

HES 795: Statistical Bioinformatics in Medicine (schedule #: 303GJ)

Provides an introduction to statistical concepts and techniques in bioinformatics and biomedical genomics. Discuss about state-of-art high throughput biotechnologies, such as gene expression array technologies, together with their applications in medicine and analysis techniques. Anticipates students' active participation in various discussions on the current topics in biotechnology and bioinformatics.

Fall 2005

Instructor: Jae K. Lee, Ph.D. (Instructor #0638; 434-982-1033, jaeklee@virginia.edu)

Time: 12:30 – 1:45 p.m. on Tuesday and Thursday

Credit: 3

Place: HES classroom A

Grade: class participation & homework (40%) and final project (60%)

Course Web site:

<http://www.healthsystem.virginia.edu/internet/hes/biostat/bioinformatics/teaching/>

Textbook: various papers and lecture notes

References:

- Statistical Methods in Bioinformatics, Ewens and Grant, 2001, Springer. (E)
- The elements of statistical learning: Data mining, inference, and prediction (2001). T. Hastie, R. Tibshirani, and J. Friedman. (H)
- Pattern recognition and neural networks (1996). B.D. Ripley. (R)
- Bioinformatics, the machine learning approach (1998). P. Baldi and S. Brunak. (B)
- Post-genome Informatics (1999). Minoru Kanehisa. (K)
- Markov chain Monte Carlo in practice (1996). W.R. Gilks, S. Richardson, and D.J. Spiegelhalter (G)
- Bayesian Data Analysis (1995). A. Gelman, J.B. Carlin, H.S. Stern, and D.B. Rubin. (GE)

Prerequisite: Introductory statistics or instructor's consent.

Outline

Fundamental Concepts in Statistical Bioinformatics

- Probability and Random Variable
- Statistical Assessment and Quality Control of High Throughput Data
- Statistical Testing for genome-wide data
- Statistical Modeling and Inference

Multidimensional Statistical Inference

- Clustering: unsupervised learning
- Classification: Supervised learning
- Multi-dimensional analysis and visualization

Advanced Statistical Inference

- Experimental designs
- Statistical Resampling
- Statistical Network Analysis

Other Topics and Presentations

- R and Bioconductor Packages
- Microarray gene expression technology and basic analysis
- Student presentations on the final projects