BME 295/300 & CSE 298/300
Special Topics in BME/CSE: Computational Molecular Biology
Fall 2005

Course time/place: MWF 10-10:50am, YNG 233

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Office hours: MWF 11am-noon and by appointment

Course outline: This course will cover mathematical models and algorithms for some important computational problems in post-genomic molecular biology. Although biological background and motivation will be discussed as needed, the course will emphasize computational aspects such as probabilistic modeling and general algorithmic techniques over biological applications.

Tentative list of topics to be covered: introduction to molecular biology, statistical modeling of biological sequences, Markov chains and hidden Markov models, Bayesian networks, gene and DNA motif finding, genome rearrangements, molecular evolution and phylogenetic trees, genetic variation in populations, comparative genomics. The topics may change according to progress.

Textbooks: There is no required textbook for this course. Much of the covered material appears in the following books:

- R.C. Deonier, S. Tavare, M.S. Waterman, *Computational genome analysis: an introduction*, Springer Verlag, 2005.
- R. Durbin, S. Eddy, A. Krogh, G. Mitchison, *Biological sequence analysis: probabilistic models of protein and nucleic acids*, Cambridge University Press, 1998.
- P. Baldi and S. Brunak, *Bioinformatics: the machine learning approach*, MIT Press, 2001 (available online at http://cognet.mit.edu/library/books/view?isbn=026202506X).
- P.A. Pevzner, *Computational molecular biology: an algorithmic approach*, MIT Press, 2000 (available online at http://cognet.mit.edu/library/books/view?isbn=0262161974).

Prerequisites: Desired prerequisites for this course are introductory knowledge in computer science, biology, and statistics, and advanced undergraduate knowledge in at least one of them. However, some background information in these areas will be provided if needed via lectures and supplementary readings.

Grading: Grades will be assigned based on bi-weekly homework assignments (50%) and a final project (50%). Homework assignments will consist of theoretical problems reinforcing the material covered in lectures. The subject of the final project can be either a topic covered in the course or related topics approved by the instructor. The final project report should give a concise description of the biological problem, a summary of the literature on the subject, including descriptions of existing solution methods and open problems, and either a theoretical investigation of an open problem, or the practical implementation and empirical evaluation of an existing or new solution method. The final project can be done in teams of two students.

Academic honesty: You are expected to adhere to the highest standards of academic honesty. Unless otherwise specified, collaboration on the homework is not allowed. Use of published materials is allowed, but the sources should be explicitly stated in your solutions. Violations will be reviewed and sanctioned according to the University Policy on Academic Integrity.