# Challenges in stochastic time series prediction

Maximilian Hornung, Jens Settelmeier

April 21, 2019

### Abstract

Predicting the future development of time series is of interest in different areas of computational biology. The time series in biological models exhibit challenging characteristics such as chaotic or stochastic behavior. In this report, time series prediction is done on different kind of biological time series using deep neural networks. In our evaluation, we identify challenges and limitations of this approach, and compare different architectures of deep neural networks with regard to their performance.

## 1 Introduction

The remaining report is structured as follows. First, we perform proper time series prediction on the *sine* function and show how different noise models impact the prediction ability of our network models. We conduct an evaluation how these results can be extended to the prediction of ordinary differential equations (**ODE**s) at the example of the differential equations of the harmonic oscillator. After that, we show how the stochasticity of noise impactss the possibility to predict deterministic chaotic time series at the example of the *Mackey Glass* time series. Last but not least, we report how the poor results of numerical approximations on stocastic differential equations (**SDE**s) can be explained based on our previous results.