Industrial & Systems Engineering
Seminar Announcement

Smart Monitoring for Complex Diseases by Machine Learning and Decision Optimization

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Abstract: The emerging data-rich environments in healthcare hold great promises to accelerate the paradigm transition of U.S. healthcare from *reactive care* to *preventive care*. One question is how we could translate the big disease data into better care management of preclinical or diseased patients. While these diseases manifest complex progression process, involving both temporal dynamics and spatial evolution, how could we model, monitor, and modify these processes are challenging problems. The challenges mainly lie on three aspects: disease modeling, monitoring, and prognosis. For example, diseases such as Alzheimer's disease and Type 1 Diabetes share the commonality that they involve slow and predictable progression processes. Knowing how a disease progresses is helpful, particularly if we'd like to prevent the disease as early as we could for maximum therapeutic efficacy and improved quality of life. The modeling of the progression process is statistically challenging given the high-dimensionality of the data (e.g., tens of thousands variables), the mixed types variables, and the data's longitudinal nature. Another commonality of these diseases is that, since they are chronic conditions, being able to recognize subtle symptoms that indicate significant clinical events or suggest worse outcomes is crucial for preventative care. Further, patients need to be dynamically prioritized by their projected risk for resource allocation optimization. This needs robust models that build on the statistical knowledge provided by disease modeling and monitoring, to guide the selection of high-risk patients for targeted care. Thus, my works collectively work towards the goal of smart monitoring. Such a smart monitoring method will provide data-driven decision-making capabilities for better disease management, leading to efficient targeted screening and affordable care, better treatment planning, and improved quality of life for both patients and caregivers.

Bio: *Shuai Huang* is an Assistant Professor at the Department of Industrial and Systems Engineering at the University of Washington. He received a B.S. degree on Statistics from the University of Science and Technology of China in 2007 and a Ph.D. degree on Industrial Engineering from the Arizona State University in 2012. He is also an adjunct faculty member at the Department of Biomedical Informatics and Medical Education (BIME) and the Integrated Brain Imaging Center (IBIC) at the University of Washington. His research is funded by the National Science Foundation, National Institute of Health, Defense Advanced Research Projects Agency (DARPA), Juvenile Diabetes Research Foundation, Helmsley Foundation, and several biomedical research institutes. Dr. Huang currently serves as Associate Editor for the IIE Transactions in Healthcare Systems Engineering and Quality Technology and Quantitative Management.

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