AI-based Anomaly Detection and Cybersecurity Situational Awareness for IoT Networks

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Abstract

The smart grid has been undergoing major transformation with the high penetration of Distributed Energy Resources (DERs), including solar and wind farms, energy storage, and microgrid technologies. These DER networks are increasingly reliant upon advanced sensors, edge computing, wide area communication, cloud infrastructures, and ML-based analytics – in the form of Energy Internet of Things (IoT) – for real-time monitoring and control applications. Cyber threats to energy infrastructures and IoT networks are growing both in numbers and sophistication. Secure and resilient operation of this energy IoT network is of paramount importance to reliable and economic operation of the DER-integrated smart grid. This talk will first present an architecture for cybersecurity situational awareness, then present algorithms and testbed-based evaluation results for ML-based anomaly detection and alert correlation, and a federated learning-based anomaly detection. Finally, the talk will conclude with some future research directions in this area.

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Manimaran Govindarasu is on the faculty of Iowa State University since 1999, and he currently holds the titles of Anson Marston Distinguished Professor in Engineering and Harploe Professor in Electrical and Computer Engineering. Prior to joining Iowa State, he received his Ph.D. in Computer Science and Engineering from Indian Institute of Technology, Madras (Chennai). His research experience includes Cybersecurity for the Smart Grid and Critical Infrastructures, and Real-time Systems and Networks. He has co-authored over 300 peer-reviewed research publications, received multiple conference best paper awards, presented several dozen conference invited talks, tutorials, and industry short-courses, hands-on training sessions, and mentored over 50 graduate students for their dissertation/thesis research. He is currently serving as the Chair of Cybersecurity Working Group for Power Grid in IEEE Power & Energy Society and has served as an Associate Editor and guest co-editor for several flagship IEEE publications. His research is supported over the years by US NSF, DOE, DHS, and DOD. He is a Fellow of the IEEE and an ABET Program Evaluator.