Kernel-based Approximation of the Koopman Operator and Generator

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The Koopman generator or Kolmogorov operator of a stochastic differential equation plays a central role for the analysis of metastable systems. Approximate models for the generator can be learned from simulation data using a variety of approaches that were suggested in recent years. In this talk, I will first present generator extended dynamic mode decomposition (gEDMD) [1], a method to compute a finite-dimensional Galerkin approximation for the generator based on simulation data, followed by a theoretical analysis of the finite-data estimation error [2]. In the second part of the talk, I will introduce a kernel-based version of gEDMD [3], which circumvents the problem of choosing a finite-dimensional approximation space. I will conclude by presenting recent results on the estimation error for kernel-based approximations of the Koopman operator [4].

References:

1 Klus, Nüske, Peitz, et al, Physica D, 2020

2 Nüske, Peitz, Philipp, Schaller, Worthmann, Journal of Nonlinear Science, 2022

3 Klus, Nüske, Hamzi, Entropy, 2020

4 Philipp, Schaller, Worthmann, Peitz, Nüske, arxiv 2301.08637