University of California, Irvine
Statistics Seminar

Robust Knockoffs Inference with Coupling

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We investigate the robustness of the model-X knockoffs framework with respect to the misspecified or estimated feature distribution. We achieve such a goal by theoretically studying the feature selection performance of a practically implemented knockoffs algorithm, which we name as the approximate knockoffs (ARK) procedure, under the measures of the false discovery rate (FDR) and family wise error rate (FWER). The approximate knockoffs procedure differs from the model-X knockoffs procedure only in that the former uses the misspecified or estimated feature distribution. A key technique in our theoretical analyses is to couple the approximate knockoffs procedure with the model-X knockoffs procedure so that random variables in these two procedures can be close in realizations. We prove that if such coupled model-X knockoffs procedure exists, the approximate knockoffs procedure can achieve the asymptotic FDR or FWER control at the target level. We showcase three specific constructions of such coupled model-X knockoff variables, verifying their existence and justifying the robustness of the model-X knockoffs framework.