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Depth bounds for artificial neural networks via algebra, polyhedral combinatorics and number theory

Does the expressive power of a ReLU neural network grow when its depth gets larger? Surprisingly, this is not known in general (but it is known that there is a difference between depth one and a higher depth). When the weights of the network are rational numbers with a bounded denominator or N-ary fractions with a fixed N, we show that the expressive power grows up to the depth of the logarithmic order in n, when n is the number of inputs.

Our study is naturally connected to integer quantization, a technique that replaces floating-point weights with integers to reduce inference costs and improve efficiency.

This is a joint work with Christopher Hojny and Maximilian Merkert, published as a conference paper at ICLR 2025 `https://openreview.net/forum?id=uREg3OHjLL`, see also `https://arxiv.org/abs/2502.06283`.

Das Kolloquium wird von Herrn Prof. Dr. Christoph Helmberg geleitet.

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