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Statistical Field Theory of Deep Neural Networks: An Ultrametric Approach to Deep Learning

Abstract

Statistical Field Theory of Deep Neural Networks: An Ultrametric Approach to Deep Learning

There is a consensus about the need for a theory to understand how large biological and artificial neural networks (with deep architectures) work. In this direction, a promising proposal is the existence of a correspondence between neural networks (NNs) and statistical field theories (SFTs). Such a theory explains the functioning of NNs through a collection of correlation functions, which can be computed perturbatively from a generating functional. The talk aims to discuss our recent results on the mathematical theory of correspondence between deep Boltzmann machines (DBMs) with a tree-like topology and certain continuous SFTs. p-Adic numbers were used to encode tree-like topologies. Some of these p-adic Boltzmann machines have been implemented, which shows the feasibility of this proposal.

References

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