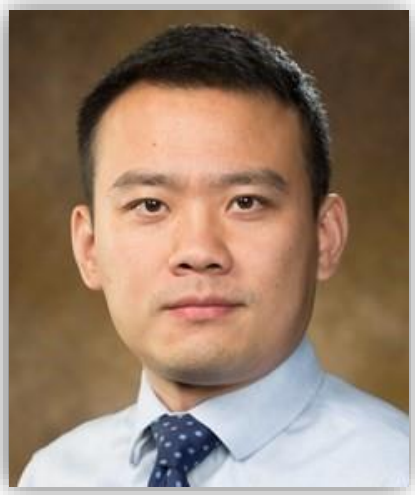
Domain-Aware Statistical Learning --- Harnessing the Convergence of Engineering Knowledge and Data-Driven Methods



Abstract: High-stakes applications require interpretable models, explainable decisions, and actionable insights that facilitate the discovery of new knowledge. Fundamental governing physics and domain knowledge impose critical constraints on how data should be modeled and how models can be interpreted. This seminar presents some new methodologies that enable the integration of fundamental governing physics into datadriven models. The first half of the talk focuses on the modeling of spatio-temporal data arising from advection-diffusion processes and its applications in environment, energy, and sustainability (e.g., wildfires and solar energy, extreme weather events, urban air pollution, etc.). The results presented in this section are mainly generated from the collaboration with IBM Research, National Renewable Energy Laboratory and Argonne National Laboratory. The second half of the talk extends the scope of the research to the statistical learning and prediction for nonlinear dynamical systems and discusses its applications in airborne aircraft-drone collision severity assessment utilizing data generated from Finite Element Analysis. A roadmap that summarizes the current challenges and future research will also be discussed.

Bio: Dr. Xiao Liu is the John L. Imhoff Endowed Chair and Assistant Professor at the Department of Industrial Engineering, University of Arkansas. Before that, he held research staff member positions at IBM Thomas J. Watson Research Center (2012~2017). From 2013 to 2016, he was also an Adjunct Assistant Professor at the ISE Department, National University of Singapore. His research focuses on domain-aware data-driven methodologies for scientific and engineering applications, environment and energy, urban resilience, applied statistics, system informatics and reliability engineering. Research outcomes have been published on both Industrial Engineering and Statistics journals (e.g., JASA, Technometrics, IISE Transactions, AOAS, etc.). Dr. Liu's work has been recognized by different academic societies, such as the Statistics in the Physical and Engineering Sciences (SPES) award from the American Statistical Association, IBM Outstanding Technical Achievement award, best paper awards from INFORMS and other conferences, etc. Dr. Liu's work has been supported by the National Science Foundation (including the NSF CAREER award), NASA and industry, and he currently serves as the President of the Data Analytics & Information Systems division of IISE.

TUESDAY, JANUARY 24, 2023 from 3:30pm – 4:30pm, GER 206