University of California, Irvine
Statistics Seminar

Statistical Inference for Noisy Incomplete 1-Bit Matrix

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Join via Zoom: https://uci.zoom.us/j/93841331474

We consider the statistical inference for noisy incomplete 1-bit matrix. Instead of observing a subset of real-valued entries of a matrix M, we only have one binary (1-bit) measurement for each entry in this subset, where the binary measurement follows a Bernoulli distribution whose success probability is determined by the value of the entry. Despite the importance of uncertainty quantification to matrix completion, most of the categorical matrix completion literature focus on point estimation and prediction. This work moves one step further towards the statistical inference for 1-bit matrix completion. Under a popular nonlinear unidimensional factor analysis model, we obtain a point estimator and derive its asymptotic distribution for any linear form of M and latent factor scores. Moreover, our analysis adopts a flexible missing-entry design that does not require a random sampling scheme as required by most of the existing asymptotic results for matrix completion. The proposed estimator is statistically efficient and optimal, in the sense that the Cramer-Rao lower bound is achieved asymptotically for the model parameters. Two applications are considered, including (1) linking two forms of an educational test and (2) linking the roll call voting records from multiple years in the United States senate. The first application enables the comparison between examinees who took different test forms, and the second application allows us to compare the liberal-conservativeness of senators who did not serve in the senate at the same time.