CSC Seminar

SPEAKER

Vahid Nateghi

TITLE

Kernel-based approximation of Koopman generator for coarse-grained stochastic dynamical systems

ABSTRACT

Much attention recently has been paid toward dimensionality-reduction and model discovery for complex systems. Such systems can not be approximated properly with deterministic dynamics. An extension of Extended Dynamic Mode Decomposition (EDMD) has been introduced in [Klus et al., Physica D (2020)] to approximate the Koopman generator for identification of stochastic dynamical systems. However, selection of basis functions upon which the generator is approximated, can not be formulated and is needed to be done heuristically. By taking advantage of kernel methods introduced in [Klus, Entropy (2020)], we develop a kernel-based data-driven method to approximate the Koompan generator of dynamical systems via Galerkin projection in reproducing kernel Hilbert spaces. The method allows us to identify stochastic differential equations governing the coarse-grained model of a high-dimensional system. Dominant dynamics and metastabilities of the system in the reduced-order space, furthermore, can be obtained by the eigen-decomposition of the coarse-grained generator. We numerically investigate the method using toy models governed by overdamped Langevin dynamics.

Tuesday, April 25, 2023 at 2 pm

seminar room Prigogine