

# Random graphs and its applications for networks

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## Ising Models with Latent, Conditional Gaussian Variables

Ising models describe the joint probability distribution of a vector of binary feature variables. Typically, not all the variables interact with each other and one is interested in learning the presumably sparse network structure of the interacting variables. However, in the presence of latent variables, the conventional method of learning a sparse model might fail. This is because the latent variables induce indirect interactions of the observed variables. In the case of only a few latent, conditional Gaussian variables this spurious interaction contributes an additional low-rank component to the interaction parameters of the observed Ising model. Therefore, we propose to learn a sparse plus low-rank decomposition of the parameters of an Ising model using a convex regularized likelihood problem. The solution to the convex optimization problem has consistency properties in the high-dimensional setting, where the number of observed binary variables and the number of latent, conditional Gaussian variables are allowed to grow with the number of training samples.

(joint work with my PhD student Frank Nussbaum)