

A U S H A N G

FREIE UNIVERSITÄT BERLIN

Fachbereich Mathematik und Informatik

Promotionsbüro, Arnimallee 14, 14195 Berlin

DISPUTATION

Montag, 26. Januar 2026, 14:00 Uhr

Ort: Seminarraum 120

(Fachbereich Mathematik und Informatik, Arnimallee 3, 14195 Berlin)

Disputation über die Doktorarbeit von

Carolina de Seixas Serra Domingos Barata

Thema der Dissertation:

**Development of mathematical and computational models for
simulating neuronal growth and wiring processes during brain
development**

Thema der Disputation:

Data-driven model discovery in biological dynamical systems

Die Arbeit wurde unter der Betreuung von **Prof. Dr. M. von Kleist** durchgeführt.

Abstract: Biological processes are often modeled using dynamical systems, where the underlying structure is defined a priori from mechanistic knowledge. However, in many biological contexts, this knowledge is often incomplete, making the assumption of a fixed model structure potentially too restrictive. This presentation addresses inverse problems in biological dynamical systems, with a focus on model structure discovery as a complement to classical parameter estimation. We will discuss the particular challenges of discovering governing equations directly from data in biological systems, highlighting the roles of noise, partial observability, intrinsic stochasticity, and the complex functional forms inherent to biological dynamics.

Sparse, data-driven approaches for model structure discovery will be introduced as one class of solutions, using the Sparse Identification of Nonlinear Dynamics (SINDy) framework as a representative example. We will outline the core principles underlying these methods, including their data requirements and key assumptions, and critically examine their limitations when applied to biological systems. Based on this, we will review methodological extensions and alternative approaches that aim to address these challenges, and discuss how model structure discovery can be integrated with mechanistic modeling and parameter estimation in a principled and biologically meaningful way.

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. M. von Kleist