

ECE 608 Quantitative Methods in Biomedical Engineering

Spring 2024

Instructor: Prof. Liang-Liang Xie (EIT-4173, ext.33697, llxie@uwaterloo.ca)

Textbook:

Holmes and Huber, *Modern Statistics for Modern Biology*, Cambridge University Press, 2019.

Free online: <https://www.huber.embl.de/msmb/index.html>

or <http://web.stanford.edu/class/bios221/book/index.html>

Grading: Homework assignments (40%) + Final exam (60%)

Audit option: Homework assignments only

Homework Assignments

Homework assignments will be posted on LEARN.

Calendar Description

This biomedical engineering core course focuses on topics related to the use of quantitative tools in biomedical engineering research studies. It will teach students how to conduct statistical analysis of biomedical data, design biomedical experiments that can offer statistical insight, and apply computational methods to solve problems in biomedical engineering. Educational emphasis will be placed on developing students' core competence in biostatistics and biomedical computing, so as to prepare them to pursue biomedical engineering investigations that are backed by quantitative reasoning and numerical insights.

R Language and Environment

The R language and environment for statistical computing is available from the R Foundation via links at the following url: <https://www.r-project.org/>

RStudio

A simple integrated development environment called RStudio Desktop is available at the following url: <https://www.rstudio.com/products/RStudio/>

Main Contents:

1. Generative Models for Discrete Data
2. Statistical Modeling
3. High Quality Graphics in R
4. Mixture Models
5. Clustering
6. Testing
7. Multivariate Analysis
8. High Throughput Count Data
9. Multivariate Methods for Heterogeneous Data
10. Networks and Trees
11. Image Data
12. Supervised Learning
13. Design of High Throughput Experiments and Their Analyses

Academic integrity, grievance, discipline, appeals and note for students with disabilities: see www.uwaterloo.ca/accountability/documents/courseoutlinestmts.pdf. The text for this web site is listed below.

Academic integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

[Check www.uwaterloo.ca/academicintegrity/ for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt please be certain to contact the departments administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity [check www.uwaterloo.ca/academicintegrity/] to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about rules for group work/collaboration should seek guidance from the course

instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties check Guidelines for the Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

Appeals: A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals)
www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.

Note for students with disabilities: The Office for persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.