A short introduction to tensors and analogies to neural networks

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> *If you really want to impress your friends and confound your enemies, you can invoke tensor products . . . People run in terror from the $\otimes$ symbol.*
>
> Some Stanford Professor, quoted in https://jeremykun.com/

The first part of this talk is intended to give a basic introduction into the concept of tensors with a particular focus on low-rank approximations. We will mainly follow the well written paper [2]. In the second part of the talk, we draw potential connections to neural networks by discussing a few results given in [1], in which we collected a variety of set-algebraic and topological properties of the set of all functions generated by neural networks with fixed size and fixed activation function. We discovered that some of these results appear to have similarities with the statements of [2]. These resemblances also might help to formulate some further neural network related open questions.

References

[1] P. Petersen, M. Raslan, and F. Voigtlaender. Topological properties of the set of functions generated by neural networks of fixed size. *arXiv:1806.08459*, 2018.

[2] V.d. Silva and L.H. Lim. Tensor rank and the ill-posedness of the best low-rank approximation problem. *SIAM J. Matrix Analysis Applications*, 30(3):1084–1127, 2008.