2023-2024 MCB Area of Interest Course Information

Computational Biology

Please check the University of Washington Time Schedule for the most updated course information.

FOUNDATIONAL COURSES

Foundational Course One:

Course Number: GENOME 541
Course Title: Introduction to Computational Molecular Biology: Molecular Evolution
Instructor (s): Bill Noble, et al.
Location: UW
Credits: 4
Quarter, Weeks, and Frequency course is offered: Spring, every year
Attributes: graded, lecture-based
Sub Area (if applicable):
Synopsis: Computational methods for studying molecular evolution. Students must be able to write computer programs in Python/R for data analysis. **Prerequisites**: Prior coursework in biology and probability.

Foundational Course Two:

Course Number: GENOME 559
Course Title: Introduction to Statistical and Computational Genomics
Instructor(s): William Stafford Noble, Mary Kuhner, Larry Ruzzo
Location (e.g., UW, FH, SLU): UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Winter, every year
Attributes (e.g., graded, lecture-based): graded, lecture-based, hands-on computational work
Sub Area (if applicable):
Synopsis: Emphasis on basic probability and statistics, and in introduction to computer programming. This course is intended to introduce students with non-computer science background to the major concepts of programming and statistics. After taking this course, students will be able to describe and perform basic analysis tasks relating to biological sequence analysis, phylogenetics, pedigree analysis, genetic association studies, population genetics and microarray analysis. Students will be able to demonstrate an understanding of fundamental statistical concepts, such as p-values, t-tests, chi-squared tests and multiple testing correction. Finally, students will be able to write computer programs to perform statistical and bioinformatics analysis.

Foundational Course Three:

Course Number: GENOME 560
Course Title: Introduction to Statistical Genomics
Instructor (s): Devin Schweppe, Nasa Sinnott-Armstrong
Location: UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-10, every year
Attributes: graded, lecture-based
Sub Area (if applicable):

Synopsis: An introduction to fundamental concepts necessary for the analysis of genetic and genomic data including, basic elements of probability theory, parameter estimation, and hypothesis testing.

Foundational Course Four:

Course Number: MCB 536
Course Title: Tools for Computational Biology
Instructor (s): Phil Bradley, Melody Campbell, Elizabeth Humphries, Maggie Russell, Manu Setty, Rasi Subramaniam
Location (e.g., UW, FH, SLU): FH
Credits: 3
Quarter, Weeks, and Frequency course is offered: Autumn, every year
Attributes (e.g., graded, lecture-based): graded, lecture-based, hands-on computational work
Sub Area (if applicable):
Synopsis: Introduction to established best practices in computational biology. Learn to organize unstructured data into standard formats, transform data for statistical analyses, and visualize the transformed data. Learn workflows for reproducible research such as version control, project organization, and code documentation. Gain basic experience with Linux command line tools and the Python and R programming languages. Classes will involve hands-on learning through coding exercises, collaborative problem solving, and extensive use of online learning resources. This course is best suited for students with minimal prior experience in programming or computational biology but interested in learning the best practices.

ELECTIVE COURSES

Elective Course One:

Course Number: CSE 512
Course Title: Data Visualization
Instructor (s): Leilani Battle (2022), Jeffrey Heer (2023)
Location: UW
Credits: 4
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-10, every year
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Techniques and algorithms for creating effective visualizations based on principles from graphic design, visual art, perceptual psychology and cognitive science. Topics: data and image models, visual encoding, graphical perception, color, animation, interaction techniques, graph layout, automated design. Lectures, reading and project.

Elective Course Two:

Course Number: CSE 527
Course Title: Computational Biology
Instructor (s): Su-In Lee
Location: UW
Credits: 4
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10, every year
Attributes: Lecture, graded
Sub Area (if applicable):

Synopsis: Introduces computational methods based on artificial intelligence (AI) and machine learning (ML) techniques for understanding biological systems and improving health care. AI/ML techniques such as explainable and interpretable ML, deep neural network learning, probabilistic graphical models, causal inference, and deep learning techniques are covered. Problem areas such as genetics, epigenomics, expression data analysis, proteomics, and electric health record data analysis are covered.

Elective Course Three:

Course Number: CSE 583
Course Title: Software Development for Data Scientists
Instructor (s): David Beck
Location: UW
Credits: 4
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10, every year
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Provides students outside of CSE with a practical knowledge of software development that is sufficient to do graduate work in their discipline. Modules include Python basics, software version control, software design, and using Python for machine learning and visualization.

