CSEP 527
Computational Biology

Course Wrap Up
Please complete online course evaluation by Sunday

https://uw.iasystem.org/survey/161047
What is DNA? RNA?
How many Amino Acids are there?
Did human beings, as we know them, develop from earlier species of animals?
What are stem cells?
What did Viterbi invent?
What is dynamic programming?
What is a likelihood ratio test?
What is the EM algorithm?
How would you find the maximum of $f(x) = ax^3 + bx^2 + cx +d$ in the interval -10<x<25?
“High-Throughput BioTech”

Sensors
- DNA sequencing
- Microarrays/RNAseq/Gene expression
- Mass Spectrometry/Proteomics
- Protein/protein & DNA/protein interaction

Controls
- Cloning
- Gene editing/knock out/knock in
- RNAi, CRISPR/CAS

Floods of data

“Grand Challenge” problems
CS Points of Contact

Scientific visualization
   Gene expression patterns

Databases
   Integration of disparate, overlapping data sources
   Distributed genome annotation in face of shifting underlying coordinates

AI/NLP/Text Mining
   Information extraction from journal texts with inconsistent nomenclature, indirect interactions, incomplete/inaccurate models,…

Machine learning
   System level synthesis of cell behavior from low-level heterogeneous data
   (DNA sequence, gene expression, protein interaction, mass spec, …)

Algorithms

…
Frontiers & Opportunities

New data:
  Proteomics, SNP, arrays, CGH, comparative sequence information, epigenomics, chromatin structure, ncRNA, interactome, single-cell everything

New methods:
  graphical models, rigorous filtering

Data integration
  many, complex, noisy sources

Systems Biology
Frontiers & Opportunities

Open Problems:
- splicing, alternative splicing
- multiple sequence alignment
  (genome scale, 100s-1000s of species, w/ RNA etc.)
- protein & RNA structure
- interaction modeling
- regulation, at all levels
- network models
- RNA trafficking
- ncRNA discovery
...

Exciting Times

“Biology is to 21st Century as Physics was to 20th”

Lots to do
Highly multidisciplinary
You’ll be hearing a lot more about it
I hope I’ve given you a taste of it
Thanks!

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