

A U S H A N G

FREIE UNIVERSITÄT BERLIN

Fachbereich Mathematik und Informatik

Promotionsbüro, Arnimallee 14, 14195 Berlin

D I S P U T A T I O N

Freitag, 12. Dezember 2025, 14:30 Uhr

Ort: Seminarraum 019

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

Disputation über die Doktorarbeit von

Wiep Kristine van der Toorn

Thema der Dissertation:

Sequence, Signal, and Spread Computational Methods to Study Within- and Between-Host Dynamics of SARS-CoV-2 and Beyond

Thema der Disputation:

Advances in Molecular Barcoding and Demultiplexing for Direct RNA Nanopore Sequencing

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

Abstract: Direct RNA sequencing (DRS) on nanopores has become a powerful approach for profiling RNA in its native biochemical state, providing access to both transcriptomic and epitranscriptomic features. As the field increasingly investigates dynamic RNA regulation and RNA modifications across diverse biological contexts, efficient multiplexing of samples has grown in importance. We will introduce the principles of DRS and outline how DNA barcodes embedded within sequencing adapters enable multiplexing while introducing a key computational challenge: the accurate inference of barcode identity from raw nanopore signal.

We will discuss the two barcoding and demultiplexing strategies that have defined the methodological development of the field: DeePlexiCon and SeqTagger. DeePlexiCon pioneered adapter-based barcoding for DRS using an image-based deep learning framework, transforming raw electrical signals into 2D representations for convolutional network classification. In contrast, the more recent SeqTagger approach treats barcode identification as a specialized DNA-basecalling problem, employing custom CTC-CRF Bonito models capable of decoding DNA barcodes under RNA sequencing chemistry. Together, these approaches illustrate how nanopore physics, signal segmentation, and machine-learning architecture collectively determine demultiplexing performance.

Building on this foundation, we will outline the remaining conceptual and practical challenges and highlight emerging methodological directions for advancing multiplexed DRS.

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