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## LEVEL SETS AND MAXIMUM LIKELIHOOD ESTIMATION FOR THE ISING MODEL

This talk concerns the existence of the maximum likelihood estimator (MLE) for a discrete exponential family on a finite set. Using the newly introduced notion of sets of uniqueness, we present new criterion for the existence of MLE. We apply this criterion in various discrete settings, in which it can be easily solved using the tools from random graph theory and discrete geometry. Most notably, we discuss the MLE existence for exponential models of random graphs and for linear spaces spanned by the products of Rademacher functions with special focus on the Ising model from statistical mechanics.

For the Ising model on a complete graph, we propose a full characterization among the level sets used in related combinatorial problems. As an application, we establish new bounds for the size of the smallest set of uniqueness for the products of Rademacher functions and discuss the asymptotics of the sample size for which the maximum likelihood estimator exists with high probability.

This is joint work with Tomasz Stroiński.