STAT 4700/5700
Philosophical and Ethical Issues in Statistics

Course Description

Statistics is often classified as a mathematical discipline. Evidence for this classification is widespread. For example, a prominent statistics department at the Florida State University defines statistics as "the mathematical science involved in the application of quantitative principles to the collection, analysis, and presentation of numerical data." Certainly, a good statistician ought to be proficient in many areas of mathematics, and thus, the close association between statistics and mathematics is justified; but classifying statistics as a mathematical discipline may suggest that statistics is *essentially* about numerical manipulation, calculation, and procedure (this idea is further perpetuated by standard courses that often present statistics as a set of numerical recipes). An emphasis on these calculative aspects of statistics conceals a number of philosophical issues that are necessary to statistical theory and practice. For example, do statistical methods tell us anything about *causality*? In what sense are statistical inferences *justified*? How ought the probability calculus be interpreted? Why do certain statistical principles (e.g., the likelihood principle, Bayesian conditioning) conjure up controversy among practicing statisticians and philosophers? Ought null hypotheses ever be accepted? What special ethical obligations do statisticians have? **The purpose of this course is to present students with the opportunity to think clearly about these and other philosophical issues in statistics.** In fact, my hope is that students will see statistics itself as *interdisciplinary*. To the extent that it requires flexible and broadly applicable modes of thinking, statistics is as philosophical as it is mathematical.

Instructor: Brian Zaharatos

Office: ECOT 318

Office Hrs: Tues, 9:45am-11:15am; Friday, 10:30am-11:30am; **or** by apt

A note about the structure of this course

While a small percentage of each meeting might be spent in a traditional lecture format, **most** of the meetings will be discussion based. **It is essential that students do the required readings before class**, and be ready to discuss them thoughtfully during class. Questions are always encouraged. The classroom atmosphere should be one that encourages honest, genuine, and respectful participation from all students. Attendance is critical for success. Absence from more than 10 percent of the scheduled class sessions (excused or unexcused) will be considered excessive. Consequently, students who are absent more than 4 times will be subject to full letter grade deductions from their final grade. Tardiness will not be tolerated. If a student is tardy (>5 minutes late), they will be marked absent.

Textbooks

- Philosophy of Statistics Vol. 7 (Handbook of the Philosophy of Science), by Prasanta S. Bandyopadhyay et al. (**PoS**; pdf)

- *Scientific Reasoning: The Bayesian Approach:* by Colin Howson and Peter Urbach.

- Various articles in pdf form, uploaded to Canvas.

Learning Objectives

The objectives of this course are:

(1) to recognize the importance of philosophical issues in a number of areas of statistics;

(2) to compare and contrast the main interpretations of probability theory and recognize some strengths and weaknesses of each;

(3) to compare and contrast the main paradigms in statistics and recognize some strengths and weaknesses in each;

(4) to develop an appreciation for the way philosophical issues in statistics arise *in practice*;

(5) to develop an understanding of the ways that statistics and probability have been used to attempt to solve important philosophical problems (e.g., the problem of scientific theory confirmation);

(6) to identify ethical challenges relevant to statisticians; and (7) to strengthen written and oral communication.

Course Webpages

Course materials such as this syllabus, a course schedule, assignments, announcements, and your grades will be uploaded to Canvas. Check Canvas frequently!

Assignments

Papers (45% total, 15% each)

There will be three papers in this course. These assignments will provide an opportunity for students to (1) demonstrate their understanding of important course themes, and (2) articulate their well-reasoned view on these themes. Philosophical writing is difficult, but incredibly rewarding. It is my hope that, in addition to learning how to better formulate arguments in the philosophy of statistics, students also learn to better formulate arguments for other positions that they hold. Clarity and consistency in our thinking is likely to lead us to hold better views, not just in the philosophy of statistics, but in other disciplines as well.

Paper #1:

The first writing assignment will be focused on articulating the strengths and weaknesses of a particular interpretation of probability. Students will be asked to reconstruct what they interpret to be the strongest argument for a particular interpretation, and then offer their own view in the interpretation of probability. **Length: ~1200-1500 words.**

Paper #2:

The second writing assignment will be focused on articulating the strengths and weaknesses of a particular paradigm in statistical inference. Students will be asked to reconstruct what they interpret to be the strongest argument for a particular paradigm, and then offer their own view in the best statistical paradigm. **Length: ~1200-1500 words.**

Paper #3:

The third writing assignment will be focused on either (1) philosophical issues in statistics or the sciences that depend on statistics (e.g., quantum mechanics); or (2) on ways in which statistics helps philosophers think about important philosophical issues (e.g., confirmation theory in the philosophy of science). Here, students will have the freedom to choose from topics covered in class, or from other topics that they are interested in. Students will be asked to describe the philosophical content in the chosen topic, charitably describe the relevant debates among the reasonable stakeholders, and offer their own view as a way forward. **Length: ~1500-1800 words.**

Revisions on Papers

Revision is the key to successful, thoughtful writing. Successful revision requires attention to peer and instructor comments, but it also requires careful personal reflection about one's own work. I am committed to helping each student become the best writer that they can be. For that reason, I am open to reading drafts of student papers. The earlier a draft is submitted, the greater the likelihood that I will be able to return the draft with thoughtful comments. More details on specific draft policies will be announced in class.

