Bioinformatics 2

Introduction

Lecture 1

- Course Overview & Assessment
- Introduction to Bioinformatics
- Careers and PhD options

- Proteomics guest lecture

About me...

- Started in Biology (behaviour genetics)
- Got interested in databases (anatomy)
- Commercial and Academic Experience
- 'wet lab' and bioinformatics projects
- Office in FH, Lab in HRB

The class (2007)

- M.Sc. Classes:

- Quantitative Genetics and Genome Analysis (assignment 1 and term paper)

- Bioinformatics 2 (assignment 1 and exam)

What do I think you know?

- Variety of backgrounds and experience:
  - Biological Sciences
  - Computing Sciences
  - Mathematics, Statistics and Physics

Course Outcomes

- Know the core algorithms in bioinformatics
- Experience in using and/or implementing simple solutions
- Appreciate the current 'state of the art'
  - what has been solved?
  - what are the key limitations?
- Be familiar with the available resources

Course Design

- Lectures cover essential background
- Guest lectures present research level
- Self-study and assignments designed to cover practical implementation

Assessment (Bio2)

- Written assignment
  - Experimental design and data analysis mini project
- Plagiarism will be refereed externally

Late submissions will be penalized

Bioinformatics?

- What is Bioinformatics?
- What does Bioinformatics do for CS?
- What does Bioinformatics do for Biology?
- What guest bioinformatics lecture would you like?

- Discuss in groups for 10 min.

What is BioInformatics?

- Sequence analysis and genome building
- Molecular Structure prediction
- Evolution, phylogeny and linkage
- Automated data collection and analysis
- Simulations
- Biological databases and resources

BioInf and CS

- Provides CS with new challenges with clear medical significance.
- Complex and large datasets sometimes very noisy with hidden structures.
- Can biological solutions be used to inspire new computational tools and methods?

BioInf and Biology

- High-throughput biology:
  - around 1989, the sequence of a 1.8kb gene would be a PhD project
  - by 1993, the same project was an undergraduate project
  - in 2000 we generated 40kb sequence per week in a non-genomics lab.

BioInf and Biology

- High-throughput biology
- Data management and mining
- Modeling of Biological theories
- Analysis of complex systems

bioinformatics

- www.bbsrc.ac.uk - oasis database
- Bioinformatics.oxfordjournals.org
- www.biomedcentral.org/bmcbioinformatics
- www.nature.com/msb

Bioinformatics@ed

- Database integration
- Data provenance
- Evolutionary and genetic computation
- Gene expression databases
- High performance data structures for semi-structured data (Vectorised XML)

1/2

Bioinformatics@ed

- Machine learning
- Microarray data analysis
- Natural language and bio-text mining
- Neural computation, visualisation and simulation
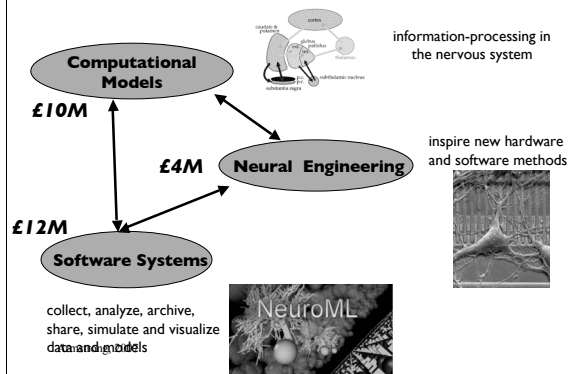- Protein complex modeling
- Systems Biology

2/2

bioInf activities @ ed

- Self organised reading groups
- http://www.bioinformatics.ed.ac.uk
- http://wwwtest.bioinformatics.ed.ac.uk/wiki/SysBioClub/WebHome

Neuroinformatics

information-processing in the nervous system

Computational Models

£10M

£4M

Neural Engineering

inspire new hardware and software methods

£12M

Software Systems

collect, analyze, archive, share, simulate and visualize data and models

NeuroML

Career Options

- Academic Routes
  - Get Ph.D, do Postdoctoral Research - lectureship and independent group
  - M.Sc. RA - becomes semi independent usually linked to one or more academic groups. Career structure is less defined but improving. RAs can do Ph.D. part-time.

Career Options

- Commercial Sector
  - Big Pharma - Accept PhD and MSc entry. Normally assigned to projects and work within defined teams. Defined career structure (group leaders, project managers etc)
  - Spin-out/Small biotech - Accept PhD and MSc entry. More freedom and variety. A degree of 'maintenance' work is to be expected.

Career Options

- Hybrid Approaches
  - Commercial and Academic research groups are becoming much closer linked.
  - University academics encouraged to exploit their IPR (intellectual property rights).
  - Companies can get government support to collaborate with academic research groups.

Ph.D.

- Assuming a start date of October 2007
- 'prize' studentships advertised on jobs.ac.uk, nature, science etc starting NOW!
  - Many linked to nationality/residency (Check details carefully).
- UK 'quota' studentships vary with department but contact/apply early.

Ph.D.

- US studentships take longer but are better paid and have extra training/coursework
  - require an entry exam
  - again, deadlines are very soon for '07