

Syllabus

PNP Seminar: Causal and Probabilistic Reasoning

SP2010 L64 PNP 495 Sec 01

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Course Description:

Causal and Probabilistic Learning Causal knowledge is essential in order to predict how a system will behave when it is subject to an intervention. In many cases we infer causal relations on the basis of probabilistic data. But not every correlation indicates a direct causal relation. So how do we tell the difference? This question has two aspects, one normative, the other descriptive: How ought we infer causal relations from probabilistic data? And on the other hand, how do we actually obtain causal knowledge? This course will address both these questions. We will consider some of the normative theory of causal learning, but also contrast this with studies that analyze causal learning in humans and animals. Prerequisite: A 300 level Philosophy course (Phil/PNP 315 is recommended).

Text Book (optional, but recommended):

Sloman (2009), *Causal Models: How people think about the world and its alternatives*, Oxford University Press

Assignments:

There are three types of assignments. The first type will be one-page summaries of the main points of articles we read. The second type are problem sets where you will be asked to actually do some causal inference. These two types of assignments are given equal weight. Thirdly, you will be asked to give a presentation on one of the papers in class. See the assignment section on Telesis for details. There are no exams.

Grading

Participation: 10%

Written assignments (summaries and problem sets): 60%

Presentations, two: 15% each

Pass/Fail cut-off: Anything below a B- overall is considered a fail in this course if you are taking the class for pass/fail grades.

There are no exams.

The expectation concerning the quality of work is higher for grad students than for undergrads. There will be extra problems for grad students on the problem sets.

Laptops etc. in class:

Generally no electronic equipment should be used in class, but I do see the value of taking notes on a laptop. To find a compromise, I will apply the following rule: If you want to take your class notes on a laptop you must ask me for permission to do so. Permission will be granted if you agree to (i) permit me to see your screen at any point in class if I request to do so, and (ii) show me the notes you took if I ask to see them after class. Permission for usage can be retracted. The hope is that this compromise will permit genuine class-usage of the laptop and discourage use that is not related to class work.

Academic Integrity

Cases of plagiarism will be reported to the academic integrity officer of Arts & Sciences with a recommendation to fail the student for the course. Please see the Telesis website for more details and please refer to Washington University's policy on academic integrity.

Tentative Course Schedule

Day	Date	Topic	Content / Reading
Wednesday	1/20	Introduction	
Monday	1/25	Basics of Probability	Events, interpretations, joint probability, sample vs. population
Wednesday	1/27	Problem of Induction	Hume, excerpts from <i>An Enquiry concerning Human Understanding</i> ; probabilistic inference and induction
Monday	2/1	Metaphysics of causation	Scheines, <i>Causation in New Dictionary of the History of Ideas</i> , Sec. 1&2; Token vs. type causation, counterfactuals, possible worlds, regularity theories etc.
Wednesday	2/3	Causal Bayes nets	graphs and their interpretation; defining a cause vs. doing causal inference
Monday	2/8	Independence	Causal and probabilistic independence, conditional independence
Wednesday	2/10	d-separation	v-structures etc. (maybe discuss latent variables)
Monday	2/15	foundations	Markov assumption, faithfulness; Sober, <i>Venetian Sea Levels, British Bread Prices, and the Principle of Common Cause</i>
Wednesday	2/17	Using the framework	Hitchcock, <i>On Humean Bondage</i> ; Mochon & Sloman, <i>Causal Models frame interpretation of mathematical equations.</i>
Monday	2/22	Categorization & conceptual structure	Keil, excerpts from <i>Concepts, kinds, and cognitive development</i> ; Mention natural kinds debate
Wednesday	2/24	Categorical Induction	Rehder & Hastie, <i>Causal Knowledge and Categories</i> ; discuss new riddle of induction
Monday	3/1	analyzing foundations	Normative vs. descriptive causal inference; excerpts from Rehder & Burnett, <i>Feature inference and the causal structure of categories</i>
Wednesday	3/3		
Monday	3/8	Spring break	
Wednesday	3/10	Spring break	
Monday	3/15	interventions	Randomization, edge-breaking, exogeneity; Hagmayer et al., <i>Causal Reasoning through Intervention</i> ; Sloman & Lagnado, <i>Do we "do"?</i> ; Maybe Meek & Glymour, Conditioning and intervening, in PSA
Wednesday	3/17	Causal Decisions	Hagmayer & Sloman; <i>The causal psycho-logic of choice</i> ; <i>Causal Models of Decision Making</i>
Monday	3/22	Bad causal	Quattrone & Tversky, <i>Causal vs diagnostic</i>

		decisions	<i>contingencies</i>
Wednesday	3/24	Seeing causation where there is none	Chapman & Chapman, <i>Illusory correlation as an obstacle...</i> ; Gilovich et al., <i>The hot hand in basketball...</i> ; Mention Michotte experiments
Monday	3/29	Language: conditionals (counterfactuals??)	Kaufmann, <i>Conditioning against the grain (??)</i>
Wednesday	3/31		
Monday	4/5	Learning: conditioning	Rescorla & Wagner-model, reading TBA
Wednesday	4/7	Learning: associative, contrastive models	Maybe Cheng & Novick, <i>A probabilistic contrast model of causal induction</i> ; Excerpts from Glymour, <i>The Mind's Arrows</i> , Ch 7
Monday	4/12	Learning: Bayes nets	Gopnik et al, <i>Causal learning mechanisms in very young children</i>
Wednesday	4/14	Animals: apes	Excerpts from Povinelli, <i>Folk Psychology for Apes</i>
Monday	4/19	Animals: rats	Blaisdell & Waldman, <i>Causal learning in rats</i>
Wednesday	4/21	discussion	Penn & Povinelli, <i>Causal Cognition in Human and Nonhuman Animals</i>
Monday	4/26	Advanced	Goodman et al., <i>Learning grounded causal models</i> ; Fishhoff et al., <i>Fault trees...</i>
Wednesday	4/28	Overview and current research	