University of California, Irvine
Statistics Seminar

Weather2vec: Representation Learning for Causal Inference with Non-Local Confounding in Air Pollution and Climate Studies

Corwin Zigler
Associate Professor
Dept. of Statistics and Data Science
University of Texas, Austin

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6011 Donald Bren Hall

Non-local confounding (NLC) can bias the estimates of causal effects when treatments and outcomes of a given unit are dictated in part by the covariates of other units. Such a scenario can arise in various spatially structured domains, including when quantifying causal effects amid the threat of confounding due to climate and meteorological factors. This talk first formalizes the problem of NLC using the potential outcomes framework. Then it investigates the use of neural networks -- specifically U-nets -- to address it. The method, termed weather2vec, uses the theory of balancing scores for causal inference to encode NLC information into a scalar or vector defined for each observational unit, which is subsequently used to adjust for NLC. We implement and evaluate the approach in two studies of causal effects of air pollution exposure, where meteorology is an inherently regional construct that threatens causal estimates with both local and non-local information. The results illustrate the ability of the proposed U-net methodology to capture relevant neighboring confounding information that simple functions of regional values of meteorological covariates cannot fully characterize.