AI and Accessibility

CSCI 497T/597T

The explosion of AI-ML technologies in the last decade has been driven by 3 factors.

- First, improvement in deep neural networks algorithms.
- Second, drop in the cost of computing hardware, e.g., GPUs.
- Third, large datasets are available online.

AI-based Assistive Technologies

- Automatic speech recognition
  - Caption videos for people who are deaf and hard of hearing
  - Speech input is also useful for people who have difficulty using their hands to control traditional input devices
- Language prediction systems
  - Augment communication for people with speech or cognitive disabilities
- Object, scene, and optical character recognition (OCR) systems
  - Produces labels, captions of images, handwriting for people with visual impairment

AI Challenges for PWD

- Dataset
  - People with particular classes of disability may represent a relatively small proportion of a population.
    - Disabilities are very diverse compared to age, gender, etc.
  - Coding of the implicit biases and limitations of the trainers
- Models
  - PWD data may be overlooked as outliers

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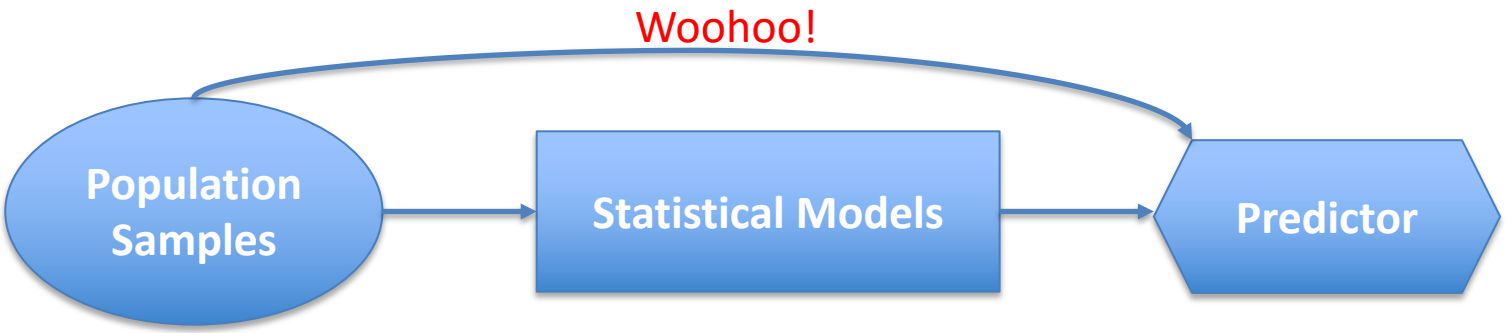

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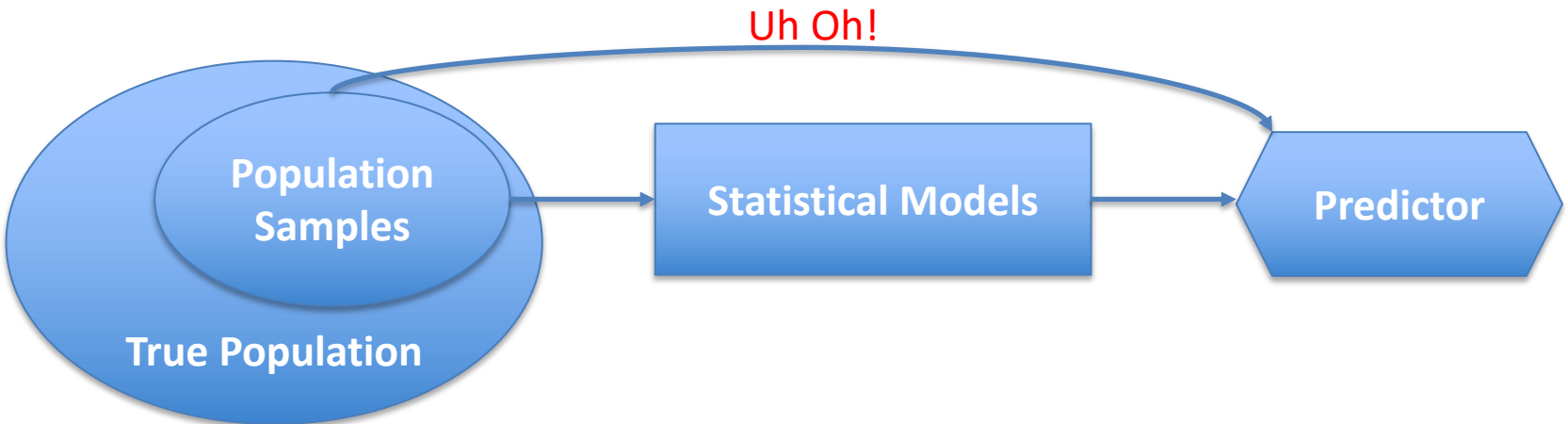

