On the reconstruction of functions from values at subsampled quadrature points

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This talk is concerned with function reconstruction from samples. The sampling points used in several approaches are (1) structured points connected with fast algorithms or (2) unstructured points coming from, e.g., an initial random draw to achieve an improved information complexity. We connect both approaches and propose a subsampling of structured points in an offline step. In particular, we start with structured quadrature points (QMC), which provide stable L_2 reconstruction properties. The subsampling procedure consists of a computationally inexpensive random step followed by a deterministic procedure to further reduce the number of points while keeping its information. In these points functions (belonging to a RKHS of bounded functions) will be sampled and reconstructed from whilst achieving state of the art error decay.

We apply our general findings on the d-dimensional torus to subsample rank-1 lattices, where it is known that full rank-1 lattices loose half the optimal order of convergence (expressed in terms of the size of the lattice). In contrast to that, our subsampled version regains the optimal rate since many of the lattice points are not needed. Moreover, we utilize fast and memory efficient Fourier algorithms in order to compute the approximation. Numerical experiments in higher dimensions support our findings.

joint work with: Lutz Kämmerer, Daniel Potts, and Tino Ullrich.