# Teaching Portfolio

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## 1 Teaching Statement

Data analytical skills have become much in demand in many fields. Teaching statistics provides a great avenue by which I can explore the analytical fields I love and pass on my knowledge to students. My overall goal for teaching is to prepare students to meet the requirements of upper division statistical courses and the needs of job markets. More specifically, I aim to equip them with statistical skills, coach them to have independent analytical reasoning, and train them to communicate statistics. My teaching strategies to achieve the goals include: develop teaching materials with a tailored focus, reach students at different levels of studying abilities, accommodate students at varying states of physical and mental health, continually improve communication skills, and keep state-of-the-art topics in courses.

Teaching course content with a tailored focus plays an essential role in students' learning. For undergraduate Introductory Probability and Statistics, the goal is mostly to prepare students for upper division statistical courses. I spent much lecturing time on developing students' interest in course topics and helping them understand basic concepts and methods. In this class, I motivate students with real data examples or experiments; then I expose them to concepts and methods; after that, I illustrate applications of concepts and methods; finally, I give them time to explore the material in class. For most of my graduate classes, the goal is to prepare them for job markets. The focuses are to teach students analytical skills in specific statistical fields and to train them in the practice of their skills. In those classes, I first introduce the topics to students by projects involving real data; then I teach them concepts, methods, and theorems; after that, I give them instructions in software packages and production tools for graphical presentations; finally, I show them real analysis examples. To cement the knowledge students have gained in class, I assign them homework problems. For graduate courses, I also ask students to carry out projects and give oral presentations, which aim to build the students' abilities to perform appropriate statistical analyses and communicate results professionally. I also encourage students to work as groups on some assignments. Discussion enhances the students' ability to explain statistics to peers.

Reaching students at different academic and health levels is one of my passions for teaching. There was a Chinese movie in the 90s telling a touching story of a teacher who relentlessly tried to reach students who dropped out of elementary schools due to poverty and child labor. In a different cultural context, students in my classes have big differences in their abilities in understanding statistics, their availabilities for showing up classrooms and finishing assignments on time. Frequently, there are students suffering from mental and physical health problems that hinder them from studying. All these factors contribute significantly to students' learning outcomes. In response to these challenges, I implemented the following strategies: (1) provide easy, medium, and hard examples for every new concept; (2) make the hard example application-oriented or otherwise connect it with applied methods where the concept will be used; (3) skillfully weave in repetitions of important concepts, (4) give students homework feedback and incentives for revisions on assignments, (5) be available to students beyond office hours. Since implementing these strategies, I have observed better performances in their tests overall and saw fewer students falling behind. One student sent an email expressing "I just wanted to send a thank you for giving a chance to those of us who did not do as well as they feel they are able to submit corrections and validate their ability through test 3."

Creating effective communication enhances student learning outcomes. Classroom teaching relies on effective verbal (oral and visual), and nonverbal communication. Verbally, I strive to have clear, well-paced, organized presentations. Visually, I use slides with short bulletins and hand-writings on the board to aid presentations. Besides lecturing, I create interaction between students and myself and stimulate communication among students. I regularly have students work on in-class exercises and get students involved in small-scale experiments. For more involved problems and projects, I ask students to work in groups and encourage students to teach each other. These practices provide versatile communication channels that stimulate but do not overwhelm students' visual or aural load. I am still improving my communication skills, for example, making slides visually more appealing, better organizing lectures, and practicing more effective nonverbal communication (eye contact and body language). Looking towards the future, I am interested in learning non-traditional teaching methods, such as the "Flipped Classroom" and online teaching. "Flipped Classroom" has been designed to stimulate more interaction among teachers and students, which also promotes self-motivated learning. In "Flipped Classroom"s, short video lectures are viewed by students at home before class, while in-class time is devoted to exercises, projects, and discussions. The trend of video lectures is also evident in the growing popularity of online courses. For video lectures, effective communication is even more paramount as it lacks student and teacher interaction during presentations.

Finally, teachers need to teach cutting edge methods and skills that prepare students to excel in job markets. The body of statistical knowledge is fast-growing and giving birth to new areas. Some old methods and concepts face potential modification or even obsolescence. In the last decade, causal discovery and causal inference methods have become powerful tools for social science, epidemiology, business, and many other areas. Machine learning algorithms greatly complement traditional regression-based prediction and classification methods. Among machine learning algorithms, deep learning methods have had significant advances in the last decade and have become important tools for big data discovery and precision medicine. Many new software packages sprout every year, which can be great aids to teaching. It takes teachers great patience and dedication to select and learn new statistical techniques and software packages. The classical concept of a p-value is currently under heated debate, and traditional interpretations of p-values are likely to be modified or supplemented. I dedicated myself to learning and passing on to my students the best practices in Statistics.

