PHIL 302 Topics: Philosophy of Statistics

Spring | 2023

Instructor Information

Instructor	Class time & location	Office hours & location
Kino Zhao (she/her)	Mo 10:30-11:20 - WMC 3253	Monday 11:30-12:30
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General Information

Course Description

*This is a philosophy class, not a statistics class.

This course surveys key philosophical issues in the use of statistics in science. We will start with interpretations of probability and the debate between frequentist and Bayesian theories in the foundation of statistics. Next, we examine recent claims that various problems in science (notably the replication crisis) originated in the misuse/ misunderstanding of statistics, or otherwise can be resolved through better statistics. Finally, we look at machine learning, "big data", and "data-driven research", and ask whether scaling statistics up to the level of "big" and having machines do it will save us from the standard pitfalls.

This class does not have statistics as a pre-requisite. However, sometimes a philosophical idea about a method may be difficult to grasp if you don't know how the method works. As such, we will cover a little bit of basic statistics throughout the term. Some assignments will also involve statistics exercises to help you get some sense of what it's like to use these techniques. You will be able to work in groups for these exercises.

Reading

All readings will be available online.

Assessment (total: 100pt)

Assignments (10pt x 8 = 80pt):

From weeks 2-10, there will be weekly assignments, for a total of 9. The lowest assignment grade will be dropped. The assignments take a variety of forms: some are statistics exercises; some are summaries of reading; some are critical reflections. **Assignments are due Tuesdays at noon.**

You have 4 days total (across all 4 essays) of free late days which you can spend however you want.

Other than that, the penalty is: 5% (1 day), 15% (2 days), 30% (3 days), 50% (4 days), 100% (5 days; in other words, don't bother). Unpenalized extensions may be granted with documentation. (Doctor's, psychiatrist's, or academic advisor's notes are acceptable. Generally speaking, no retroactive extensions are allowed.)

You are allowed to work in groups. If you do, **please put all of your groupmates' names on the assignment sheet. You must write your own answers.**

Group presentation (15pt)

Students, in groups of 4-5, will give a 10min presentation in the last week of class where you 1) pick a scientific study that uses a statistical method, 2) explain how the method works and what the paper concludes, 3) use what we learned in this class to identify at least one weakness and one strength of this paper.

Within-group peer evaluation (1pt)

To make sure people pull their weight during prep, everyone needs to submit a peer evaluation. Taking the final product as 100%, for each groupmate including yourself, estimate how much work is the result of that person's contribution.

Assessment of other groups' presentations (4pt)

During presentation week, students should listen carefully to other groups' presentations and, using a simple rubric I provide, conduct a brief assessment of other groups' performance. You don't have to do assessment on your own group or the group that immediately precedes your presentation. These assessments will inform but not dictate each group's final grade.

Schedule

Week	Topic	Reading	Assignment
		Prologue: probability calculus and the problem of induction	
Week 1	Going over this syllabus Induction: the basics of probability theory	[Thursday] Chapters 1&6 in Skyrms, "Choice and Chance"	Extra credit (1pt) assignment: find and download all of the class's readings. Title them appropriately. Upload a screenshot on Canvas
Week 2	The old and new problems of induction	> Chapters 3&4 in Skyrms, "Choice and Chance"	[Assignment 1]
		Unit 1: from interpretations of probability to the statistics wars	
Week 3	Subjective vs. physical interpretations of probability The reference class problem	> Section 2 of Stanford Encyclopedia of Philosophy entry on "Philosophy of Statistics" > Colyvan et al. 2001, Is it a crime to belong to a reference class? (> Hajek, 2007, The reference class problem is your problem too)	[Assignment 2] Extra credit (1pt) assignment: submit 1 class notes and 1 reading notes (photos are fine) on Canvas. Due Friday.
Week 4	NHST (Null Hypothesis Significance Testing) and the "statistics wars"	> Krueger 2001, Null Hypothesis Significance Testing, On the Survival of a Flawed Method > Schneider 2015, Null hypothesis significance tests. A mix-up of two different theories: the basis for widespread confusion and numerous misinterpretations	[Assignment 3]
Week 5	The error-statistical defense of frequentism	> Mayo & Spanos, 2011, Error Statistics	[Assignment 4] Presentation groups formed
		Unit 2: the replication crisis and the statistical reform	
Week 6	The replication crisis and the statistical reform	> Romero 2019, Philosophy of Science and The Replicability Crisis	[Assignment 5]

Week	Topic	Reading	Assignment
		> Open Science Collaboration 2015, Estimating the reproducibility of psychological science	
Week 7	Just say no to p-values	> Colling & Szucs 2021, statistical inference and the replication crisis > Button et al. 2013, Power failure: why small sample size undermines the reliability of neuroscience	[Assignment 6]
		Reading week (Feb 20-26)	
Week 8	The stopping rule debate	> Simmons et al. 2011, False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant > de Heide & Grunwald 2021, why optional stopping can be a problem for Bayesians	[Assignment 7]
		Unit 3: "big data" approaches, or does putting stats on steroids save it?	
Week 9	Correlation, causation, and Simpson's paradox	> Fitelson 2017, Confirmation, Causation, and Simpson's Paradox > Pearl 2022, comment-understanding simpsons paradox	[Assignment 8]
Week 10	Model selection	> Section 5 of Stanford Encyclopedia of Philosophy entry on "Philosophy of Statistics" > Forster & Sober 1994, How to Tell When Simpler, More Unified, or Less Ad Hoc Theories will Provide More Accurate Predictions	[Assignment 9]
Week 11	Black-box reasoning	> Roush 2017, The epistemic superiority of experiment to simulation	
Week 12	Proxy variables	> Johnson (draft), Proxies aren't intentional; they are intentional	
Week 13	Presentation week	[Monday] presentation prep + Q&A [Thursday] group presentation	Presentation assessment
Week 14	Presentation week	[Monday] group presentation	Presentation assessment

Last updated January, 2023