Statistical Genomics (22S:295 and 171:290)

Place: 60 Schaeffer Hall
Time: Tuesday, 9:30-10:20am

Instructor: Jian Huang
Department of Statistics and Actuarial Science
and Department of Biostatistics
Email: jian-huang@uiowa.edu
Phone: 335-0823
Office: 221 SH

Office hours: Tuesday 10:30-11:30am

Statistics and Actuarial Science DEO: Dr. Dale Zimmerman, 241 SH, Phone: 335-0712.

Biostatistics Head: Dr. Kathryn Chaloner, C22N-1 GH, Phone: 384-5029

Prerequisites: This course is suitable for upper level undergraduates or graduate
students with an interest in statistics and its application to problems in genomics.
Students should have a basic understanding of biostatistics or have taken 22S:101, or
171:161 and 22S:153 and 22S: 154 or consent of instructor.

Attendance: Attendance at lectures and participation in discussions are expected.
Failure to attend class regularly will affect your grade.

Course web site: Students are responsible for consulting the ICON course web site
regularly. In particular, materials needed for class assignments, all changes to the
syllabus and reading lists, and all announcements will be provided electronically and will
not otherwise be available.

Lecture notes: Lecture notes will be made available on the ICON course website.

Suggested reference books:

Prentice Hall.


Reading materials: I will suggest a list of reading materials for each topic to be covered
in the course. They will be made available on the ICON course website.
Grading: Pass or fail grade will be used.

Course Description

This course focuses on the statistical methods for analyzing genomic data, which include array-based gene expression data, single nucleotide polymorphism (SNP) data and high-throughput sequence data. Basic concepts and methods will be presented in connection with analysis of published genomic data. The objective of the course is for students to have a good understanding of the statistical concepts and methodologies as well as computational algorithms for analyzing large genomic datasets. Students will gain personal experience and expertise in the statistical analysis of large datasets by participating team based analytical projects. Students will also gain exposure to the recent methodological developments in this active research area.

Topics to be covered:

1. Biological background: genes, DNA, RNA, Protein and phenotypes; high-throughput technologies.
2. Exploratory analysis of large genomic data, cluster analysis.
3. Statistical design issues, data preprocessing and normalization.
4. Two- and k-sample comparisons, adjusting for multiple comparisons, false discovery rate and false missingness rate.
5. Disease classification using gene expression data.
6. Genome wide association studies of qualitative and quantitative traits, linkage, linkage disequilibrium, population stratification.
7. Modern regularization methods for variable selection with emphasis on their application to high-dimensional genomic data.
8. Re-sampling and permutation based methods for honest evaluation of statistical significance of findings from large genomic data.
9. Methods for the analysis of copy number variation, ChIP-chip and ChIP-seq data.

Additional UI and CLAS Policy and Procedures

Administrative Home  The College of Liberal Arts and Sciences and The College of Public Health are the administrative homes of this course and govern matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges have different policies.

Students registered for the 22S:295 should address questions to 120 Schaeffer Hall or see the CLAS Student Academic Handbook (www.clas.uiowa.edu/students/academic_handbook/index.shtm.)
For students registered for 171:290 class policies on matters such as requirements, grading, and sanctions for academic dishonesty are governed by the College of Public Health and students should address any concerns to Terry Kirk in 22C GH, or send email to terry-kirk@uiowa.edu. Students wishing to add or drop this course after the official deadline must receive the approval of the Associate Dean for Academic and Student Affairs in the College of Public Health. Details of the University policy of cross enrollments may be found at: [http://www.uiowa.edu/~provost/deos/crossenroll.doc](http://www.uiowa.edu/~provost/deos/crossenroll.doc)

**Electronic Communication** University policy specifies that students are responsible for all official correspondences sent to their standard University of Iowa e-mail address (@uiowa.edu). Students should check this account frequently. (Operations Manual, III.15.2. Scroll down to k.11.)

**Accommodations for Disabilities** A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See [www.uiowa.edu/~sds](http://www.uiowa.edu/~sds) for more information.

**Academic Fraud** Plagiarism and any other activities when students present work that is not their own are academic fraud. Academic fraud is a serious matter and is reported to the departmental DEO and to the Associate Dean for Undergraduate Programs and Curriculum. Instructors and DEOs decide on appropriate consequences at the departmental level while the Associate Dean enforces additional consequences at the collegiate level. See the CLAS Student Academic Handbook.

**CLAS Final Examination Policies** Final exams may be offered only during finals week. No exams of any kind are allowed during the last week of classes. Students should not ask their instructor to reschedule a final exam since the College does not permit rescheduling of a final exam once the semester has begun. Questions should be addressed to the Associate Dean for Undergraduate Programs and Curriculum.

**Making a Suggestion or a Complaint** Students with a suggestion or complaint should first visit the instructor, then the course supervisor, and then the departmental DEO. Complaints must be made within six months of the incident. See the CLAS Student Academic Handbook.

**Understanding Sexual Harassment** Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment at [www.uiowa.edu/$\sim$eod/policies/sexual-harassment-guide/index.html](http://www.uiowa.edu/~eod/policies/sexual-harassment-guide/index.html) for assistance, definitions, and the full University policy.

**Reacting Safely to Severe Weather** In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will
continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Public Safety website [www.uiowa.edu/~pubsfty/intlinks.htm](http://www.uiowa.edu/~pubsfty/intlinks.htm).

**Student Classroom Behavior** The ability to learn is lessened when students engage in inappropriate classroom behavior, distracting others; such behaviors are a violation of the Code of Student Life. When disruptive activity occurs, a University instructor has the authority to determine classroom seating patterns and to request that a student exit the classroom, laboratory, or other area used for instruction immediately for the remainder of the period. One-day suspensions are reported to appropriate departmental, collegiate, and Student Services personnel (Office of the Vice President for Student Services and Dean of Students).