MIND, TECHNOLOGY, AND SOCIETY

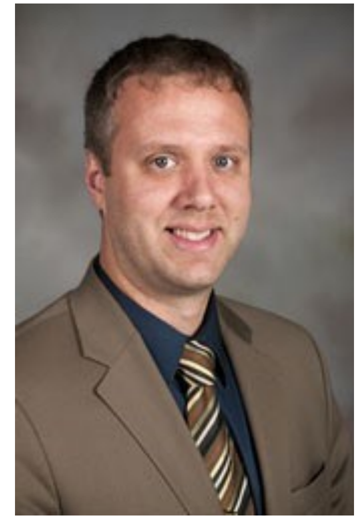
Seminar Series

UC MERCED, Fall 2016

Benjamin Jantzen

Virginia Tech

Discovering Dynamical Kinds



Much scientific work, especially in the early exploration of new phenomena, involves grouping distinct physical systems into categories that can serve as the targets for law-like generalization. Put differently, a primary goal of scientific research is the identification of kinds whose member systems are sufficiently similar in causal structure that they share at least some behaviors useful for prediction or control. The possibility of identifying such kinds algorithmically is therefore of theoretical interest to those pursuing automated scientific discovery. It is also of practical interest to the scientist. Learning the detailed causal structure of the natural world would be easier if one could know in advance whether two systems share a common causal dynamical structure. For example, a direct test of 'dynamical sameness' would allow one to pool data from many systems in order to learn an explicit model of the dynamics, to validate complex models directly without an explicit model, and to determine how many types of dynamical model are needed to explain the behavior of systems within a given domain. Developing such a test requires two things: (i) a precise theoretical account of what it means to share causal dynamical structure, and (ii) an algorithm for applying that account. In this talk, I summarize how the theory of "dynamical kinds" meets the first requirement, and present algorithms that satisfy the second. Specifically, I present a robust algorithm for testing whether two deterministic systems are of the same dynamical kind on the basis of noisy samples. I then suggest how this algorithm can be extended to the more general case of stochastic causal systems describable by nonlinear structural equation models.

Dr. Jantzen is an Assistant Professor of Philosophy and Assistant Professor of Computer Science (by courtesy) at Virginia Tech. He is interested in the contents and character of the natural world and how we come to know it. Mostly this amounts to a concern with questions about inference and language in science: How do we infer successful theories from limited observations of the world? How and to what do scientific terms refer? His current research is focused on building new kinds of algorithms for automated scientific discovery that are capable of autonomously identifying interesting new domains of research and novel variables with which to describe phenomena in those domains. He believes that doing so is the best way of testing answers to questions about scientific inference: working algorithms provide the most concrete answers possible about how (if not why) various sorts of induction are possible. Doing so is also a way of getting at questions of meaning and reference in scientific theory. Outside of his work in the philosophy of science, Dr. Jantzen has published philosophical works on judgment aggregation, inductive inference, pragmatism, and the philosophy of religion. He has also published scientific papers on insect flight and single-molecule biophysics. Dr. Jantzen received his PhD in Logic, Computation, & Methodology from the Department of Philosophy at Carnegie Mellon University in 2010. In addition, he holds an MA in philosophy (also from CMU), an MS in physics from Cornell, and BS degrees in biology and physics from Penn State.

MONDAY,

October 17, 2016

3:00 PM - 4:30 PM

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Please contact Jeff Yoshimi (jyoshimi@ucmerced.edu) for more information.