CIS 745 / BMI 730 / IBGP 730: Biomedical Informatics I

Description

- Introduce students to the development of methods for carrying out detailed, realistic and predictive simulations of biological phenomena at many time and length scales.

Level and credits

- UG 3

Prerequisites

- Cptr/Inf 230 or equivalent; or permission of instructor

Quarters offered

- Au

General Information, Exclusion, Crosslistings

- Crosslisted with Biom Inf 730 and IBGP 730

Objectives

- Mastery of algorithms for pairwise and multiple sequence alignment
- Familiarity with heuristics for sequence alignment
- Familiarity with algorithmic approaches to protein structure classification and prediction
- Familiarity with current approaches to gene prediction and identification
- Familiarity with algorithms for phylogenetic analysis
- Familiarity with algorithms for genomic analysis

Textbook

- D. Mount, *Bioinformatics: Sequence and Genome Analysis*. 2001, Cold Spring Harbor Laboratory Press, NY.

Topics

Number of weeks	Topics
2	Introduction to the course; sequence, structure, and function; algorithms on sequence-alignment problems and definitions
2	Sequence alignment: dynamic programming algorithm, scoring and statistics; heuristic based algorithms; BLAST and PSI-BLAST; multiple sequence alignment
1	Protein 3D structure prediction: protein classification, structural motifs, homology-based modeling
1	Gene prediction algorithms, finding signals in DNA, transcriptome analysis
1	Algorithms for phylogenetics
2	Whole genome analysis: genome landscape, genome evolution, genome stability; comparative genomics
1	Future directions in biomedical informatics and computational biology; review and exams

Grading Plan

midterm	30%
final	30%
term paper	40%

The term paper is a review of the current state-of-the-art on a topic related to the course. Students are encouraged to select their own topic of interest. However, all students are required to discuss the topic with the course instructor for advice and approval. It is most important that the entire writing is based on original and peer-reviewed research articles. The final paper should include the following sections: 1) Title; 2) Abstract; 3) Statement of the Problem; 4) Motivation; 5) Related Work; 6) Overview of Current Approaches; 7) Methods; 8) Experimental Results; 9) Conclusion and Discussion; 10) Future Directions; 11) References. Students must write up their paper completely by themselves.

Relation to ABET Criterion 3 and CSE Program Objectives

Contributes significantly to the following aspects of ABET Criterion 3:
- a. an ability to apply knowledge of mathematics, science, and engineering
- e. an ability to identify, formulate, and solve engineering problems
- k. an ability to use techniques, skills, and modern engineering tools necessary for engineering practice

Contributes significantly to the following CSE Program Objectives:
- 1. To provide graduates with a thorough grounding in the key principles and practices of computing, and in the basic engineering, mathematical, and scientific principles that underpin them.

Prepared by:

Mario Lauria - February 7, 2003