CULTURALLY INCLUSIVE EDUCATION FOR THE **SPEECH SCIENCES**

SPEECH & TECHNOLOGY

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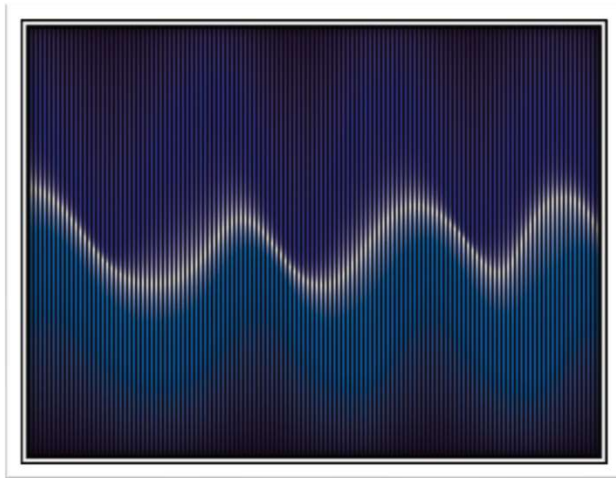Doctoral Student
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PREREQUISITE KNOWLEDGE

SPEECH FREQUENCIES

PHONEMIC CHARACTERISITCS OF ENGLISH DIALECTS

OUTLINE

SPEECH TECHNOLOGY

- Current uses
- Equipment and processing
- Benefits and drawbacks

BIASES OF ARTIFICIAL INTELLIGENCE

- How SLPs use AI
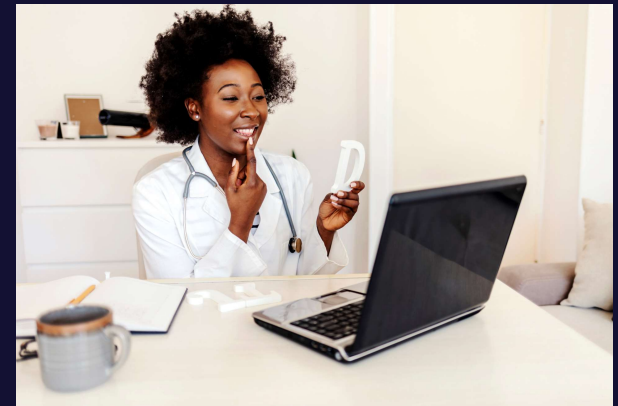- Bias in AI
- Awareness of AI bias in the clinic

Speech Technology

Current Trends in Speech Technology

- Text-to-Speech

- Telehealth and Telecommunication

- Speech-to-Text
 - Voice Assistants (Siri, Cortana)
  - Educational Software

SPEECH-RELATED TECHNOLOGY
has become a part of
everyday life for many

Benefits of Speech Recognition

- Automatic speech recognition (ASR) allows for "hands free" access to technology that is unrestricted by...
    - Physical abilities
    - Literacy abilities

- Speech recognition can help individuals...
    - Independent Living
    - Social connectivity
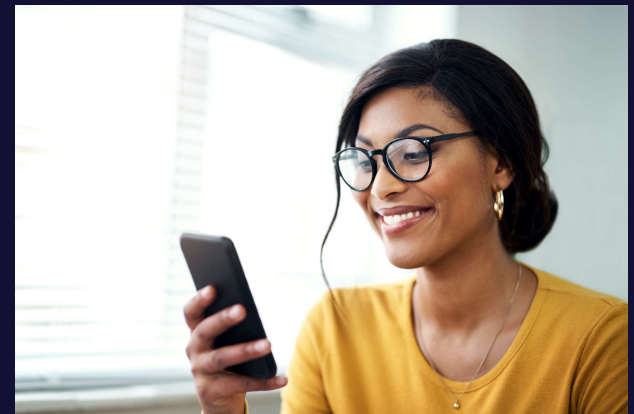
MICROPHONE

- Directionality

- Distance from the speaker

- Minimize background noise, or improve the signal-to-noise ratio

ASR: Equipment & Processing

MICROPHONE

- Directionality

- Distance from the speaker

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SAMPLING RATE

- High-quality recordings are at 44.1 kHz

- What is the minimum sampling rate for speech?

ASR: Equipment & Processing

Examples of Sampling Rates

A rainbow is a division of white light into many beautiful colors.
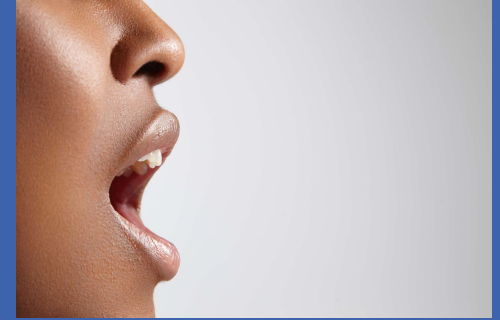
| 4 kHz | 8 kHz | 12 kHz | 16 kHz | | | | 44.1 kHz |

How does speech recognition work?

- Hardware and software to acquire and digitize speech signal

- Processing capabilities to extract and categorize speech features
  - Artificial intelligence (AI) systems learn and modify categorization based on user input
  - Initial AI rules are developed based on a speech corpus

Why does speech recognition fail?

