Industrial & Systems Engineering
Seminar Announcement

Physics-driven Spatiotemporal Regularization for High-dimensional Predictive Modeling

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Abstract: Rapid advancement of distributed sensing and imaging technology brings the proliferation of high-dimensional spatiotemporal data, i.e., y(s; t) and x(s; t) in manufacturing and healthcare systems. Traditional regression is not generally applicable for predictive modeling in these complex structured systems. For example, infrared cameras are commonly used to capture dynamic thermal images of 3D parts in additive manufacturing. The temperature distribution within parts enables engineers to investigate how process conditions impact the strength, residual stress and microstructures of fabricated products. The ECG sensor network is placed on the body surface to acquire the distribution of electric potentials y(s; t), also named body surface potential mapping (BSPM). Medical scientists call for the estimation of electric potentials x(s; t) on the heart surface from BSPM y(s; t) so as to investigate cardiac pathological activities (e.g., tissue damages in the heart). However, spatiotemporally varying data and complex geometries (e.g., human heart or mechanical parts) defy traditional regression modeling and regularization methods. This talk will present a novel physics-driven spatiotemporal regularization (STRE) method for high-dimensional predictive modeling in complex manufacturing and healthcare systems. This model not only captures the physics-based interrelationship between time-varying explanatory and response variables that are distributed in the space, but also addresses the spatial and temporal regularizations to improve the prediction performance. In the end, we will introduce our lab at Penn State and future research directions will also be discussed.

Bio: *Dr. Hui Yang* is the Harold and Inge Marcus Career Associate Professor in the Harold and Inge Marcus Department of Industrial and Manufacturing Engineering at The Pennsylvania State University, University Park, PA. Prior to joining Penn State in 2015, he was an Assistant Professor in the Department of Industrial and Management Systems Engineering at the University of South Florida from 2009 to 2015. He is a recipient of 2015 Outstanding Faculty Award at the University of South Florida.

Dr. Yang's research interests focus on sensor-based modeling and analysis of complex systems for process monitoring, process control, system diagnostics, condition prognostics, quality improvement, and performance optimization. His research program is supported by National Science Foundation (including the prestigious NSF CAREER award) and 2 equipment grants from NSF and State of Florida for laboratory computing infrastructure improvement.

Dr. Yang is the president (2015-2016) of INFORMS Quality, Statistics and Reliability (QSR) society and the program co-chair of 2016 Industrial and Systems Engineering Research Conference (ISERC). He is also the Best Reviewer of IEEE JBHI in 2015, and a referee for a diverse set of top tier research journals such as Nature, Physical Review, IEEE Transactions on Biomedical Engineering, IEEE Journal of Biomedical and Health Informatics, Biophysical Journal, IIE Transactions, Technometrics, and IEEE Transactions on Automation Science and Engineering. He is a professional member of IEEE, IEEE EMBS, INFOMS, IIE, ASEE and American Heart Association (AHA).

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