Assignments

Exams (30% total, 15% each)

There will be two exams: one approximately half-way through the semester, and the other at the end of the semester. The purpose of each exam is to give students an opportunity to demonstrate their understanding of the major themes in the course. For each exam, a number of questions will be distributed in advance, and the exam will be made up of the same (or very similar) questions.

Participation/Classwork (25%)

Participation in this course is essential for doing well. We will frequently have opportunities for class participation. The majority of this portion of your grade will come from in-class assignments, attendance (you are allowed to miss three classes with no penalty to your grade), online discussion, attending office hours, and, potentially, pop quizzes. Those who participate in these activities will earn high participation grades; students who do not actively participate but seem reasonable well prepared for most seminars can expect to earn a B- for participation. Students, who regularly show up unprepared, or attempt to text, do work for other classes, etc., can expect a very low (most likely failing) participation grade.

Prerequisites

At least one course in inferential statistics. A course in probability theory is preferred. Examples are: STAT 4000/5000, STAT 4520/5520, CSCI 3022, STAT 2600 together with STAT 3400.
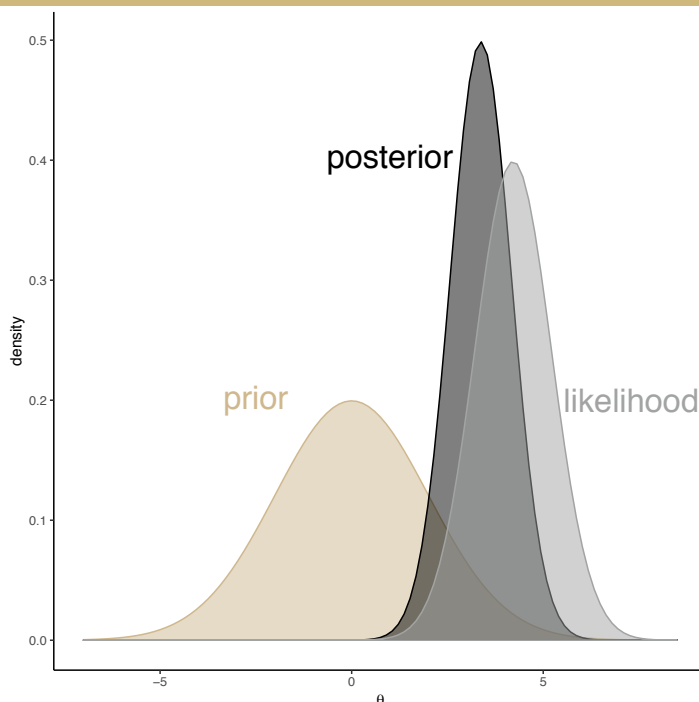
Policies

Trigger Warning

It is possible that discussions in this course could be potentially disturbing or traumatizing. If you feel the need to leave class during a discussion that you find disturbing or traumatizing, for however long, you may do so without academic penalty. You will, however, be responsible for any material you miss. If you do leave class for a significant time, please make arrangements to get notes from another student (or see me). If a topic is disturbing to you to the extent that you do not feel comfortable working on it, I am happy to try to make reasonable accommodations, e.g., work with you on a different topic that demonstrates the same (or similar) learning objectives.

Disability Accommodations

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, or http://disabilityservices.colorado.edu/

Religious Observances

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please send me e-mail or visit me in office hours to notify me of such a situation at least two weeks in advance of the event. See full details at http://www.colorado.edu/policies/observance-religious-holidays-and-absen...

Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See polices at http://www.colorado.edu/policies/student-classroom-and-course-related-be....

Discrimination and Harassment

The University of Colorado at Boulder policy on Discrimination and Harassment (http://www.colorado.edu/policies/discrimination-and-harassment-policy-an...), the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships applies to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550.

Honor Code

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Information on the Honor Code can be found at http://www.colorado.edu/policies/student-honor-code-policy. and at http://www.colorado.edu/policies/academic-integrity-policy.