Examples of AI Systems that May Not Work for PWD: Computer Vision

- Face recognition
  - Used in biometric authentication, security systems, criminal justice, interview support software, and social/entertainment applications
  - May not work well for people with Down syndrome, achondroplasia, cleft lip/palate, or other conditions that result in characteristic facial differences
  - Emotion processing algorithms may misinterpret the facial expressions of someone with autism or Williams syndrome, experienced stroke, Parkinson's disease, Bell's Palsy, or other conditions that restrict facial movements.

Examples of AI Systems that May Not Work for PWD: Computer Vision

- Body recognition
  - Used in applications using gesture recognition (e.g., in VR and AR or gaming), or gait analysis (e.g., for biometric authentication, sports biomechanics, and path predictions used by self-driving vehicles
  - May not work well for PWD characterized by body shape, posture, or mobility differences, e.g., a person with an amputated arm, tremor or spastic motion, Parkinson's disease, elderly
  - If a self-driving car's pedestrian-detection algorithm does not include examples of people with posture differences during its training and evaluation, it may not correctly identify such people as objects to avoid, or may incorrectly estimate the speed and trajectory of those who move differently than expected, similar to Uber's self-driving car accident that killed a pedestrian walking a bicycle

Datasets Missing Data Produced by PWD

- Objection detection systems
  - Most datasets of images are of high quality
  - Images taken by PWD (e.g., blind, or with motor disabilities) have higher error rates
    - Poor framing, lighting, unusual angles

Risks

- Bias
  - Inferring disability status from online data
    - Mouse movements
    - Twitter profiles and activity
- Privacy
  - People with rare disabilities may experience greater privacy risks if they contribute data to AI systems or participate in research studies evaluating AI technologies.
  - PWD privacy concerns differ based on
    - Visibility of the disability
    - Type of contributed data
      - less comfortable to share identifiable information like, e.g., name, contact information.
    - Trust in the data collecting organization

Future Directions

- Create benchmark datasets to support replication and inclusion
- Innovate new modeling, bias mitigation, and error measurement techniques in order to address any shortcomings of status quo methods with respect to PWD.
- Develop ethical and legal frameworks regarding the application of AI to inferring disability status

Motivations for Contributing Data

- Willingness to contribute.
- Monetary compensation
  - a simple photo of an object that does not reveal the participants is considered the least valuable (median=$8.75), followed by
  - a self-portrait photo (median=$20.00),
  - videos of speech (median=$40.00) and
  - motion (median=$50.00) which are considered the most valuable data type in this set.
- Credit attribution for the data they contributed or offers for publicity by appearing in advertisements for accessible technology
- Get early access to use the trial version of the technology that was built with their data

Best Practices For Collecting Disability Data

- Use the following two questions when asking adults about their disability status
  - Do you identify as having a disability or other chronic condition?
    a. Yes
    b. No
    c. Prefer not to disclose
  - How would you describe your disability or chronic condition?
    a. Attention deficit
    b. Autism
    c. Blind or visually impaired
    d. Deaf or hard of hearing
    e. Health-related disability
    f. Learning disability
    g. Mental health condition
    h. Mobility-related disability
    i. Speech-related disability
    j. Other (please specify)

Best Practices For Collecting Disability Data

- Respect the culture of the community
- Avoid performance anxiety
- Provide a proper benchmark to help the participants reason about the compensation amount
- Accessible process

Discussion

- How to create inclusive datasets given privacy concerns?
- How to create inclusive datasets without overloading the disability communities?

References

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