

IWR Colloquium

Winter Semester 2019 / 2020

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**Mathematikon, Conference Room / 5th Floor
Im Neuenheimer Feld 205, 69120 Heidelberg**

Speaker:

Prof. Jakob Macke
Technical University of Munich (TUM)

Title:

“From statistics to mechanisms, and back”

Abstract:

Many fields of science make extensive use of complex simulations describing the structure and dynamics of the process being investigated. These models are derived from knowledge of the underlying mechanisms and principles, and are of critical importance for scientific hypothesis-building. However, linking such complex models to high-dimensional empirical measurements can be challenging.

We develop computational tools which aim to bridge the gap between data-driven machine learning and theory-driven, mechanistic modelling. In this talk, I will focus on our recent work on using neural conditional density estimators to perform Bayesian inference on simulation-based models. I will demonstrate the efficiency and flexibility of this approach, and highlight applications to dynamical models of biological systems and source-reconstruction in biological imaging.

References:

D Greenberg, M Nonnenmacher, JH Macke: Automatic Posterior Transformation for likelihood-free Inference, International Conference on Machine Learning (ICML) 2019, <https://arxiv.org/abs/1905.07488>

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JM Lueckmann, G Bassetto, T Karaletsos, JH Macke: Likelihood-free inference with emulator networks, Proceedings of The 1st Symposium on Advances in Approximate Bayesian Inference, PMLR 96:32-53, 2019. <https://arxiv.org/abs/1805.09294>

A Speiser, S Turaga, JH Macke: Teaching deep neural networks to localize sources in super-resolution microscopy by combining simulation-based learning and unsupervised learning, preprint, arxiv.org/abs/1907.00770

DGT Barrett, AS Morcos, JH Macke: Analyzing artificial and biological neural networks: Challenges with opportunities for synergies?, Current Opinion in Neurobiology, 02 2019
<https://arxiv.org/abs/1810.13373>

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www.iwr.uni-heidelberg.de/iwr-colloquium