Error bounds for approximations with deep ReLU neural networks in Sobolev-type norms

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Abstract

Applications of deep neural network based algorithms have lately shown successes in a wide variety of classical machine learning areas, such as computer vision, speech recognition or robotics. As Philipp Petersen pointed out in his talk "Neural Networks and Partial Differential Equations: Challenges and Opportunities" in the AFG Oberseminar, neural networks are now also used to tackle the problem of approximating solutions of high-dimensional PDEs. The question arises if error bounds for approximations with deep neural networks can be obtained in norms suitable in the context of PDEs.

Yarotsky showed in [1] upper error bounds for approximations with deep ReLU neural networks where the approximation error is measured in the L^∞ norm. In this talk, I will present a generalization of this result where the approximation error is measured in the $W^{\alpha,\infty}$ norm for $0 \leq \alpha \leq 1$.

References

[1] D. Yarotsky. Error bounds for approximations with deep relu networks. *CoRR*, abs/1610.01145, 2016.

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