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Covering Numbers for Convex Functions

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In this paper we study the covering numbers of the space of convex and uniformly bounded functions in multi-dimension. We find optimal upper and lower bounds for the ϵ-covering number of $\mathcal{C}([a, b]^d, B)$, in the L_p-metric, $1 \le p < \infty$, in terms of the relevant constants, where $d \geq 1$, $a < b \in \mathbb{R}$, $B>0$, and $\mathcal{C}([a,b]^d, B)$ denotes the set of all convex functions on $[a, b]^d$ that are uniformly bounded by B. We summarize previously known results on covering numbers for convex functions and also provide alternate proofs of some known results. Our results have direct implications in the study of rates of convergence of empirical minimization procedures as well as optimal convergence rates in the numerous convexity constrained function estimation problems.

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