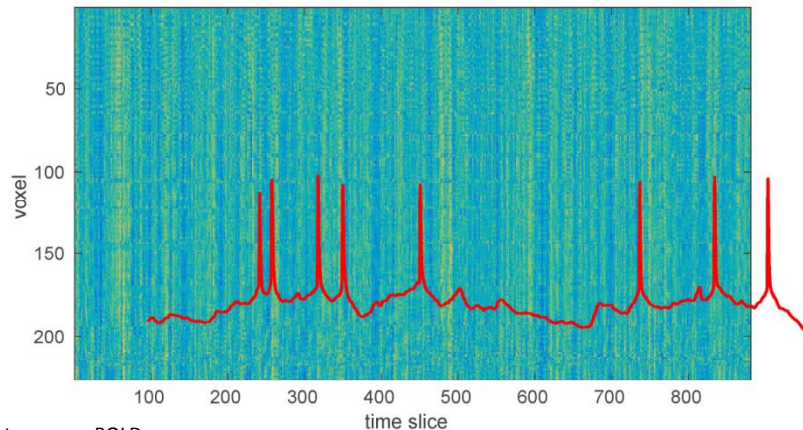


MVSpec lecture ‘Time Series Analysis & Recurrent Neural Networks’, summer term 2021

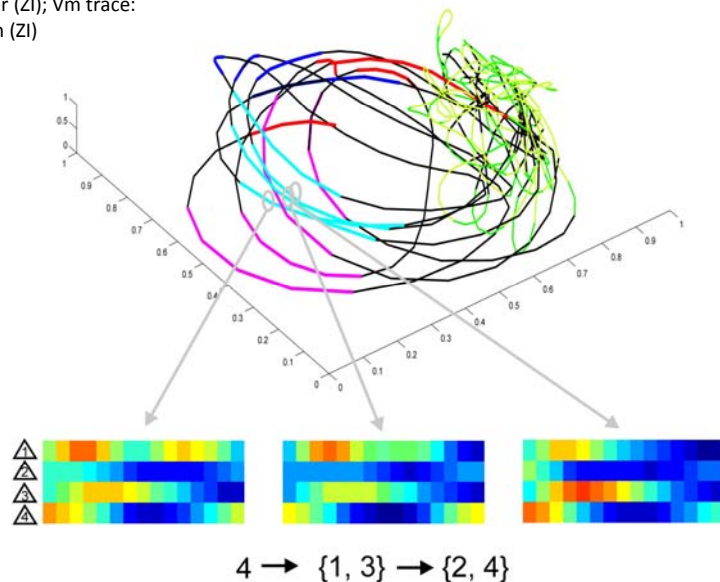
Time: Wed 11.00-13.00 (lecture), Wed 14.00 – 16.00 (exercises)

Location: INF 227, SR 2.403

Lecturers: D. Durstewitz, N.N. (www.zi-mannheim.de/en/research/departments-research-groups-institutes/theor-neuroscience-e.html)



Data source: BOLD rec.:
F. Bähner (ZI); Vm trace:
Th. Hahn (ZI)



Data source: multiple SU rec. by Chris Lapish, Univ. Indianapolis

Time series are ubiquitous in nature and social networks, and provide a very rich source of information about the underlying system. Examples include anything from stock markets and financial data, sun spot emissions, weather forecasts, GPS tracking and other mobile/wearable sensor readings, healthcare and epidemiological data, to behavioral data like website-visit histories, choice behavior, spoken language, or recordings from the brain like functional neuroimaging or electrophysiological data. General aims of time series analysis reach from predicting the future or generating forecasts, to a thorough scientific understanding of the underlying dynamical system that generated the observed series.

This course will deal primarily with *model-based* analysis of time series, that is with insights and predictions that could be gained by inferring a mathematical model of the dynamical process from the observed data. It will cover state of the art methods from the fields of *computational statistics*, *machine learning & AI*, and *nonlinear dynamics*. Starting from simple linear auto-regressive models, we will advance to nonlinear dynamical systems, state space approaches, and generative deep recurrent neural networks. The latter class of models is particularly interesting and powerful, as it can – after being trained on time series data – generate new instances of the observed system’s behavior on its own, e.g. new samples of text written in a certain style, or new trajectories from an observed dynamical system.

In the practical part of the course, in addition to theoretical exercises, you will analyze time series data yourself (and you are free to suggest or bring data along yourself), using provided or simple self-written Python- or Matlab-based code (prerequisite is familiarity with at least one of these two languages, as well as some basics in statistics).