

Department of Systems Engineering and Engineering Management

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Seminar Series

Analysis of Large Heterogeneous Repairable System in Big Data Environment

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Date	11 July 2018 (Wednesday)
Time	10:30am - 11:30am
Venue	P7303, 7/F, Yeung Kin Man Academic Building

Abstract

In the age of Big Data, one pressing challenge facing engineers is to perform reliability analysis for a large fleet of heterogeneous repairable systems with covariates. In addition to static covariates, which include time-invariant system attributes such as nominal operating conditions, geo-locations, etc., the recent advances of sensing and IoT technologies have also made it possible to obtain dynamic sensor measurement of system operating and environmental conditions. As a common practice in the Big Data environment, the massive reliability data are typically stored on some distributed storage systems such as the Hadoop Distributed File System. Leveraging the power of modern statistical learning, this talk investigates a statistical approach which integrates the Random Forests algorithm and the classical data analysis methodologies for repairable system reliability, such as the nonparametric estimator for the Mean Cumulative Function and the parametric models based on the Nonhomogeneous Poisson Process. We show that the proposed approach effectively addresses some common challenges arising from practice, including system heterogeneity, covariate selection, model specification and data locality due to the distributed data storage. The large sample properties as well as the uniform consistency of the proposed estimator is established by extending existing theoretical results.

The strengths of the proposed approach are demonstrated by comparison studies. A case study is presented to illustrate the application of the proposed approach on a real problem.

About the Speaker

Dr. Xiao Liu is an Assistant Professor at the Department of Industrial Engineering, University of Arkansas. Before that, he was a Research Scientist at IBM Thomas J. Watson Research Center, Yorktown Heights, New York (2015~2017), and IBM Research Collaboratory Singapore (2012~2015). He also served as an Adjunct Assistant Professor at the Department of Industrial and Systems Engineering, National University of Singapore (2013~2016), a postdoctoral researcher on a joint project between Rutgers University, New Jersey, and Qatar University, Doha, Qatar (2011~2012), and he is currently on the editorial board of Quality and Reliability Engineering International (Apr 2016~Present). Dr. Xiao Liu's research focuses on industrial statistics, spatio-temporal modeling, big data analytics, and various engineering-knowledge-based data-driven methodologies in broad areas such as quality and reliability, manufacturing yield prediction, preventive maintenance, urban air quality modeling, extreme weather events prediction, etc. Dr. Xiao Liu has published on peer-reviewed journals such as Technometrics, Annals of Applied Statistics, IEEE Transactions on Reliability, Journal of Quality Technology, IISE Transactions, etc. Dr. Xiao Liu received the prestigious Ralph A. Evans/P.K. McElroy Award for the best paper at RAMS 2011, Best Referred Paper Award of the Quality, Statistics and Reliability (QSR) section at INFORMS 2016, and IBM Outstanding Technical Achievement Award in 2015 and 2017.

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