Data Ethics and Professionalism

ISEA Session 15

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Overview

1. Data ethics
2. Reproducibility
3. Communicating results

Data ethics


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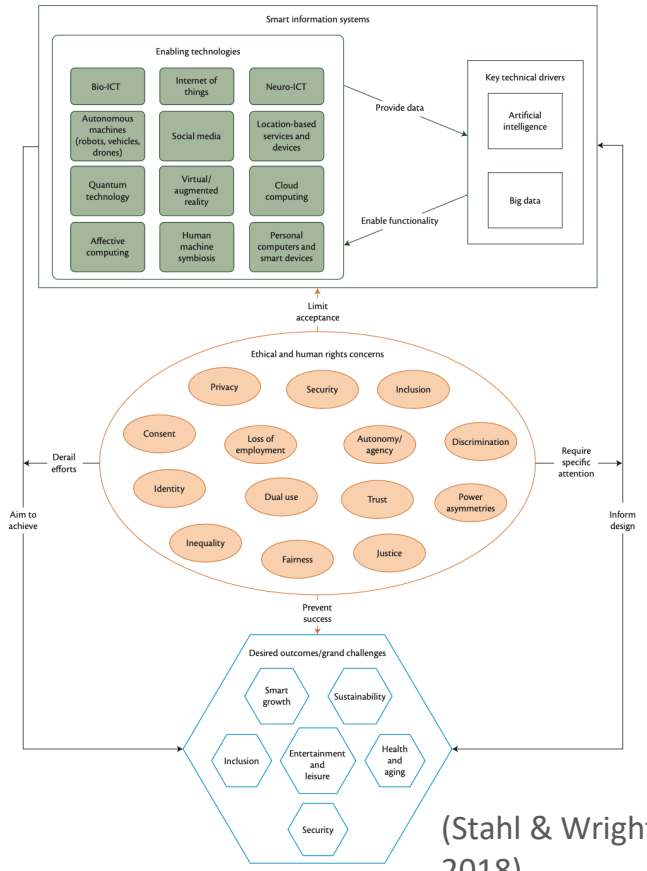
Motivation

- **Potential and peril**
  - **Massively accelerated rate at which data are produced**
  - **Ways in which data are analyzed and understood are changing rapidly**
- **Artificial intelligence (AI)**
  - **The use of hardware, software, and applications to perform analytics and mimic human cognitive capabilities** (Stahl & Wright, 2018)

Smart information systems

- Shorthand for technologies that use AI, machine learning, & big data (Stahl & Wright, 2018)
- Main takeaway:
  - Wide range of tech
  - Driven by AI & big data
  - Influenced by many concerns
  - That affect desired outcomes



(Stahl & Wright, 2018)

Smart information systems (SIS)

- Modern SIS are ubiquitous
  - Amazon recommendations/Alexa
  - Google search/Google Translate
  - Facebook/Instagram
- Other (education) examples?

Edtech SIS

- Personalized learning systems (PLS) based on individual students' needs & skills (Regan & Jesse, 2019)
- Both exciting and controversial
  - Facilitates collection of more, and more granular, information about students, teachers, and families
- Widely used and promoted in and beyond US
  - Gates Foundation, Chan Zuckerberg Foundation
  - Ubiquitous: used in nearly all US school districts

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Just privacy?

- Privacy as multi-faceted concept incorporating multiple distinct ethical concerns (Westin, 1967; Solove, 2008)
- US discussions largely focus on privacy (Regan, 1995)
- Can lead to a myopic focus on protecting student information from inappropriate access
- Reality is more nuanced

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Information privacy

- Minimize the amount of information collected to that required for a specific purpose
- Addressed by fair information practice principles (FIPP): notice, consent, choice, and transparency
  - Family Educational Rights and Privacy Act (FERPA, 1974)
  - Children's Online Privacy Protection Act (COPPA, 1998)
- Widespread agreement that focusing on info privacy is ineffective in a big data context

Anonymity

- The idea that individuals should be able to remain anonymous if they so choose
- Nearly impossible to anonymize modern data sets, as a handful of characteristics are likely sufficient to identify individuals, particularly when combined with other data

Surveillance

- Monitoring of activities, extraction of data about those activities, and analysis of resulting data
  - Time to answer a question or read a page
  - Keystrokes or other patterns of responding
  - Location, time of day, other students doing same task
  - Cross-matched with other data (e.g., how much a student moves, or time spent on social networking)
  - Predictive analytics to determine patterns, strengths and weaknesses, and advice about how to personalize

Autonomy

- Big data algorithms jeopardize autonomy by leading or nudging people to make specific decisions
- Although PLS may seem to be in students' best interests, they can influence e.g., instruction without allowing students a choice

Discrimination & Bias

- SIS can
  - Perpetuate prejudices and accentuate social inequities in subtle ways
  - Create new forms of inequality
  - Introduce potential for bias from:
    - Those who design the systems
    - The algorithms themselves
- Algorithmic complexity can make identification of bias and discrimination difficult

“Average person” in US states

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Ownership

- Who owns data produced by PLS?
- To what extent does data generated about and by students as they use PLS belong to the school or district vs. companies?
- Should there be limits on how companies use this data (e.g., to improve their offerings)?

