

Causality and algebraic geometry

Andrew Critch, UC Berkeley

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Abstract

What constitutes valid causal reasoning has for centuries been a topic of great philosophical and scientific controversy. Now at the mercy of algebraic geometry, graph theory, and probability, this stale old debate may be coming to a fruitful end, with applications in machine learning and computational biology already being implemented, not to mention serious implications for public policy, economics, and cognitive psychology.

The relevant theory of *graphical causal models* is a major entry point to the budding field of algebraic statistics, where algebraic geometry meets statistical modeling, and this talk will give an introduction to it from a geometer's perspective. I'll introduce some conceptual tools and methods that are peculiar to algebraic statistics, and work through an example such causal inference computation using the commutative algebra software Macaulay2. At the end I'll review some of my research on binary hidden Markov models, and their close connection to certain matrix product state models of quantum entangled qubits.