Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Data-driven discovery of Koopman eigenfunctions using deep learning BETHANY LUSCH, STEVEN L. BRUNTON, J. NATHAN KUTZ, University of Washington — Koopman operator theory transforms any autonomous non-linear dynamical system into an infinite-dimensional linear system. Since linear systems are well-understood, a mapping of non-linear dynamics to linear dynamics provides a powerful approach to understanding and controlling fluid flows. However, finding the correct change of variables remains an open challenge. We present a strategy to discover an approximate mapping using deep learning. Our neural networks find this change of variables, its inverse, and a finite-dimensional linear dynamical system defined on the new variables. Our method is completely data-driven and only requires measurements of the system, i.e. it does not require derivatives or knowledge of the governing equations. We find a minimal set of approximate Koopman eigenfunctions that are sufficient to reconstruct and advance the system to future states. We demonstrate the method on several dynamical systems.

Bethany Lusch
Univ of Washington

Date submitted: 31 Jul 2017

Electronic form version 1.4