Inference in kinetic Ising models: mean field and Bayes estimators

We consider the problem of statistical inference in a non-equilibrium Ising model with parallel updates, paradigmatic for the study of network reconstruction from dynamical data and reverse engineering of complex biological systems, e.g., gene regulation or neural networks. Exact inference of the couplings between the sites is not tractable for large networks, but algorithms which are based on statistical physics approximations have recently been discussed. First, we investigate the system dynamics in a mean-field framework and show that using an extension of the Plefka expansion one gains significant improvement in predicting local system properties compared to other mean field techniques. Second, we discuss the applicability of mean-field approaches as inference tools for dynamical data, studying and comparing the theoretical performance of two algorithms aimed at computing, respectively, the mean field and the Bayes estimators for the couplings.