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Breaking the Curse of Dimensionality with Convex Neural Networks

We consider neural networks with a single hidden layer and non-decreasing positively homogeneous activation functions like the rectified linear units. By letting the number of hidden units grow unbounded and using classical non-Euclidean regularization tools on the output weights, they lead to a convex optimization problem and we provide a detailed theoretical analysis of their generalization performance, with a study of both the approximation and the estimation errors. We show in particular that they are adaptive to unknown underlying linear structures, such as the dependence on the projection of the input variables onto a low-dimensional subspace.

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