UNIVERSITÄT LEIPZIG

Faculty of Physics and Earth System Sciences
Prof. Dr. I. Sodemann
Prof. Dr. K. Taute

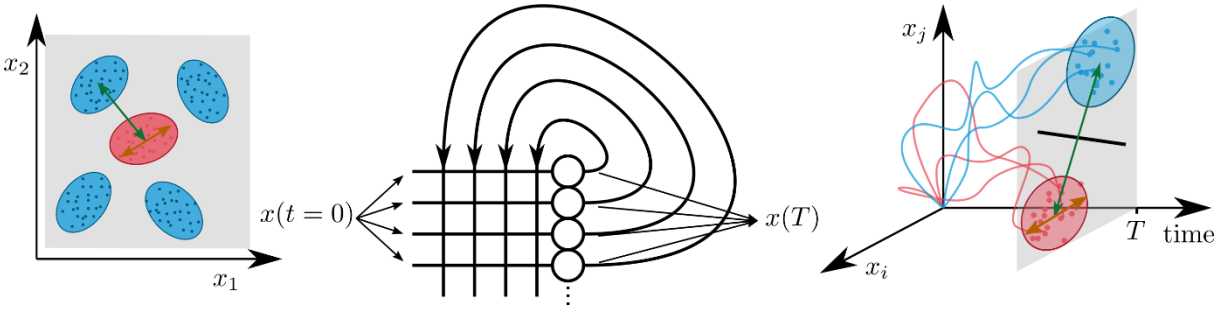
Physics Colloquium

Tuesday, 4 February 2024 at 16:30

Prof. Dr. Moritz Helias

Forschungszentrum Jülich, RWTH Aachen

Physics of AI: From Artificial to Brain Network



Neural networks are often treated as black boxes. In this talk, we open that box with methods from statistical physics to show how networks learn and make predictions. We will explore how neural networks discover relevant features in training data [1], how variability limits their predic-tive power [2], and how similar principles can be applied to recurrent architectures that resemble brain circuits [3].

A key insight is that Gaussian processes provide a unifying framework, explaining how artificial networks learn while also predicting the ability of biological networks to classify patterns by exploiting transient and even chaotic activity. Finally, we will present evidence from large-scale brain recordings that supports these theoretical predictions, highlighting ;

[1] Fischer K, Lindner J, Dahmen D, Ringel Z, Krämer M, Helias M (2024) *Critical feature learning in deep neural networks*, arXiv:2405.10761 (ICML2024)

[2] Lindner J, Dahmen D, Krämer M, Helias M (2023) *A theory of data variability in Neural Network Bayesian inference*, arXiv:2307.16695

[3] Segadlo K, Epping B, van Meegen A, Dahmen D, Krämer M, Helias M (2022) *Unified field theoretical approach to deep and recurrent neuronal networks*, J Stat Mech 103401.

Host: Prof. Dr. Bernd Rosenow

Venue: Universität Leipzig, Faculty of Physics and Earth Sciences
04103 Leipzig, Linnéstraße 5, Small Lecture Hall

Everyone is welcome to a reception with coffee, drinks and cookies in the Aula following the talk.

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