Ethical Challenges from Medical Big Data and AI

Risks, harms and potential solutions

Brian Jackson, MD, MS
Associate Prof of Pathology, Univ of Utah
Medical Director, ARUP Laboratories
AI Winter
What can I help you with?
Laptop
Search for articles on venous insufficiency

Phone
Facebook ads for support stockings
“Tesla car that crashed and killed driver was running on Autopilot, firm says” The Guardian Mar 31, 2018
AI is Powerful Technology
Powerful Technologies Require Smart Regulation
Early Automobiles
Managing the Risks of Automotive Technology
What about medical technologies?
Medical Ethics

• Respect for Persons
  » Privacy
  » Autonomy

• Beneficience
  » Includes non-maleficence

• Justice
Scientific Ethics

• Creation and dissemination of knowledge
  » Transparency
  » Objectivity
  » Open sharing
  » Publication
Applying these principles to AI
Beneficence

- Does the AI system improve health?
- Does it have negative side effects?
An evaluation of machine-learning methods for predicting pneumonia mortality

Gregory F. Coopera,*, Constantin F. Aliferisa, Richard Ambrosinob,
John Aronisb, Bruce G. Buchananc, Richard Caruanac,
Michael J. Fined, Clark Glymourc, Geoffrey Gordonc,
Barbara H. Hanusad, Janine E. Janoskyc, Christopher Meekc,
Tom Mitchellc, Thomas Richardsonc, Peter Spirtesy
Pneumonia Mortality Model

• Goal: Stratify patient subgroups according to mortality risk
  » Admit the high-risk patients
  » Send the low-risk patients home
Pneumonia Mortality Model

• Unexpected effect: Asthmatic patients identified to be low risk
• Implication: hospital using this software would discharge asthmatic pneumonia patients to home
• Problem: Asthma increases mortality in pneumonia patients!

But what if…?

• The model had been developed for commercial purposes...
• Kept as a black box...
• Not been subject to extensive academic evaluation...

• What then?
#1 Source of error in AI models = Unidentified biases in training data
The Best Algorithms Struggle to Recognize Black Faces Equally

US government tests find even top-performing facial recognition systems misidentify blacks at rates five to 10 times higher than they do whites.
Opacity Problem in Machine Learning

Source: Bornstein A. *Nautilus* 2016
So...

AI is full of biases

And...

We can’t directly study biases due to opacity
Privacy-related harms
How Target Knew a High School Girl Was Pregnant Before Her Parents Did

By Keith Wagstaff @kwagstaff | Feb. 17, 2012

In Charles Duhigg’s new piece for the New York Times, a father finds himself in the uncomfortable position of having to apologize to a Target employee. Earlier he had stormed into a store near Minneapolis and complained to the manager that his daughter was receiving coupons for cribs and baby clothes in the mail.

Turns out Target knew his daughter better than he did. She really was pregnant.

(MORE: Google Wallet Hack Shows NFC Payments Still Aren’t Secure)

It was a fact Target had obtained after carefully collecting information about her. The company, like many others, assigns each shopper a unique Guest ID. Every time you buy toilet paper with a credit card, visit its website, fill out a survey or, really, interact with the retailer in any way, Target assigns this
Respect for Persons

• Can the patient make informed decisions about how their data is used?

• What if any data ownership rights does the patient have?
Do Americans Care about Control of their Health Information?

• Pew Study: 74% said “very important” to be in control of who can get info about you
  » Source: Pew Research. Americans’ attitudes about privacy, security and surveillance. 2015

• ONC Study: 8% of individuals had withheld information from a healthcare provider due to privacy or security concerns
  » Source: ONC Data Brief No 27. 2015
Ownership of personal health data
The Legacy of Henrietta Lacks

The Legacy of Henrietta Lacks

In 1951, a young mother of five named Henrietta Lacks visited The Johns Hopkins Hospital complaining of vaginal bleeding. Upon examination, renowned gynecologist Dr. Howard Jones discovered a large, malignant tumor on her cervix. At the time, The Johns Hopkins Hospital was one of only a few hospitals to treat poor African-Americans.

As medical records show, Mrs. Lacks began undergoing radium treatments for her cervical cancer. This was the best medical treatment available at the time for this terrible disease. A sample of her cancer cells retrieved during a biopsy were sent to Dr. George Gey's laboratory by Dr. Coots, a prominent cancer researcher.
HeLa Cells
Shouldn’t we treat personal data the same way we treat cells and organs?
EU data protection rules

Stronger rules on data protection mean people have more control over their personal data and businesses benefit from a level playing field.

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Rules for business and organisations
Application of the GDPR obligations, individuals’ requests, enforcement

Rights for citizens
Protection of your personal data, your rights and redress

About the regulation and data protection

- What does the General Data Protection Regulation (GDPR) govern?
- What is personal data?
But what about de-identification?
Estimating the success of re-identifications in incomplete datasets using generative models

Luc Rocher, Julien M. Hendrickx & Yves-Alexandre de Montjoye

Nature Communications 10, Article number: 3069 (2019) | Download Citation
79k Accesses | 1 Citations | 1784 Altmetric | Metrics
“Using our model, we find that 99.98% of Americans would be correctly re-identified in any dataset using 15 demographic attributes.”
Justice

• Does the AI system enhance fairness?
• Does it reduce health disparities?
• Does it improve affordability?
So what can we do about all this?
Scientific Ethics

• Creation and dissemination of knowledge
  » Transparency
  » Objectivity
  » Open sharing
  » Publication
No Black Boxes!
Achieving Ethical AI in Medicine

• Need to update patient rights regarding PHI
  » De-identification
  » Right to be forgotten
  » Data ownership/control
Data Trafficking
Achieving Ethical AI in Medicine

• Business relationships: AI vendors, health care orgs, academics
  » Ethical downstream uses
  » Fair/reasonable pricing on products
  » Study and publication
  » Patient data rights
Brian’s contact information

- Email: brian.Jackson@aruplab.com
- LinkedIn
- Twitter: @BrianJClinPath
ARUP is a nonprofit enterprise of the University of Utah and its Department of Pathology.