Elective Course Four:

Course Number: GENOME 540
Course Title: Introduction to Computational Molecular Biology: Genome and Protein Sequence Analysis
Instructor (s): Phil Green
Location: UW
Credits: 4
Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-10, every year
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Algorithmic and probabilistic methods for analysis of DNA and protein analysis. Students must be able to write computer programs for data analysis. Prior coursework in biology and probability is highly desirable.

Elective Course Five:

Course Number: GENOME 569
Course Title: Bioinformatics Workflows for High-Throughput Sequencing Experiments
Instructor (s): Cole Trapnell
Location: UW
Credits: 1.5
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-5, every year
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Programming skills and software tools for building automated bioinformatics pipelines and computational biology analyses. Emphasis on UNIX tools and R libraries for distilling raw sequencing data into interpretable results. For students familiar with UNIX and with some programming experience in Python, R, or C/C++.

Elective Course Six:

Course Number: STAT 509
Course Title: Econometrics I: Introduction to Mathematical Statistics
Instructor (s): Thomas Richardson
Location): UW
Credits: 4
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10, every year
Attributes: Graded, lecture
Sub Area (if applicable):
Synopsis: Examines methods, tools, and theory of mathematical statistics. Covers, probability densities, transformations, moment generating functions, conditional expectation. Bayesian analysis with conjugate priors, hypothesis tests, the Neyman-Pearson Lemma. Likelihood ratio tests, confidence intervals, maximum likelihood estimation, Central limit theorem, Slutsky Theorems, and the delta-method.

INFORMATICS COURSES

additional course fee required for Informatics courses

The following courses ae offered through the Information School. Some courses may be offered irregularly. If a course looks interesting to you, check with the department to see when it will be offered next.

Informatics Course One:

Course Number: IMT 511
Course Title: Introduction to Programming for Information and Data Science
Instructor (s): Alex Davis
Location: UW
Credits: 4
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Introduces fundamentals of computer programming as used for data science. Covers foundational skills necessary for writing stand-alone computer scripts, including programming syntax, data structuring, and procedural definition (functions). Includes programming tools and environments (e.g., command-line). Emphasizes skills in language syntax, debugging, algorithmic thinking, and data comprehension. Assumes no previous programming background.

Informatics Course Two:

Course Number: IMT 561
Course Title: Visualization Design
Instructor (s):
Location: UW
Credits: 4
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Students develop a human-centered visualization design practice using real-world data. This process includes applying graphic principles of visual encoding to data; conducting design explorations using sketches and prototyping; and gathering user feedback to assess

output. Design workshops provide opportunities for hands-on engagement with concepts and technical skills.

Informatics Course Three:

Course Number: IMT 562
Course Title: Interactive Information Visualization
Instructor (s):
Location: UW
Credits: 4
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Introduces techniques for visualizing, analyzing, and supporting interaction with structured data)numbers, text, graphs). Provides experience creating interactive visualizations for the web. Exposes students to cognitive science, statistics, and perceptual psychology principles. Students design and evaluate visualizations using perceptual and statistical accuracy.

Informatics Course Four:

Course Number: IMT 572
Course Title: Introduction to Data Science
Instructor (s):
Location: UW
Credits: 4
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Introduces a broad, non-technical overview of key concepts, skills, and technologies used in "data science". Provides a high-level introduction to common data science pipelines, such as experimental design, data collection and storage, basic analytics, machine learning, and data visualization, focusing on analyzing in real-world datasets using industry standard statistical packages.

Informatics Course Five:

Course Number: IMT 573
Course Title: Data Science I: Theoretical Foundations
Instructor (s): Saba Kawas
Location: UW
Credits: 4
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Introduces technically focused theoretical foundations of "Data Science." Provides an overview of key concepts, focusing on foundational concepts such as exploratory data analysis and statistical inference. Assignments are data-intensive and require significant programming and statistical analysis. Students are expected to have college-level statistics and programming experience (R and python preferred).
Prerequisite(s): either QMETH 201, IMT 570, or equivalent college coursework; and either CSE 121, CSE 122, CSE 123, CSE 142, or equivalent college coursework.

Informatics Course Six:

Course Number: IMT 574
Course Title: Data Science II: Machine Learning

Instructor (s): Kevin West
Location: UW
Credits: 4
Attributes: Lecture, graded
Sub Area (if applicable):
Synopsis: Provides theoretical and practical introduction to modern techniques for the analysis of large-scale, heterogeneous data. Covers key concepts in inferential statistics, supervised and unsupervised machine learning, and network analysis. Students learn functional, procedural, and statistical programming techniques for working with real-world data.
Prerequisite(s): IMT 573.