- Speech accuracy is based on pre-established patterns that come from a speech "corpus"

- What happens when the user has speech patterns that are not part of the training corpus?

Biases in Artificial Intelligence

Common Uses of AI:

Automated Speech Recognition (ASR) Software

- Alexa
- Google Home
- Cortana
- Siri
- Any speech-to-text software

How Can AI Be Biased?

The foundational knowledge and data input into to AI systems is provided by everyday human beings with their own biases, therefore, if the foundational knowledge given to the system is biased, no matter how much the artificial intelligence learns, it and the information it is providing will inherently be biased too.
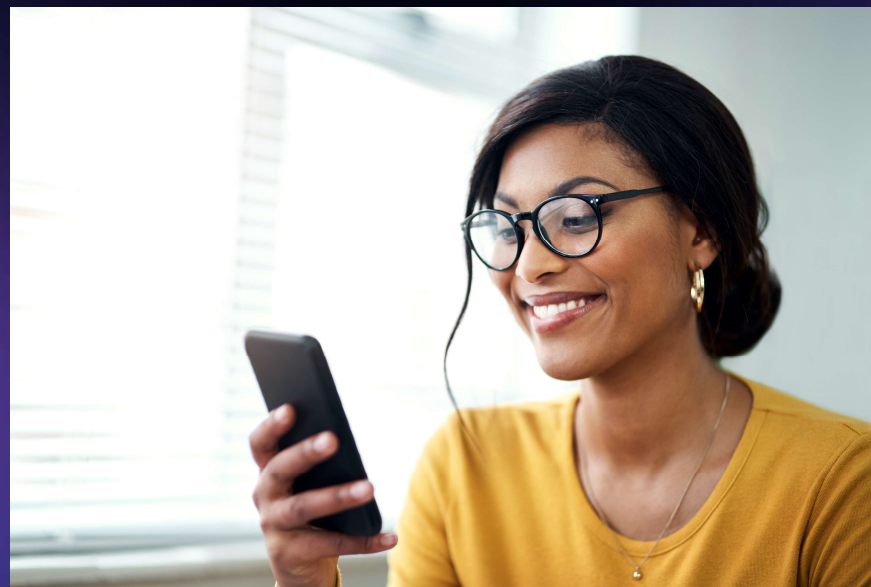
The era of blind faith in big data must end – Cathy O'Neil

Who is Affected?

(Mengesha et al., 2021)

Lack of Satisfaction of ASR Technology among African American participants

27%

Dictating, sending, or reading a message

10%

- playing music

- dictating, sending or reading an email

- technology not understanding words, phrases, or names (especially ethnic) used

(Mengesha et al., 2021)

Why African American participants aren't satisfied with the ASR

36%
Gave incorrect results

32%
Didn't understand the commands
Ended up having to do the task manually

27%
Transcribed the message incorrectly

18%
Still had to proofread or edit

(Mengesha et al., 2021)

Top Three Reasons for ASR Errors

30%
Technology wasn't designed to pick up accents and slang

20%
Technology didn't understand me or my speech patterns

10%

Technology isn't familiar with the words, phrases, or ethnic names used

(Mengesha et al., 2021)

Who African American Participants Believe
ASR Technology Works Better For

36%
White people
People without an accent

21%

People who don't use slang

14%
People with an American accent
People who use correct standard
American English

(Mengesha et al., 2021)

Frequency of Speech Modification of African American Participants Using ASR Technology
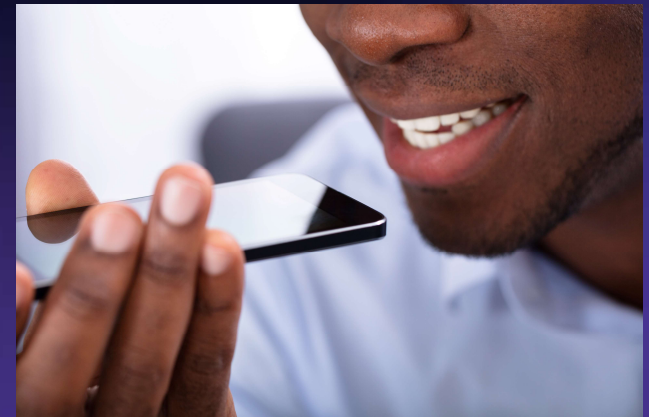
Yes, every time (23%)

Yes, most of the time (33%)

Yes, some of the time (30%)

Yes, infrequently/sporadically (7%)

No, I've never done this (7%)

(Mengesha et al., 2021)

What can you as future clinicians do?

References & Resources

- Behrman, A. (2018). Speech and Voice Science. 3rd edition. Plural Publishing, San Diego, CA.

- Defined.AI. (2021). "Building inclusive speech technology with diverse data." Blog post. Received October 31, 2022. https://www.defined.ai/blog/building-inclusive-speech-technology-with-diverse-data/

- Mengesha, Z., Heldreth, C., Lahav, M., Sublewski, J., & Tuennerman, E. (2021). "I don't think these devices are very culturally sensitive."—impact of automated speech recognition errors on African Americans. *Frontiers in Artificial Intelligence, 4.* https://doi.org/10.3389/frai.2021.725911

THANK YOU

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