## 2 Summary of My Teaching Effort

In my last five years of teaching in UNM, I have taught graduate-level courses Introduction to Time Series Analysis (four times), Spatial Statistics and Bio-applications (once), Introduction to Bayes Modeling (once), Biostatistics and Logistic Regression (once), and an undergraduate-level course Elements of Probability and Statistics (seven times). Spatial Statistics and Its Bio-applications was a new topic course for the department. In Fall 2019, I am teaching Elements of Probability and Statistics and a graduate-level course Statistical Computing. Our typical course load is two courses per semester except that I had course releases during the first two years after hiring and a research semester in my fourth year. I typically have forty to sixty students in undergraduate courses and six to twenty students in graduate-level courses. In addition to classroom teaching, I have had two master students graduated, several graduate students involved with research reading, two current master students and one current Ph.D. student. I attended a teaching seminar in the Department of Mathematics and Statistics about the "Flipped Classroom" method and several workshops by Professor Erhardt on computing packages. I am also a member of Statistical Education Section sponsored by the American Statistical Association.

# 3 Documentation of Course Development

**STAT 345 Elements of Mathematical Probability and Statistics**: The course is a foundational course for upper division statistical courses. The content includes axioms of probability, combinatorics, Bayes' theorem, probability distributions, expectations, variances, correlations, point estimation, confidence intervals, and hypothesis testing. The components are selected to achieve the learning goals for this course. Specifically, the learning goals are: demonstrate knowledge of probability and statistical inferences, including a) concepts of probability and statistical inferences, b) calculus foundations, c) symbolic and abstract thinking, and d) applications using discrete and continuous univariate random variables. Applications include the Central Limit Theorem, estimation, confidence intervals, and hypothesis testing. I prepare slides for classroom teaching, which provide the main ingredients for concepts and methods, as well as examples and exercises. I give seven homework assignments and three exams which are designed to help students understand concepts and employ statistical methods.

**STAT 481/581 Introduction to Time Series Analysis**: Time-series data modeling is a powerful tool to analyze trends, variabilities, rates of change, covariations, and cycles, etc. Data arises from business processes, weather forecasting stations, temporal measurements in engineering, and many other fields. The course content includes exploratory methods for time series data, modeling of stationary processes, such as ARIMA modeling, analysis in the frequency domains using Fourier analysis, and some advanced topics, such as long memory models, GARCH models, and state-space models. My goals for students in this course include: understanding state-of-art time series models, performing appropriate data analysis, interpreting technical results within their scientific context, and performing diagnostic evaluations of models. Students in this class are highly motivated to learn because of the subject's importance in real-world applications. Students are given six to seven homework assignments and a final project. The final project requires the students to perform statistical analysis on real data and to give a short talk to the class.

**STAT 579 Spatial Statistics and Its Biostatistics Application**: This course is a new topic course to the department. Researchers in diverse areas such as climatology, ecology, environmental health, and real estate marketing are increasingly faced with the task of analyzing data that are highly multivariate, with many important predictors and response variables. The variables are geographically referenced, and often presented as maps, and temporally correlated, as in longitudinal or other time series structures. This motivates hierarchical modeling and data analysis for complex spatiotemporal data sets. The course content includes an overview of spatial data, basics of point-referenced data models and areal models, basics of Bayesian inference, hierarchical model-

ing for univariate and multivariate spatiotemporal data, and point pattern modeling. Many topics, including spatiotemporal data analysis and point pattern modeling, have been receiving increased attention in the literature and for applications. Students are given several homework assignments and a final project. My goals for the students in this course include: understand basic spatial and spatial-temporal models, performing data analysis of spatial and spatiotemporal data using appropriate models and interpreting technical results within their scientific context. While the textbook we use is widely accepted for graduate-level spatial data analysis courses, this discipline is still under development and it lacks a well-organized software package for use. When I teach this course again, I will write a study guide of software packages for the students and a monograph to reflect the recent developments.

