

**University of California, Irvine
Statistics Seminar**

Nonparametric Tensor Completion via Sign Series

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Higher-order tensors arise frequently in applications such as neuroimaging, recommendation system, social network analysis, and psychological studies. We consider the problem of tensor estimation from noisy observations with possibly missing entries. A nonparametric approach to tensor completion is developed based on a new model which we coin as sign representable tensors. The model represents the signal tensor of interest using a series of structured sign tensors. Unlike earlier methods, the sign series representation effectively addresses both low- and high-rank signals, while encompassing many existing tensor models – including CP models, Tucker models, single index models, several hypergraphon models – as special cases. We show that the sign tensor series is theoretically characterized, and computationally estimable, via classification tasks with carefully-specified weights. Excess risk bounds, estimation error rates, and sample complexities are established. We demonstrate the outperformance of our approach over previous methods on two datasets, one on human brain connectivity networks and the other on NeurIPS topic data mining.