BIOCB7700 Topics in Statistical Genetics

Fall 2024

Meeting time(s) and location(s): R 1:25-2:15pm, room Weill Hall 224

Instructors:

Shaila Musharoff sam442@cornell.edu

Teaching Assistants:

None

Credit Hours and Credit Options: 1 credit hour

- The course will have one 50 minute meeting each week consisting of group discussions among course participants and the instructor.
- Students will learn about recent advancements in statistical genetics including trait prediction, polygenic scores, genome-wide association studies, heritability estimation, and methods for admixed populations.
- Students will become comfortable discussing and evaluating statistical genetic methods and critiquing recent papers.
- Students will be encouraged to consider and discuss application of recently-developed methods to their own research domains and problems of interest.
- At the end of the course, students will be expected to be familiar with broad classes of statistical genetic methods, terminology and concepts related to these methods, and to have developed fluency in discussing methods and their applications to biological problems.

Prerequisites: This course has no prerequisites

Bibliographic and Other Course Materials: Students in the course and the instructor will select weekly readings.

Course Description

Graduate seminar on methods in statistical genetics, with an emphasis on recent developments for admixed populations. Students will read and discuss recent literature in this area and, through group discussions, develop strategies for applying methods within their own research domains. Participation in discussion and presentation of at least one paper required for course credit.

Student Learning Outcomes/Course Objectives

As a result of participating in this course, students should be able to:

(1) critically read a statistical genetics paper,

(2) assess the strengths and weaknesses of a scientific paper

(3) determine whether a paper's conclusions follow from the presented analyses
(4) describe the current state of statistical genetics research

Expectations and Resources for Student Success

Successful students will come prepared for class, be attentive and participate in class discussions, and are expected to have critically read reading assignments before each meeting. Each student will be required to present results of at least one reading and lead the discussion of that reading.

Inclusivity Statement: The instructor is a member of the department of Computational Biology, and the syllabus will point to the DEI statement on that department's web page, which goes into detail outlining our commitment to Diversity, Equity and Inclusion.

Course Support and Supplemental Instruction: The instructor will be available to discuss material with students outside class by appointment. Students are also directed to campus opportunities to seek help, such as the Learning Strategies Center and the Knight Writing Institute.

Mental Health and Stress Management Resources

> If you are feeling overwhelmed, or unable to even get started on an assignment, please reach out to the instructor or your academic advisor. If the problem is of a more personal nature, we can try to help or we can put you in touch with someone who can help. Cornell has trained counselors available to listen and help: Empathy, Assistance, and Referral Service (213 Willard Straight Hall, 607-255-3277), Cornell Health's Counseling and Psychological Services (CAPS, 607-255-5155), and Let's Talk.
>
> Cornell also offers more comprehensive support for our campus community. Please go to mentalhealth.cornell.edu to learn more.

Class Participation Expectations: Students are expected to attend all course meetings. Students are expected to participate in group discussions during course meetings and to demonstrate that they have carefully read and sought to understand reading material. Each student will be required to participate in discussions and to present results of a minimum of one reading in order to receive credit.

Course Management and Policies

Academic Integrity:

> Each student in this course is expected to abide by the Cornell University Code of Academic Integrity.

Accommodations for Students with Disabilities: Students with Disabilities: Your access in this course is important. Please give the instructor your Student Disability Services (SDS) accommodation letter early in the semester so that we have adequate time to arrange your approved academic accommodations. If you need an immediate accommodation for equal access, please speak with the instructor after class or send an email message to the instructor and/or SDS at sds_cu@cornell.edu. If the need arises for additional accommodations during the semester, please contact SDS. Student Disability Services is located at Cornell Health Level 5, 110 Ho Plaza, 607-254-4545, sds.cornell.edu.

Attendance and Absences: Students are expected to provide a reason for each absence, and up to three class meetings missed will be tolerated without penalty. Beyond this, only cases of serious illness will be accepted.

Weekly assignments: Students will have weekly reading assignments. Students are expected to have critically read reading material prior to each class and to be prepared to discuss material in group discussions. Students assigned to lead discussion in a given week should be prepared to present results of the paper assigned and to lead discussion of that paper.

Course Grading

To receive a Satisfactory grade, students are expected to attend class as described in *Attendance and Absences* above, participate in discussion of reading material during each class, and to present results and lead discussion of a minimum of one reading during the course of the semester.

Weekly Topic Schedule

Week, date	Topic
1, Aug 29	Introduction to statistical genetics
2, Sept 5	Complex trait modeling
3, Sept 12	Genome-wide association studies (GWAS)
4, Sept 19	Population structure (PCA, UMAP)
5, Sept 26	Ethics of genetics and race/ethnicity
6, Oct 3	Polygenic scores
7, Oct 10	Portability issues with polygenic scores
8, Oct 17	Leveraging admixture in statistical genetics
9, Oct 24	Estimating relatedness
10, Oct 31	Heritability estimation
Nov 7	**ASHG Conference - No class**
11, Nov 14	Incorporating environmental heterogeneity
12, Nov 21	Novel approaches in statistical genetics
Nov 28	**Thanksgiving break – No class**
13, Dec 5	Final discussion