**STAT 477/577 Introduction to Bayesian Modeling**: Bayesian modeling is a branch of Statistics that can be very helpful for modeling, inference, and predictions. This course starts with a review of multivariate probability distributions and then an introduction to Bayes' rule, prior elicitation, posterior derivation, Markov Chain Monte Carlo computation, single and multiple parameter inferences, and hierarchical linear and generalized linear modeling. We also cover the basics of using 'STAN' package in R, which implements the Hamiltonian Monte Carlo computational algorithm. My goals for the students include: being able to employ Bayesian modeling in some foundational inference problems, being familiar with informative and non-informative prior construction, being capable of carrying out Bayesian inference, and correctly interpreting results. Students are given six to seven homework assignments and a final project. The final project requires the students to perform full Bayesian analysis to a real dataset and write a report.

**STAT 474/574 Biostatistics and Logistic Regression**: In this course, we focus on survival analysis and logistic regression. Survival analysis is a branch of statistics analyzing time-to-event data where the event of interest is biological, for example, death, the occurrence of cancer relapse after treatment, heart attack, etc. Time-to-event data is often accompanied by censoring in which time measurements are only partially known. Censoring requires different statistical methods from what students are exposed to in other statistics classes. I teach data display, introduce hazard and survival functions, various censoring mechanisms, likelihood principle, proportional hazard and accelerated failure time modeling including Cox survival modeling, Cox survival model diagnosis using Cox-Snell residuals, Deviance residuals, and Schoenfeld residuals, modeling for time-varying coefficients, and modeling for time-varying covariates. Logistic regression is used to explore the quantitative relationship between categorical outcomes and covariates. I teach basic modeling, likelihood construction, statistical inference, interpretations, and regularized logistic regression. Students are given six to seven homework assignments and a final project. The final

project requires analysis to a real time-to-event dataset and a written report.

**STAT 590 Statistical Computing**: Computational data analysis is an essential part of modern statistics. Competent statisticians must not just be able to run existing programs but to understand the principles on which they work. They must also be able to read, modify, and write code so that they can assemble the computational tools needed to solve their data analysis problems. This class is an introduction to statistically-oriented programming, targeted at statistics majors, without assuming extensive programming background. Students will learn the core of ideas of programming–data structures, functions, iteration, input and output, debugging, logical design, and abstraction–through writing code to assist in statistical analyses. Students will also learn some advanced statistical numerical methods–Bootstrapping, Monte Carlo methods, sampling, and optimization algorithms. I give students weekly labs to cement their learning on coding and algorithms.

# 4 Peer Evaluation of Teaching

Based on previous peer evaluations of teaching, I worked on my introduction to each class so as to capture more of the students' attention. This was done by presenting an overview of previous teaching content and some related examples to motivate the students. I also encouraged the students to participate more in class and ask more questions. I included more examples that are related to their subject fields to increase their interest.

# 5 Student Evaluation of Teaching

**STAT 345 Elements of Mathematical Probability and Statistics**: Based on multiple teaching assessments, 65% to 90% of the students rated the overall teaching to be effective and highly effective. 70% to 90% of the students thought that they feel comfortable or very comfortable to approach me with questions or comments. Representative student comments include: "Nicely made notes and clear structure. Always knew what we are doing and what was expected!"; "The homework was fantastic and really representative of the exams and class in general."; "She was very willing to help."; "The teacher's preparedness and thorough explanations. Very organized and helpful."; "The features of this course that contributed to my learning were the notes that Dr. Li gave out to the class for use. The notes were well put together and easy to understand. The examples in these note packets were also very helpful because they closely related to the homework.

The homework assignments in this class were also very helpful for when it came time for the exams. As long as you studied the note sheet and the homework, then you are able to be successful in this class. Dr. Li was also very flexible when it came to setting up meetings to answer questions. Most of the time she would give you various times to meet with her outside of her set office hours. She wants her students to succeed in this course, and will do whatever she can to help them. Overall, she is a great professor who knows statistics very well and is willing to help you learn." There were also suggestions, such as, "Daily Quiz. Or iClickers. Something to make class engaging."; "Maybe more real life examples outside of the notes!". In response to some of the past comments, I have improved the organization of the course material and write more clearly on the board. In response to some newer comments, I prepare examples that are more related to their subject fields.

**STAT 481/581 Introduction to Time Series Analysis**: 90% of the students rated the overall teaching to be effective and highly effective. 80% rated "comfortable" in approaching me. Representative student comments include: "The topics of this course are very useful and interesting. Instructor taught this course in detail, which is really good."; "1. She was very clear about which subjects she wanted us to study. 2. The homework assignments were not too lengthy but required us to do a lot of research. The assignments prepared me for the final project, at least over the subject matter part. 3. She is approachable and the one on one time that I got helped. She responds really well to emails. 4. I would just like to say again that the homework assignments were not too lengthy. I had time to think about what I was writing down, instead of trying copy the right answer down before a short deadline", "Explaining in plain English what we were doing and why"; "Dr. Li is a sweet person that cares about her students. She is thoughtful and challenges the students to work hard (because she works hard)"; "I think it's better for the instructor to pick up some important problems from homework to review." I will use homework problems to review the content when I teach this course again.

