Fall 9-1-2015

CSCI 451.01: Computational Biology

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CSCI 451: Computational Biology

Course Information

Fall 2015
CSCI 451 section 1 (CRN: 73300)
T/Th 12:40PM – 2:00PM
Social Science 362
URL: See Moodle

Instructor Information

Instructor: Travis Wheeler
Office: Social Science 412
E-mail: travis.wheeler@umontana.edu
Phone: 406-243-6219
Office Hours: Wed 1:30-3:30, Thurs 2:00-4:00, or by appointment

TA information

TA: Rutger Evans
Office: Social Science 415
Office Hours: Mon 11:00-1:00

Overview

This class will introduce you to bioinformatics, exposing you to fundamental problems, algorithms, and tools in the field. The course will include a basic introduction to genomics, along with in-depth coverage of a multitude of algorithms and methods relevant to modern computational genomics, including:

- Biological sequence alignment
- Sequence database homology search
- Phylogeny inference
- Gene prediction

Course Prerequisites

I will assume that you are familiar with basic computer programming. As such, I require that you have completed at least one of: CSCI 136 (Fundamentals of Computer Science II), CSCI 250 (Computer Modeling for Science Majors), or BIOB 491 (Programming for Genomics), or an equivalent (at my discretion). If your only programing experience is a single one of these classes, you'll need to push to keep up with the pace – more experience will be better. If you're not sure how this applies to you, feel free to come and discuss it with me.

Resources

Unix: http://www.ee.surrey.ac.uk/Teaching/Unix/

Perl: http://www.ebb.org/PickingUpPerl/pickingUpPerl.pdf

Python:
http://learnpythonthehardway.org/book/, https://www.coursera.org/course/programming1

Required textbook

DEKM: "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids". Richard Durbin, Sean Eddy, Anders Krogh, and Graeme Mitchison (ISBN: 0-521-62971-3)

JP: "An Introduction to Bioinformatics Algorithms". Neil C. Jones and Pavel A. Pevzner (ISBN: 0-262-10106-8)

Approximate Schedule

Week	Content	Reading
Aug 31 – Sept 4	Intro	JP 1,3 (by Th)
Sept 7 – Sept 11	Algorithm overview; Prob. Theory overview	JP 2 (by T) DEKM 1 (by Th)
Sept 14 – Sept 18	Pairwise sequence alignment	DEKM 2
Sept 21 – Sept 25	Homology search	TBD
Sept 28 – Oct 2	Text indexes, suffix trees, read mapping	JP 9
Oct 5 – Oct 9	Hidden Markov models	DEKM 3 (part)
Oct 12 – Oct 16	HMMs (cont), exam	DEKM 3 (remainder)
Oct 19 – Oct 23	Profile HMMs, project	DEKM 5 (part)
Oct 26 – Oct 30	Profile HMMs (cont), project	DEKM 5 (remainder)
Nov 2 – Nov 6	Multiple sequence alignment	TBD
Nov 9 – Nov 13	Clustering, phylogeny	JP 10
Nov 16 – Nov 20	Phylogeny, project	TBD
Nov 23 – Nov 25	Exam, Thanksgiving	
Nov 30 – Dec 4	Space efficient DP, Gene prediction	JP 7, TBD
Dec 7 – Dec 11	Project	

(TBD = to be determined)

Project

You are welcome to propose any topic that you find interesting. I will help establish appropriate scope. I am happy to supply suggestions for topics; this will be best achieved in a visit to my office.

Undergraduate Students

You will identify a topic in the field of bioinformatics or computational biology, and write a short paper describing that topic (background, application, existing methods). This is akin to the Introduction section of a scholarly article.

Graduate students

You will develop a bioinformatics method or perform research with actual biological data (or both), with a significant programming component. The project will be performed in four major

parts: (1) a proposal, (2) a preliminary paper (in sections), (3) the final paper, and (4) a conference-style presentation of your work. You may work individually or in groups.

Grading (tentative)

Undergraduates:

- Exams / Quizzes: 35%
- Class Participation: 15%
- Homework Assignments: 35%
- Project: 15%

Graduates:

- Exams / Quizzes: 25%
- Class Participation: 15%
- Homework Assignments: 25%
- Project: 35%

Late policy:

Late homework and assignments will be penalized 10% for each 24 hours that the assignment/homework is late, up to a maximum penalty of 50%. I view this as a very lenient policy, designed to allow you to get partial credit even assignments are late

Final Exam:

There will be no final exam.

Collaboration

Discussion of problems and programs is OK if you acknowledge and describe the discussion when you turn in the assignment. You must write your own programs and assignments, and you must understand what you turn in. I reserve the right to ask any student to explain what he/she has done, and to adjust the grade assigned on the basis of this explanation.

Attendance

Attendance is not recorded, so there are no direct rewards or penalties for attending or not attending, outside of class participation grades. That said, students are expected to understand material presented in class, and be aware of, complete, and submit all assignments on time. Assignments will be made regularly and are due regularly, so students who attend regularly will see some advantage, and students who fail to attend regularly will see some disadvantage. Students who miss class because of “unavoidable circumstance” should contact me ASAP afterwards to seek “relief”. Students who know in advance they will miss a class due to prior commitment, unavoidable circumstance, religious observance, or other special circumstance should contact me prior to the class in question to seek relief. In accord with UM policy, students participating in an officially sanctioned, scheduled University extracurricular activity will be given appropriate relief. Dates for exams will be announced several days in advance. Attendance at exams is mandatory unless arrangements are made with the instructor in advance.

Additional Course Guidelines and Policies:

Incompletes and Late Drops

I will strictly follow University policy. In for me to consider an incomplete or late drop or change to audit status, you will have to submit documentation (such as a note from a doctor) to verify your reason for the incomplete or late drop. The acceptable reasons for a late drop are limited to: registration errors, accident or illness, family emergency, and change in employment schedule. See pages 20 and 21 of the catalog for the University policies.

Student Conduct Code

Disability Modifications (H3)

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call (406) 243-2243. I will work with you and Disability Services to provide an appropriate modification.

Policy on E-Device Use During Class.

Students are welcome to use laptops, tablets, or other e-devices to take notes, refer to materials, or whatever, as long as this use doesn't create noise or other potential distractions. Students are not welcome to have e-devices "sound off" during class (please set them on vibrate or equivalent) and students are not welcome to answer calls verbally or otherwise generate noise in class. If you know that you have an important call you might have to take during class, tell me ahead of time, sit near the exit, and when your phone vibrates wait until you are out in the hallway to answer.