CPSC 445   **Algorithms in Bioinformatics**   **Spring 2012**

Course Description

Bioinformatics involves the application of computational methods to answer or provide insight on questions in molecular biology. This course provides an introduction to the design and analysis of algorithms for bioinformatics applications.

Topics covered will include sequence alignment, phylogenetic tree reconstruction (parsimony and distance-based methods), prediction of RNA and protein structure, gene finding, and motif finding. Algorithmic techniques that will be covered include dynamic programming and heuristic search methods, as well as combinatorial algorithms for exploration of graphs and trees. Statistical models of molecular sequence and structure, such as hidden Markov models and stochastic context free grammars, and associated algorithms, will also be covered.

Text: Biological sequence analysis: Probabilistic models of proteins and nucleic acids, R. Durbin, S. Eddy, A. Krogh, and G. Mitchison. Cambridge University Press, 1998.

Web Page: http://www.cs.ubc.ca/~hoos/cpsc445/

The web page will point to lecture notes, homework assignments, additional literature and other useful information.

Prerequisites

CPSC 320 and six credits of BIOL beyond BIOL 111, or equivalent. Experience with design and analysis of algorithms is essential for this course. Related texts listed below, such as "Molecular Biology of the Cell", will be useful for those who need to catch up on biological background. The algorithms texts by Cormen et al. and Kleinberg and Tardos provide useful background on combinatorial algorithms, including graph algorithms and dynamic programming algorithms. The text by Hoos and Stützle is a more advanced text which provides very useful background on local search techniques.

Related Texts

- Alberts, Bruce et al. Molecular Biology of the Cell (4th edition) Garland Publishing, 2002,

- Baldi, Brunak. Bioinformatics - The Machine Learning Approach. MIT Press, 1998.

- Cormen, Thomas H., Leiserson, Charles, E., and Rivest, Ronald L. Introduction to Algorithms. The MIT Press 1992.

- Gusfield, Dan. Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology. Cambridge University Press, 1997.

- Hoos, Holger H. and Stützle, Thomas. Stochastic Local Search: Foundations and Applications. Morgan Kaufmann, 2005.

- Kleinberg, Jon and Tardos, Eva. Algorithm Design. Addison Wesley 2006.

Homework and Exams

A student's grade will be based on 5 or so homework assignments (accounting for approx. 45% of the final grade), in-class quizzes (accounting for approx. 20% of the grade) and a final exam (accounting for approximately 35% of the total grade). Discussing problems on the homeworks with your classmates is fine, but all writeups must be done on your own. Depending on final enrolment, homework assignments may or may not include a mini-project, and the final exam may be oral or written (this will be decided at least 4 weeks before the exam and announced in class and via the course web page).

Office Hours: Weekly office hours are posted on the course web page. Additional consultation time with Holger can be arranged by appointment.