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Paper Review: Universal Function Approximation by Deep Neural Nets with Bounded Width and ReLU Activations

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This article concerns the expressive power of depth in neural nets with ReLU activations and bounded width. We are particularly interested in the following questions: what is the minimal width wmin(d) so that ReLU nets of width wmin(d) (and arbitrary depth) can approximate any continuous function on the unit cube [0,1]d aribitrarily well? For ReLU nets near this minimal width, what can one say about the depth necessary to approximate a given function? Our approach to this paper is based on the observation that, due to the convexity of the ReLU activation, ReLU nets are particularly well-suited for representing convex functions. In particular, we prove that ReLU nets with width d+1 can approximate any continuous convex function of d variables arbitrarily well. These results then give quantitative depth estimates for the rate of approximation of any continuous scalar function on the d-dimensional cube [0,1]d by ReLU nets with width d+3.