

PROCESS DATA ANALYTICS VIA LATENT STRUCTURE MODELING

S. Joe Qin

The Chinese University of Hong Kong, Shenzhen and The University of Southern California

Abstract: The recent interest in big data has shown up in almost all aspects of knowledge discovery; including engineering, medicine, business, commerce, finance, and even science to benefit from the power of big data. The Internet of Things, smart and wireless sensors, wireless communications, mobile devices, smart devices, and smart manufacturing make data an abundant source of information from which to derive knowledge and make decisions. A recent paper by the author, Process Data Analytics in the Era of Big Data, published on AIChE Journal in September 2014, quickly tops the Wiley “Hottest Articles in Chemical Engineering” within six months after its publication.

For process engineering systems where processes, units, and equipment are designed with well-specified purposes under well-controlled operations, mechanistic models and principles are dependable. However, for the operation of emerging or abnormal situations that are not expected in the design, data become indispensable assets for the decision-making in safe and efficient operations. In this plenary we offer a perspective on the essence of process data analytics, how data have been effectively used in process operations and control, and new perspectives on how process systems operations might evolve to a paradigm of data-enhanced operations and control. In particular the focus is on the latent structure modeling of high dimensional and massive amount of data from which to explore interesting latent data structures for the purpose of process data analytics, including abnormal condition monitoring, inferential estimation, and predictions based on principal auto- and cross- correlations. The concept of principal time series modeling will be introduced. To conclude the talk, we give a future perspective in exploring the power of new machine learning techniques that have enjoyed tremendous development in two decades.