**STAT STAT 579 Spatial Statistics and Its Biostatistics Application**: 50% of the students rated the overall teaching to be effective and highly effective. 100% rated "comfortable" in approaching me. Representative student comments include: "The instruction of the R code within the lectures helped significantly"; "Dr. Li is very approachable, and always willing to help. Her lectures are pretty good, and the homework load was very reasonable." "Didn't like our book, it should be accompanied with easier (more practical) book. It is better to include more examples from other sources. The class is more theoretical than practical. She didn't feel very confident and experienced while teaching". In response to students' comments about needing a more practical book and more applicable contents, I hope this can be addressed in future teaching.

**STAT 477/577 Introduction to Bayesian Modeling**: 100% of the students rated the overall teaching to be effective and highly effective. 100% rated "comfortable" in approaching me. Representative student comments include: "The prof. was very attentive so student can follow the entire course contents"; "The matter of this matter is complex, but she really makes sure everybody understand everything. Sometimes I think there is too much matter for a single course. Probably it would be great have one course focused on theory and other more focused on programming with R and other tools."; " I think the professor puts a lot of time into her lectures, and they are usually very clear. I also really liked the textbook, and thought that the problems chosen were good problems and really contributed to my learning."; "Dr. Li's approachability was the best part about this course. She really took the time to understand my problems with the material and clarify them. Also, her talent for explaining something as complicated as Bayesian Analysis is a testament to her ability as an instructor. Overall, I really enjoyed this class, and I felt like I learned a lot from Dr. Li. I'm so excited to take more classes with her! :)"; "Dr. Li keeps the examples relevant to real-world application of Bayesian analysis. She takes opportunities, whenever possible, to contrast this analysis framework with the classical frequentist approach. Dr. Li also puts a lot of prep time into her lessons and it shows - lectures are easy to follow. Lastly, this level of stat is calculus-based."; "Dr. Li is willing to sometimes just slow down, and explain this math, without making students feel intimidated because their calculus skills need a few pointers. Very patient." Students had suggestions to use a more accessible textbook for an introductory level and also felt a little overwhelmed by too many contents in one semester. Our department now offers two courses as a sequel for Bayesian data analysis, which would make the pace much more easier. If I get to teach the sequel, my pace would be slower and more detail oriented.

**STAT 474/574 Biostatistics and Logistic Regression**: 100% of the students rated the overall teaching to be effective and highly effective. 100% rated "comfortable" in approaching me. Representative student comments include: "She's so nice! I really struggled with a homework and she wrote the kindest feedback. I actually thought about framing it because it made me feel so much better about struggling."; "I would teach the class with your own power points. Your notes were great, I liked them much more than his."; "if we can get homework solutions that would be great." Teaching in Spring 2019, I mostly wrote down corrections on students' papers. In response to students' comments though, I will develop more of my notes and post answers to homework problems.

## 6 Interaction Between Scholarship and Teaching

One of my primary research areas involves Bayesian survival analysis. I employ both Bayesian methods and survival modeling to develop new methodologies for complex time-to-event data. My experience in these fields helps me to teach the two courses on Bayesian Statistics and Survival Analysis. My research also involves advanced statistical computing. My experience in programming and statistical algorithms prepares me to teach Statistical Computing. I use my expert knowledge to enhance my teaching while at the same time teaching motivates me to keep a broader perspective on these fields. I also find great joy in teaching these courses as I have relevant experience to share with the students.

Another area of my research regards spatiotemporal data modeling. I have worked on large environmental and epidemiological time-to-event data, which involves subject-specific geographic information. This research prepared me to teach the course Spatial Statistics and Its Biostatistics Application. Since large epidemiological and environmental data are also often collected at multiple time points, there is a need for understanding techniques that can analyze longitudinal or other time series data. Teaching of Introduction to Time Series Analysis increases my knowledge on temporal modeling.

Lastly, my multidisciplinary collaborations with biostatisticians and toxicologists have recently sparked my interest in causal inference and mediation analysis. I learned that causal reasoning plays such an important role in interpretations for many statistical models, for example, multivariate regression and mixed modeling. I am looking forward to developing and teaching a course on causal inference and mediation analysis.