

Multilayer neural networks and tensor decompositions

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Abstract

This talk will focus on connections between neural networks and low-rank tensor decompositions. In the first part of the talk, we consider feed-forward polynomial neural networks and will exhibit the connections to partially symmetric tensor decompositions. Using such a connection, we show how to prove identifiability of deep polynomial neural networks for a wide range of architectures. This part is based on ongoing work with R. Borsoi, M. Clausel and C. Dérand. The second part of the talk is motivated by neural network architectures with trainable activation functions. Such architectures can be linked to multi-layer tensor decompositions, which can be used for training and compression. Despite their nice properties, there is a lack of reliable algorithms for such decompositions. We will report recent results for a special case, ParaTuck-2 decomposition. We present a recent algorithm that can perform decomposition and approximation in ParaTuck-2 format using a lifting approach.

References

- [1] K. Usevich. A lifting approach to ParaTuck-2 tensor decompositions. <https://arxiv.org/abs/2302.00922>, 2025.