

**University of California, Irvine
Statistics Seminar**

*Analyzing High-dimensional Mediators
by Mixed Integer Optimization*

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Join via Zoom: <https://uci.zoom.us/j/91370133600>

In this talk I will introduce an extension of the best-subset regularization to perform a high-dimensional mediation analysis in the framework of directed acyclic graphs (DAGs). This new methodology allows a simultaneous operation of parameter clustering and estimation in structural equation models to search causal mediation pathways. The double regularization on homogeneity fusion and sparsity is formulated as a mixed integer optimization (MIO) problem, in the hope to minimize estimation bias and give rise to an appealing setting for post-variable selection inference. We develop a fast and reliable algorithm, Alternating Penalization Operator for L-zero Loss Optimization (APOLLO), to implement the MIO problem for numerical solutions, which is shown to be superior over existing commercial integer programming solver Gurobi. APOLLO algorithm begins with an upper bound search for warm start, followed by a lower bound search via cutting-planes. The proposed MIO estimator is rigorously investigated for its key theoretical guarantees. Numerical examples are used to illustrate the performance of the proposed MIO solver in simulation experiments and in motivating scientific studies. This is a joint work with Dr. Wen Wang.