No equations, no variables, no parameters, no space and no time - some new and some old results in data-driven modeling of complex dynamical systems

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Obtaining predictive dynamical equations from data lies at the heart of science and engineering modeling, and is the linchpin of our technology. In mathematical modeling one typically progresses from observations of the world (and some serious thinking!) first to equations for a model, and then to the analysis of the model to make predictions.
Good mathematical models give good predictions (and inaccurate ones do not) - but the computational tools for analyzing them are the same: algorithms that are typically based on closed form equations.

While the skeleton of the process remains the same, today we witness the development of mathematical techniques that operate directly on observations -data-, and appear to circumvent the serious thinking that goes into selecting variables and parameters and deriving accurate equations. The process then may appear to the user a little like making predictions by "looking in a crystal ball". Yet the "serious thinking" is still there and uses the same -and some new- mathematics: it goes into building algorithms that jump directly from data to the analysis of the model (which is now not available in closed form) so as to make predictions. Our work here presents a couple of efforts that illustrate this ``new'' path from data to predictions. It really is the same old path, but it is travelled by new means.