Sampling inequalities and applications to regularization methods

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Abstract

Sampling inequalities quantify the observation that a differentiable function cannot attain large values anywhere if its derivatives are bounded, and if it produces small data on a sufficiently dense discrete set. Inequalities of this kind can be used to derive a priori error estimates for various regularized approximation problems as they occur for instance in many machine learning algorithms or PDE solvers. In this talk we focus on two applications of sampling inequalities. The first example comes from manifold regularization as introduced by Niyogi [1]. When interpreted as regularized reconstruction method, sampling inequalities provide an error analysis for this technique. As a second example, we present how such inequalities provide error bounds for kernel based reconstruction methods if the occurring linear systems of equations are not solved exactly but only approximately by iterative gradient methods.
The talk is partly based on joint work with B. Zwicknagl (Pittsburgh).

Literature

[1] M. Belkin, V. Sindhwani, and P. Niyogi. Manifold regularization: a geometric framework for learning from examples. *Journal of Machine Learning Research*, 7:2399–2434, 2006.