Optimal sampling for L^2 approximation: from linear to nonlinear models

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We consider the approximation of functions in L^2 from point evaluations, using linear or nonlinear approximation tools. For linear approximation, recent results show that weighted least-squares projections allow to obtain quasi-optimal approximations with near to optimal sampling budget. This can be achieved by drawing i.i.d. samples from suitable distributions (depending on the linear approximation tool) and subsampling methods. In a first part of this talk, we review different strategies based on i.i.d. sampling and present alternative strategies based on repulsive point processes that allow to achieve the same task with a reduced sampling complexity. In a second part, we show how these methods can be used to approximate functions with nonlinear approximation tools, in an active learning setting, by coupling iterative algorithms and optimal sampling methods for the projection onto successive linear spaces. We particularly focus on the approximation using tree tensor networks, whose architectures allow for an efficient implementation of optimal sampling procedures within coordinate descent algorithms.

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