Complexity reduction of ill-posed integral equations

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Abstract: The aim is to solve an ill-posed integral equation from noisy point-evaluations on a grid. Naturally, the numerical complexity of solution algorithms scales directly with the number of point evaluations. We show that in the noise dominant case, i.e., when the uncertainty of the point evaluations is larger than the mesh width of the grid, it is possible to significantly reduce the computational complexity. Concretely, a discretisation on a coarser grid is obtained through averaging of the initially given data, and it is shown that this yields the same optimal reconstruction error. The particular optimal choice depends on the relation of data noise to mesh width and on the (unknown) smoothness of the exact solution, and we discuss some ideas how to obtain the optimal choice adaptivly.