University Ph.D. Dissertation Defense
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Blind Deconvolution with Heterogeneous and Missing Data

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A blind deconvolution problem seeks two signals that convolve approximately to some known data, which is also a signal. A data signal may have multiple rows or columns, and entries are typically real or complex. However, some applications involve data where entries are non-numeric, e.g., Boolean, interval-constrained or categorical. Blind deconvolution in this setting has been studied before in a limited way, and usually on a case-by-case basis.

We present a general-purpose method for blind deconvolution where data is heterogeneous, i.e., each column has its own data type. Our approach extends Generalized Low Rank Models (an exploratory analysis tool for heterogeneous data tables) to the signal setting, so that blind deconvolution in our framework is analogous to matrix factorization in GLRMs. By extension, missing values in a data signal can be overlooked with a careful choice of objective, and later imputed from deconvolved signals. We use alternating proximal gradient descent to leverage the Fast Fourier transform and parallelize updates over rows and columns of the data signal. We report results for some numerical experiments, demonstrating the improvement from our method over a naive approach.