HETEROGENEOUS TRANSFER LEARNING FOR POWER SYSTEMS

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OVERVIEW

Machine Learning (ML) is gaining increasing popularity to tackle uncertainty in physical systems, such as modern power systems. However, ML models can be hardly trained for newly-built power grids with limited data, especially when different power grids have different dimensionalities and distributions for measurement data. To tackle this problem, we propose a novel Heterogeneous Transfer Learning (HTL)-based method to boost the data volume of the target grid. Specifically, we propose a Merged Multi-Modal Gaussian Graphical Model (M^3G^2M) with a physical data merging process for knowledge transfer. To solve the maximum likelihood estimation of M^3G^2M with imbalanced data from two grids, we propose a novel Expectation-Maximization algorithm.

Finally, we quantify the negative transfer via the KL-Divergence to measure the distribution similarity between the source grid and the target grid for the transferring confidence. We demonstrate the advantages and the generalizability of our proposed models in diversified data sets for power systems and human action-sensing systems.

BIO

Dr. Yang Weng received his PhD from Carnegie Mellon University (CMU). Before that, he obtained three MS degrees in Machine Learning (CMU), Electrical and Computer Engineering (CMU), and Statistics (UIC). After earning his PhD, he joined Stanford University as a Postdoctoral Fellow for Sustainable Energy. He is currently an Assistant Professor in the School of Electrical, Computer, and Energy Engineering at Arizona State University (ASU). Dr. Weng received the 2021 NSF CAREER Award, 2021 Outstanding IEEE Young Professional Award (Phoenix Section), 2020 Outstanding Faculty Mentor Award (ASU), as well as the 2020 Centennial Award for Teaching (ASU). He also got 7 Best Paper Awards or Best Papers, Winner Award for International Competition on Innovation and Entrepreneurship, and 2nd Place in Accuracy/1st Place in Speed for the RTE International Competition on "Learning to Run a Power Network" in 2019. His work is also recognized via a Stanford Tomcat Fellowship, CMU Dean's Fellowship, and ABB Fellowship.