

FREIE UNIVERSITÄT BERLIN

Fachbereich Mathematik und Informatik

Promotionsbüro, Arnimallee 14, 14195 Berlin

D I S P U T A T I O N

Dienstag, 15. Juli 2025, 10:00 Uhr

**Ort: Seminarraum 2006
(Zuse-Institut-Berlin, Takustr. 7, 14195 Berlin)**

Disputation über die Doktorarbeit von

Matthias Plock

Thema der Dissertation:

**On Methods for Bayesian Optimization of Least-Squares Problems
and Optimization of Nanophotonic Devices**

Thema der Disputation:

**Variational Inference and the Evidence Lower Bound (ELBO) --
Solving Bayesian inference problems through optimization**

Die Arbeit wurde unter der Betreuung von **Prof. Dr. C. Schütte** durchgeführt.

Abstract: Bayes' rule provides a straightforward way to determine the posterior distribution based on the likelihood of the parameters given the data, and prior beliefs about those parameters. Actually computing the posterior, however, is often an extremely arduous task due to the difficulty of integrating the joint distribution -- the product of likelihood and prior -- over all parameters.

In this presentation, we give a brief introduction to Bayesian inference and show how Variational Inference (VI) can be used to approximately solve the inference problem by transforming an often intractable integration task into a much more manageable optimization problem. We derive the Evidence Lower Bound (ELBO) as the central objective function for this optimization and demonstrate different approaches for maximizing it. The methodology is applied in the context of parameter reconstruction problems, where the goal is to determine the full posterior distribution of model parameters used to parameterize fit functions in least squares settings. We evaluate several VI strategies in terms of accuracy, computational effort, and practical usability, and compare the resulting posteriors against reference solutions obtained through Markov Chain Monte Carlo sampling.

Die Disputation besteht aus dem o. g. Vortrag, danach der Vorstellung der Dissertation einschließlich jeweils anschließenden Aussprachen.

Interessierte werden hiermit herzlich eingeladen

Der Vorsitzende der Promotionskommission
Prof. Dr. C. Schütte