BSTA 511 Biostatistics in Practice (Fall 2024)

Description: BSTA 511 focuses on rigorous scientific thinking in the practice of biostatistics, both in the application of existing methods to biomedical problems and development of new methodologies. Part 1 of the course covers topics fundamental to an understanding of the role of biostatistics in medical research including study design, ethics, reproducibility, exploratory data analysis and critiquing the literature. With these basic concepts in hand, Part 2 moves to a discussion of more advanced topics under study by the Biostatistics faculty, for example, research frontiers in statistical genomics, predictive modeling, high-dimensional and functional data analysis, big data, health policy and causal inference.

Objectives:

- Provide a foundation for key concepts used in the practice of biostatistics
- Introduce motivation and development of new methodologies in biostatistics
- Practice critical thinking of applications and methodologies
- Practice communication skills
- Practice thoughtful and constructive criticism of others' work

Evaluation:

Class Participation: (50%)

Consistent class participation is expected for each student. Participation points will be evenly distributed across all lectures and will be determined in advance of the class by the instructor for that day. Examples of activities might include attending class, completing a quiz, submitting an assignment, or participating in a CANVAS discussion board. Students are expected to attend all lectures.

Project 1: (25% of the grade)

Students will be assigned to groups. Each group will consider a case study highlighting either a novel application of biostatistics or some controversy in the use of biostatistics for a particular application. Case studies will be provided by the instructor or students may choose a study of their own interest. The initial case study provided by the instructor will include one or more published papers. Students will read the papers to determine the scientific question of interest and the study design, assess the success of the study/study publication for answering the question of interest and think about next steps. This process will often entail further reading of the peer-reviewed literature. Critiques might incorporate topics covered by instructors in the first ½ of the semester e.g. was the study design appropriate, did the figures/tables effectively and validly convey the study results, are there better ways of presenting the data, are there concerns about reproducibility or ethics. Optionally, students may describe a novel statistical method used in the analysis or

design and describe the advantages/disadvantages of the method. Students will be evaluated on the quality of a classroom presentation, a brief writeup of their findings and constructive peer-review of a fellow students' presentation.

Groups: Groups are pre-assigned based on random pairings through CANVAS. You may change your groups as long as everyone agrees to do so.

Project 2: (25% of the grade) Students will carry out a literature review of a novel statistical method of interest to them, and/or carry out a data analysis comparing the novel and more traditional methods. Students are encouraged to seek guidance on possible topics from any of the instructors or indeed the Biostatistics faculty. Students will be evaluated on the basis of a classroom presentation and a short writeup of their findings. The presentation/writeup should include a description of the scientific question of interest, the motivation for the new method (why didn't the original method do the job effectively?), and a summary of advantages/disadvantages of the new method. Students will be evaluated on the quality of their classroom presentation, a brief writeup of their findings and a constructive peer-review of a fellow student's presentation.

Late Policy: Assignments/quizzes are generally due 1 week after the lecture. Individual instructors may have different expectations, for example some quizzes may be due before the lecture. There are no points given for a late submission. The class participation points will be calculated by dropping the lowest grade.

Student Accomodation for Disabilities: A student in need of accommodations must contact the Student Disabilities Services (SDS) through the Weingarten Learning Center. After a formal evaluation through SDS, reasonable accommodations will be determined.

Month	Week	Date	Topic	Instructor
August				
	1	27 (T)	Syllabus: Introduction (Big Data Conference First Project Description)	Mary Putt, ScD
		29 (Th)	Responsible Use of Data (ENAR Webinar)	Virtual (Sarah Ratcliffe) University of Virginia
September				
	2	3(T)	Reproducible Research (Markdown, SAP's, Github)	Jesse Hsu, PhD
		5(Th)	Study Design I (Clin Trials)	Rui Feng, PhD
	3	10(T)	Study Design II (Observational Studies)	Dane Isenberg (BS, MS)/ Mary Putt, ScD
		12(Th)	Survey Sampling	Dawei Xi, PhD
	4	17(T)	Conference: Big Data/Causal Inference in Biomedical Research Penn Big Data Conference	Optional Registration ($50 per student includes food) *Tuesday*: Attend at least 1 session from 1:00-2:30 PM *Thursday:* Hongzhe Lee, PhD facilitates discussion
		19 (Th)		
	5	24(T)	Exploratory Data Analysis: Visualization	Mary Putt, ScD
		26(Th)	Biostatistics in Drug Development I (Government Perspectives)	Susan Ellenberg, PhD
October				
	6	1(T)	Spatial Transcriptomics	Mingyao Li, PhD
		3(Th)	Fall Break No Class	
	7	8(T)	Biostatistics in Drug Development II (Industry Perspectives)	Devan Mehrotra, PhD Merck & Co, Adjunct Professor of Biostatistics
		10(Th)	Project 1 Preparation	Students/MPutt
	8	15(T)	Project 1Presentation	Students/MPutt
		17(Th)	Project 1 Presentation	Students/MPutt
	9	22(T)	Biased Sampling	Jinbo Chen, PhD
		24(Th)	Microbiome Data Science	Hongzhe Li , PhD

	10	29 (Th)	Causal Inference	Alisa Stephens,PhD
		31(Th)	Smart Trials	Kristin Linn, PhD
November				
	Week	**Date**	**Topic**	**Instructor**
	11	5(T)	Class Cancelled	US Federal Election: No assignments per PSOM
		7(Th)	Statistical Measures of Agreement	Jarcy Zee, PhD
	12	12(T)	Problems in Survival Analysis	Doug Schaubel, PhD
		14(Th)	Imaging	Taki Shinohara, PhD
	13	19(T)	Functional Data Analysis	Jeff Morris, PhD
		21 (Th)	Predictive Modeling	Jing Huang, PhD
	14	26(T)	Project preparation	Students/MPutt
		28(Th)	Thanksgiving	
December				
	15	3 (T)	Student Project 2	Students/MPutt
		5 (Th)	Student Project 2	Students/MPutt