

Big Data Analytics for Real-time Complex System Monitoring and Prognostics

Kaibo Liu, PhD
Assistant Professor
Industrial & Systems Engineering
University of Wisconsin-Madison

Abstract: The rapid advancements of internet of things (IoT) technology and computing power have resulted in a temporally and spatially dense data-rich environment, which provides unprecedented opportunities for performance improvement in various complex systems. Meanwhile, it also raises new research challenges on data analysis and decision making, such as heterogeneous data formats, high-dimensional and big data structures, inherent complexity of the target systems, and potential lack of complete a priori knowledge, etc. In this talk, two research topics will be discussed in details to elaborate the needs of developing multidisciplinary data fusion and analytics methods for effective online monitoring and prognostic analysis by harnessing the power of Big Data. The first topic introduces a generic data-level fusion methodology, which is capable of integrating multiple sensor signals to effectively visualize and continuously model the evolution of a unit's health status for degradation modeling and prognostic analysis. This methodology will be tested and validated through a degradation dataset of aircraft gas turbine engines. In the second topic, a dynamic and adaptive sampling algorithm will be introduced to actively decide which data streams should be observed to maximize the anomaly detection capability subject to resources constraint. As a specific demonstration, we will focus on the real-time detection of the occurrence of solar flares based on a large video stream collected by NASA satellites.

Bio: *Kaibo Liu* is an assistant professor at the department of Industrial and Systems Engineering, University of Wisconsin-Madison. He received the B.S. degree in industrial engineering and engineering management from the Hong Kong University of Science and Technology, Hong Kong, China, the M.S. degree in statistics and the Ph.D. degree in industrial engineering from the Georgia Institute of Technology, Atlanta, respectively. Dr. Kaibo Liu's research is in the area of system informatics and data analytics, with an emphasis on the data fusion for system modeling, monitoring, diagnosis, prognostics and decision making. The significance of his research has been evidenced by the wide recognition in a broad of research communities such as Quality, Statistics, Reliability and Data Mining. In addition, his research has been successfully funded by the National Science Foundation. More information can be found in his website: <http://kaibo.ie.wisc.edu/index.html>.

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MEB 235