Teaching Statement

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1 Overview of teaching

1.1 Courses developed

I have developed a graduate-level course that introduces students to three popular streams of research in statistics, machine learning, and artificial intelligence: low- and high-dimensional graphs representing

- data structure: e.g., network data;
- model structure: e.g., conditional independence structure;
- mathematical operations: e.g., neural networks and deep learning.

I have taught the course 8 times since 2014, including 7 times at Rice University (Stat 648) and 1 time at the University of Missouri, Columbia (Stat 9100).

1.2 Courses taught

I have taught statistics classes at the following universities:

- Department of Statistics, Penn State University (PSU): summer 2012 and fall 2012 (2 classes);
- Department of Statistics, Rice University (Rice): fall 2013 until spring 2021 (16 classes);
- Department of Statistics, University of Missouri, Columbia (MU): fall 2021 and spring 2022 (2 classes).

These classes include introductions to the mathematical foundations of statistical learning from data at all levels:

- Bachelor's level (8 classes): Stat 401 at PSU (2 times); Stat 310 & Econ 307 at Rice (5 times); and Stat 4710 & 7710 at MU (1 time, 2 sections);
- advanced Bachelor's and Master's level (3 classes): Stat 419 & 519 at Rice (3 times);
- Ph.D. level (8 classes): Stat 532 at Rice (1 time); Stat 648 at Rice (7 times).

1.3 Ph.D. qualifying exam

As a result of teaching the core courses on the mathematical foundations of statistical learning from data at Rice (Stat 519), I was in charge of preparing and grading the written Ph.D. qualifying exam in statistics at Rice and leading oral examinations in 2018, 2019, and 2020.

2 Teaching philosophy

Statistics provides the guiding principles for learning from data and making well-informed decisions and predictions in the face of uncertainty, which is a critical skill in the complex, interdependent and interconnected world of the twenty-first century.

As such, statistics has much to offer to students, but the age of data science presents both opportunities and challenges for teaching statistics. On the one hand, it presents opportunities in that statistics courses have witnessed a surge of demand and statisticians have the opportunity to help shape an important slice of the world's future workforce. On the other hand, it presents challenges as statistics courses have more students, and the background and career goals of those students is more heterogeneous than in the past.

I have attempted to make my courses useful for all students, regardless of background and career goals, and have placed a strong emphasis on

- connecting with students by choosing examples that appeal to them, such as examples from artificial intelligence and machine learning;
- leaving no student behind, making sure that all students understand the key ideas of how to learn from data.

2.1 Connecting with students

In all of my courses, I attempt to connect with students by choosing examples that appeal to them. These examples are taken from my research, which is related to three popular streams of research in statistics, machine learning, and artificial intelligence: low- and high-dimensional graphs representing

- data structure: e.g., network data;
- model structure: e.g., conditional independence structure;
- mathematical operations: e.g., neural networks and deep learning.

Examples from machine learning and artificial intelligence demonstrate that statistics is used to answer relevant questions, which may appeal to them and help them understand the key ideas of how to learn from data. I therefore use simplified examples from the three popular streams of research in all of my courses: e.g., to demonstrate maximum likelihood estimation without missing data, I use a small-scale Markov random field as a model of the human brain, and to demonstrate

maximum likelihood estimation with missing data, I use a small-scale Boltzmann machine from artificial intelligence. These examples are chosen with care, so that the examples do not distract from the main contents of my courses, but serve to demonstrate important ideas and applications of statistics.

2.2 Leaving no student behind

I have designed my courses so that no student is left behind, regardless of background and career goals. To leave no student behind, I place a strong emphasis on the key ideas of how to learn from data. I believe that the key ideas are simple and that every student can understand them, regardless of background. I explain the key ideas as clearly and simply as possible, and support them by careful mathematical arguments that start simple and proceed step by step, without skipping steps that may seem trivial to me but may not be obvious to students. I encourage students to ask questions in the classroom, so that I can address gaps in understanding on the spot.

2.3 Undergraduate courses

In introductions to the mathematical foundations of statistical learning from data at the undergraduate level and the advanced undergraduate level, I have found it useful to exploit analogies, such as analogies with criminal investigations and criminal trials. For example, to introduce statistical estimators, I use analogies with criminal investigations: Statistical estimators resemble detectives in criminal investigations, using a trail of evidence $X_1, \ldots, X_n$ to track down the source θ of the evidence. To explain statistical tests, I use analogies with criminal trials.

3 Teaching evaluations

Please note:

- **I have done most of my teaching at Rice University (16 classes).** In addition, I have taught at Penn State University (2 classes) and the University of Missouri (2 classes).
- **Neither Rice University nor the University of Missouri issue peer-reviewed teaching evaluations.** Both universities rely on student-based teaching evaluations.
- **I have peer-reviewed teaching evaluations from Penn State University.** While these peer-reviewed teaching evaluations date back to 2012, I attach them.
- Due to a lack of resources, **I had no teaching assistants and no graders at the University of Missouri,** despite teaching two sections of an undergraduate class with 96 students.

I first present peer-reviewed teaching evaluations from Penn State University and then present all student-based teaching evaluations from Rice University and the University of Missouri since 2017: