solar array testbed at MTW. We describe in detail the methodology used to obtain these real-time measurements. The solar array is also connected to an automated custom load which performs real-time switching to adapt the load. We vary the load based on the time of the day to allow for maximum power at any given instant of time. We then develop machine learning and neural network algorithms for fault classification using these real-time measurements. Automatic detection of solar array faults reduces maintenance costs and increases efficiency. More specifically, we address the problem of fault detection, and classification in utility-scale photovoltaic (PV) arrays using machine learning methods. Fault detection and classification using metrics such as accuracy, confusion matrices, and the Risk Priority Number (RPN) is evaluated. We explore, examine and assess the use of customized neural networks with dropout regularizers. This approach promises to elevate the performance and robustness of PV arrays and compares favorably against existing methods.

Biography: Sunil Rao received a B.E. degree in electronics and communications engineering from Visvesvaraya Technological University, India, in 2013, and an M.S. degree in electrical engineering from Arizona State University, Tempe, AZ, USA, in 2018. He is currently pursuing a Ph.D. degree at the School of Electrical, Computer, and Energy Engineering, Arizona State University. He is a member of the SenSIP center. Most recently, in the Summer of 2020, he was an intern at Bosch. His research interests include solar array fault classification using machine learning, signal processing, and deep learning.

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