What can be done?

- Responsible Research and Innovation (RRI)
  - Efforts to ensure that SIS processes & outcomes are acceptable, desirable, and sustainable
  - Built on principles of technology ethics, technology assessment, science and technology studies, and philosophy of technology

RRI

- Consensus is elusive
- Common foci include:
  - Stakeholder engagement
  - Openness and transparency
  - Willingness to be flexible and responsive
  - Integration into projects, funding, & support environments

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Discussion

- Join the breakout room most relevant to you
  - 1) Info privacy, 2) anonymity, 3) surveillance
  - 4) autonomy, 5) discrimination/bias, 6) ownership
- Discuss implications of that concern in Edtech
  - What can we, as educators with data science training, do to bring awareness to or help mitigate the issues?
  - How can we help develop a culture of responsibility among stakeholders for the processes and outcomes they develop and implement in schools?

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BREAK

> 5-minute break

Reproducibility

Reproducibility

- **What** does it mean to be reproducible?
- **Why** does reproducibility matter?
- **How** is reproducibility achieved?

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Reproducibility: What

- Conceptual
  - Replicating a study with new, independent data
    - Expensive
    - Hard(er) to get funded and published
    - Methodological challenges
- Computational
  - When others reproduce study results given only the original data, code, & documentation
    - Retains many advantages while minimizing the largest barrier (i.e., costs)

Reproducibility: Why

- **Benefits those who do it**
  - **Encourages robust documentation**
  - **Makes revisions easier**
  - **Promotes modularity and reuse of code**
  - **Provides an indication of rigor, trustworthiness, & transparency**
  - **Increases citation rates**

Reproducibility: Why

- **Benefits the larger community**
  - **Makes findings more accessible**
  - **Allows others to learn from your work**
  - **Facilitates follow-up studies**
  - **Leads to faster progress**
  - **Provides protection when mistakes occur**

Reproducibility: How

- **Plan**
  - Develop a well-defined question
  - Write and register study protocol
  - Justify the proposed sample size
  - Construct a data management plan
  - Proactively address sources of bias
- **Execute**
  - Avoid questionable practices
  - Interpret significance carefully
  - Make research open
- **Report**
  - Report all findings
  - Follow relevant reporting guidelines

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Reproducibility: Analysis

- Before: Plan data storage & organization
  - Location & format, data structure, metadata
- During: Use coding best practices
  - Clean, well commented code; code review; document environment & parameters
- After: Finalize & share results
  - Include input data, scripts, program versions, parameters, and important intermediate results
  - Choice of repository, prioritize DOI for citations

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Reproducibility: Resources

- UW eScience Reproducible and Open Research
  - http://uwescience.github.io/reproducible/
- Coursera Reproducible Research course
  - https://www.coursera.org/learn/reproducible-research
- Reproducibility and Replicability in Science
  - https://www.ncbi.nlm.nih.gov/books/NBK547537/

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Communicating results

Clear communication

- > Motivate the contribution
- > Provide context (what's known)
- > Balance interpretability and accuracy

A Checklist for Communicating Science and Health Research to the Public: https://www.nih.gov/about-nih/what-we-do/science-health-public-trust/checklist-communicating-science-health-research-public

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Clear communication

> **Use visuals that can be easily understood**

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Clear communication

- > Be respectful
- > Avoid potentially offensive terms
- > Include other relevant resources
- > Provide citations and sources

A Checklist for Communicating Science and Health Research to the Public: https://www.nih.gov/about-nih/what-we-do/science-health-public-trust/checklist-communicating-science-health-research-public

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Innovative communication

- Get the basics right
  - Define objectives, specify your audience, frame your message, and develop a dissemination plan
- Use websites, social media, and unique identifiers to make your work visible
- Foster participation and collaboration

(Ross-Hellauer et al., 2020)

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Innovative communication

- Embrace open science
  - Principles of equitable participation and transparency that enable others to collaborate in, contribute to, scrutinize and reuse research, and spread knowledge as widely as possible
- Think beyond traditional research outputs

(Ross-Hellauer et al., 2020)

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Innovative communication

- > Engage stakeholders
- > Think data visualization
- > Reflect and respect diversity
- > Find and use the right tools
- > Evaluate, evaluate, evaluate

(Ross-Hellauer et al., 2020)

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Assignment

- Write a brief reflection (300-500 words) on the current or anticipated role of ethics & reproducibility in your own work.
  - What areas are most pertinent to you? How might principles of reproducibility help address (some of) these issues?

References

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