

# From greedy approximation to greedy optimization

V.N. Temlyakov \*

The talk is devoted to theoretical aspects of sparse approximation and optimization. The main motivation for the study of sparse approximation is that many real world signals can be well approximated by sparse ones. Sparse approximation automatically implies a need for nonlinear approximation, in particular, for greedy approximation. We will discuss greedy approximation in different settings: with respect to bases and redundant dictionaries, in Hilbert and in Banach spaces.

We also discuss sparse approximate solutions to convex optimization problems. It is known that in many engineering applications researchers are interested in an approximate solution of an optimization problem as a linear combination of a few elements from a given system of elements. There is an increasing interest in building such sparse approximate solutions using different greedy-type algorithms. The problem of approximation of a given element of a Banach space by linear combinations of elements from a given system (dictionary) is well studied in nonlinear approximation theory. At a first glance the settings of approximation and optimization problems are very different. In the approximation problem an element is given and our task is to find a sparse approximation of it. In optimization theory an energy function is given and we should find an approximate sparse solution to the minimization problem. It turns out that the same technique can be used for solving both problems. We discuss how the technique developed in nonlinear approximation theory, in particular the greedy approximation technique can be adjusted for finding a sparse solution of an optimization problem.

---

\*University of South Carolina; Steklov Institute of Mathematics