

Philo 801 Topics in Philosophy and Methodology of Science:
(Philosophical Foundations of Mathematical Modeling)

This course will introduce students to a variety of philosophical issues that arise in the context of statistical modeling of observational and experimental data. We focus on three broad areas. When a model is to be inferred by some procedure or other from data, we ask: 1) what kinds of predictions or explanations is the model to generate, 2) given this, in what sense should the inference procedure be reliable, and 3) under what conditions will specific inference procedures be reliable on the chosen measure of reliability.

1. Varieties of Underdetermination
 - a) Global Underdetermination: Descartes; 1st Meditation
 - b) Underdetermination of Inference Rules: Hume; Treatise
 - c) Underdetermination of Variables: Goodman; New Riddle of Induction
2. Aims
 - a) Prediction and Prediction Under Intervention
 - b) Explanation: Hempel; Aspects of Scientific Explanation, Salmon; Scientific Explanation, Kitcher; The Advancement of Science
3. Notions of Reliability
 - a) Convergence in the Limit; Kelley: Logic of Reliable Inquiry
 - b) Probabilism (Bayesian conceptions): Earman; Bayes or Bust
 - c) Likelihoodism (Non-Bayesian model selection): Sober; Evidence and Evolution
 - d) Special Statistical Metrics
4. Causal Modeling: Epistemology
 - a) The Idea of Causal Modeling: Pearl; Causality
 - b) Axiomatic Theory: Spirtes, Glymour and Schienens; Causation, Prediction and Search, and CMU online courseware.
 - c) Specification vs Estimation: Scheines; Causation in Crises
 - d) Randomized Experiment: Fisher; Design of Experiments
5. Causal Modeling: Metaphysics
 - a) Failures of Markov and Faithfulness: Cartwright; collected papers
 - b) Inadequacies of Scoring Procedures: Burnham and Anderson; MultiModel Inference
 - c) Complexities: Prediction and Model Averaging
 - d) Complexities—Defined Variables, Multiple Levels and Realism
6. Realism: Carving Nature at its Joints
 - a) Carving Nature at its Joints: Plato
 - b) Abstraction vs Idealization: Cartwright; How the Laws of Physics Lie
 - c) Dreams of Completeness