

A U S H A N G

FREIE UNIVERSITÄT BERLIN

Fachbereich Mathematik und Informatik

Promotionsbüro, Arnimallee 14, 14195 Berlin

DISPUTATION

Montag, 21. Dezember 2020, 11:00 Uhr

[WebEx](#)

Disputation über die Doktorarbeit von

Herrn Tobias Zehnder

Thema der Dissertation:

Computational Approaches for the Prediction of Gene Regulatory Elements and the Analysis of their Evolutionary Conservation

Thema der Disputation:

The Engineering of Supervised Hidden Markov Models

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

Abstract: Hidden Markov models (HMMs) are used to model a sequence of observations emitted by a sequence of underlying hidden states. HMMs were first described in the 1960s and became popular for modeling speech recognition problems. In the 1980s they were first applied to biological sequence data and have since then evolved into many facets. Today, they are widely applied to numerous problems in various fields.

In the first part of the disputation I will give an introduction to the mathematical foundation of HMMs and present prevalent algorithms used for parameter learning and state decoding. I will address the issue of choosing a suitable model topology, which allows to fine-tune HMMs and explains their wide array of applications. This is especially evident in the field of bioinformatics, and I will discuss several applications to biological questions, for example the detection of CpG islands, gene finding and the functional annotation of the genome. The latter is currently predominantly achieved by standard HMMs in an unsupervised fashion and neglects the opportunity of employing our current knowledge about genomic elements during model construction. Therefore, I will introduce the notion of HMM supervision and thus the incorporation of prior biological knowledge by means of model topology and training.

The second part of the disputation is dedicated to the content of the dissertation.

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. Vingron