Data science training at the University of Colorado

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PhD Program

• Focus: Creating developers of novel methods

• Core curriculum:
  – Shared biomedical research “core” course
  – Introduction to Biomedical Informatics
  – Advanced Biomedical Informatics
  – Statistics requirement (various ways to meet)
  – Ethics for Biomedical Informaticians

• Our students matriculate with strong CS (usually MS or industrial experience)
How to stay up to date?

• All core courses (except statistics) are updated annually.
• Advanced biomedical informatics course reflects faculty research interests
• Key pillar of our training program mission statement is that students are trained to become self-directed and life-long learners.
  – Woven into curriculum and training experiences throughout graduate program
Student diversity

- Despite very diverse backgrounds (majority female, significant African-American, Hispanic and Native American enrollment), all of our students matriculate with substantial computational and mathematical backgrounds.
- Preparatory work available in our non-degree summer STTP program (several current students are graduates).
Tools and Techniques

• Our focus is on hands-on research training.
  – Students begin learning about design of research projects on the first day of first semester
  – ”Intro” course work is to write an R03-like proposal, do peer review, rewrite, and present orally and in writing.
  – “Advanced” course work is similar, but requires executing proposed project and reporting, orally and in writing, on the results of the project
  – Rotations begin second semester.
Tools and Techniques (2)

• Strong focus on scientific communication:
  – Making a claim and supporting it with evidence
  – How to argue for significance of a claim
  – How to contest a claim and/or evidence

• Lots of practice in written and oral presentations in various genres:
  – Research plans and critiques (grants and reviews)
  – Research results and critiques (papers, manuscript reviewing, oral presentations, asking questions)
Tools and Techniques (3)

• Ethics training a central program component
  – Social context in which research takes place:
    • Who pays for what kind of research, and why?
    • How biomedical informatics fits into society, including an international perspective
    • What are the broader impacts of informatics research?
  – Technical solutions to ethical problems
    • Protected Health Information, and why it matters
    • Privacy, security and encryption, with examples
  – Student selected topics
Postdoctoral training

• More flexible about backgrounds of trainees, but all have decent computational background
• Individual training plans, carefully monitored
• Sometimes involve distance learning for computational skills (including Boulder).
• Coordination with other postdoctoral training programs on campus (D2V: Big Data to Patient Value, Genomic Cardiology fellowship)
Challenges

• Recruiting computer scientists to join our program (often for a personal reason)

• Training skilled bioinformatics analysts
  – Some of our faculty help, but it’s not a responsibility of our training program
  – Distributed across different programs (statistics, biochem & genomics, personalized medicine)

• Finances (we could admit and train many more good students, but are limited financially)