Opportunities in biomedical data science

Karl Broman

Biostatistics & Medical Informatics, UW–Madison

kbroman.org
github.com/kbroman
@kwbrman

Slides: bit.ly/carleton2019
Biomedical data explosion

- Electronic health records (EHR)
- Imaging
- Genome/proteome/metabolome/microbiome data
- Personal activity/health tracking devices
Biomedical data explosion

- Electronic health records (EHR)
- Imaging
- Genome/proteome/metabolome/microbiome data
- Personal activity/health tracking devices
- High-throughput measurements in agriculture and ecology
Intercross

P₁  ×  P₂
  
F₁  ×  F₁
  
F₂
Genome scan

Chromosome
LOD score

BB  BR  RR

0.8  0.9  1.0  1.1
Genome scan
High-throughput phenotypes
High-throughput phenotypes

islet

QTL position (cM) vs. Probe position (cM)
Multi-parent crosses
The work

- Collaboration
- Data exploration
- Methods development
- Software development
The work

- Collaboration
- Data exploration
- Methods development
- Software development
  - R
  - C++
  - Coffeescript
  - Ruby
Qiongshi Lu

Human genome-wide association studies
Sündüz Keleş

Functional mediation analysis
Clock genes in stem cells

Self-renewal human ESC → Differentiation → ESC-derived presomitic mesoderm

- NOTCH
- WNT/β-catenin
- TGF-β

Wild type: HES7

Spondylocostal dysostosis: HES7

Gene oscillation: ~ 5h periodicity

No gene oscillation
Pathways disrupted by cancer
Vikas Singh

Analysis of brain images
Biomedical data science PhD at UW-Madison

- Faculty spanning biostatistics, bioinformatics, and computer science
- Broad opportunities for scientific collaborations
- Flexible course requirements
- Research rotations
- Literature and professional skills seminars

bit.ly/MadBDS
Slides: bit.ly/carleton2019

kbroman.org

github.com/kbroman

@kwbrmoman