Exercise

Information-Based Complexity

Prof. Dr. S. Heinrich

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Sheet 1

Return until 05.05.2015, 12:00, into the box of the work group (Building 48, 6. floor)

Exercise 1:

Consider the search problem introduced in the lecture. Find an algorithm having the same error and the same cost as the algorithm in the lecture, but now T_i is not allowed to depend on $Q(f, T_1), ..., Q(f, T_{i-1})$, i.e., the algorithm has to be non-adaptive.

Exercise 2:

Determine the minimal error for the search problem if we only admit non-adaptive information operators, and additionally, the set of information functionals consists only of questions of the form $Q(\cdot, T)$,

$$T = \{f : \quad f \geq \alpha\},$$

where $\alpha \in [0, 1)$.

Exercise 3:

We want to approximate $f \in [0, 1)^d$ with an error less than ϵ. As information about f we receive answers to Yes/No-questions: $Q(f, T) = 1$ if $f \in T$ and $Q(f, T) = 0$ if $f \notin T$, where T denotes an arbitrary subset of $[0, 1)^d$. The error is measured in the $\|\cdot\|_\infty$-norm:

$$\|(a_1, ..., a_d)\|_\infty = \max_{i \in \{1,...,d\}} |a_i|.$$

Find an algorithm with error 2^{-n-1} that uses at most nd Yes/No-questions. Moreover, show that there is no algorithm that has the same error but uses less Yes/No-questions.