BIOE 210: Linear Algebra for Biomedical Data Science

Spring 2020

Tu/Th 9:30-10:50am in 1306 Everitt Lab
http://bioe210.github.io

Course Instructor

Paul A. Jensen
pjens@illinois.edu
2254 Everitt Lab

Office Hours: Tuesday, 3:00-4:00pm in 2254 Everitt Lab

Course Graders

Nicole Johnson (nicolej2@illinois.edu)
Brendan Brasch (bbrasch2@illinois.edu)

Matlab Technical Help Sessions

Monday, 2:00-3:00pm in 3213 Everitt Lab
Tuesday, 8:00-9:00pm in 3213 Everitt Lab

Description

Using analytical and computational tools from linear algebra, we will

- Solve large systems of linear equations, systems of linear ODEs, and linear PDEs.

- Analyze large, multivariable datasets to quantify relationships between variables.

- Decompose complex datasets into simpler representations.

- Introduce and solve common problems in classification, image processing, and machine learning.

- Develop a geometric understanding of high-dimensional spaces.

Topics

- Vector spaces and field algebra

- Linear systems, solvability, and rank

- Basis vectors, eigenvectors, and network matrices

- Vector and matrix decompositions

- Singular values and principal components

Applications

- Least squares, regularized, and partial least squares regression

- Classification

- Linear and quadratic programming

- Examples in bioengineering, medicine, and biology

Textbook

Linear Algebra & Data Science by P.A. Jensen
Available for free on the course website.

Matlab is required for the course and can be accessed via the EWS machines (https://it.engineering.illinois.edu/ews/lab-information/remote-connections).

Assessments

Three in-class exams (2/20, 4/2, 5/5). Any non-electronic materials are allowed during the exam, including the course textbook and notes. Exams are during the lecture period.

Six homework sets. Homeworks are due by the assigned date and time (usually 9:00am Wednesday). Homework assignments will typically include both analytical problems plus Matlab-based exercises. Written answers to the analytical problems and Matlab solutions (plus code) must be uploaded using Gradescope (additional details regarding homework submission will be provided).

Late Work

Any work submitted after the deadline will be penalized. The penalty is 10% if submitted within 24 hours of the deadline and 50% within 48 hours of the deadline. Homework submitted more than 48 hours after the deadline will not be scored. The submission time of an assignment is the time of the latest submission. (If half of the assignment is submitted before the deadline and the other half late, the entire assignment will be scored as late.)

Grading

Homework 30% ($6 \times 5\%$ each)
Exams 70% ($3 \times 23\ 1/3\%$ each)

Letter Grades:

A+	>97%	B+	>87%	C+	>77%
A	>93%	B	>83%	C	>73%
A-	>89.5%	B-	>79.5%	C-	>67%

Grades will be posted on Gradescope.