A Framework for Optimizing Hearing Aids In Situ Based on Patient Feedback, Auditory Context, and Audiologist Input

Octav Chipara[ι], Yu-Hsiang Wu[*],Tianbao Yang [ι], and Harinath Garudadri[~]

[*]Department of Communication Sciences & Disorders, The University of Iowa; [ι]Department of Computer Science, The University of Iowa, [~]Qualcomm Institute, University of California San Diego

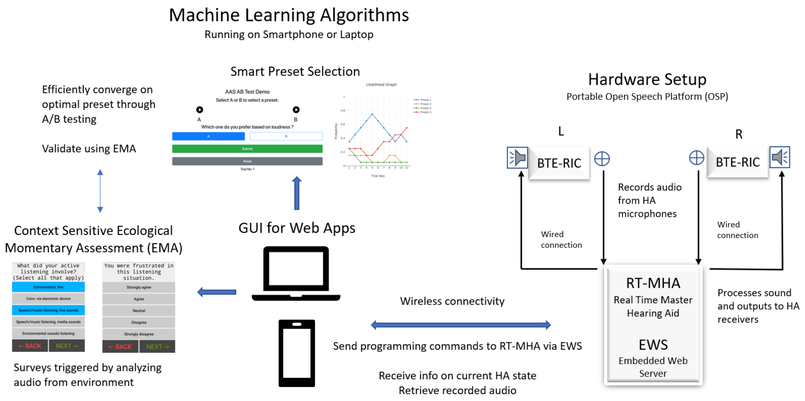
BACKGROUND

GOAL

- Develop machine learning algorithms that can control the hearing aid (HA) state in-situ and incorporate user feedback to converge on contextually optimal HA configurations.

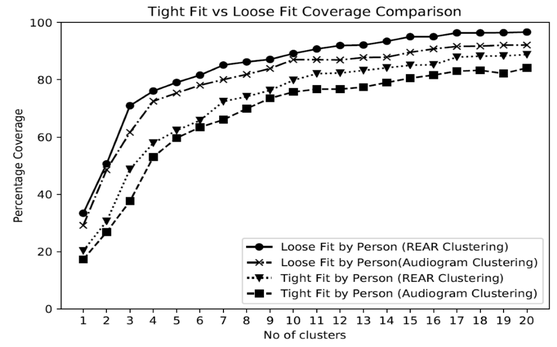
IMPLEMENTATION

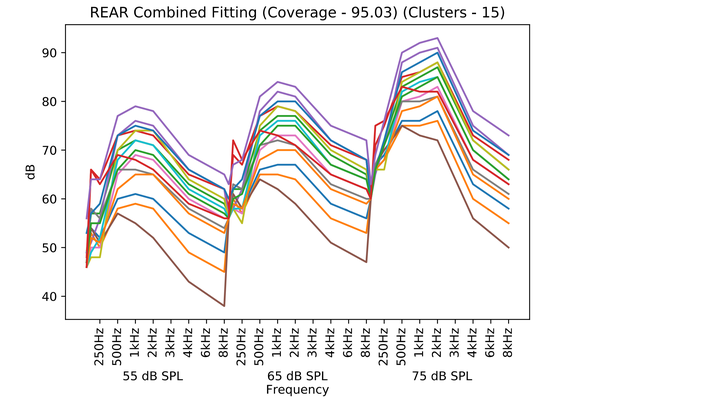
- Integrate the wearable units of the Open Speech Platform (OSP) and the smart-phone based Ecological Momentary Assessments (EMA) system
- Develop machine learning algorithms that incorporate time-aligned, real-time data about listening experience, listening context, and signal processing/HA state
- The algorithms updates the HA parameters in-situ and validate these changes via app-based user interaction



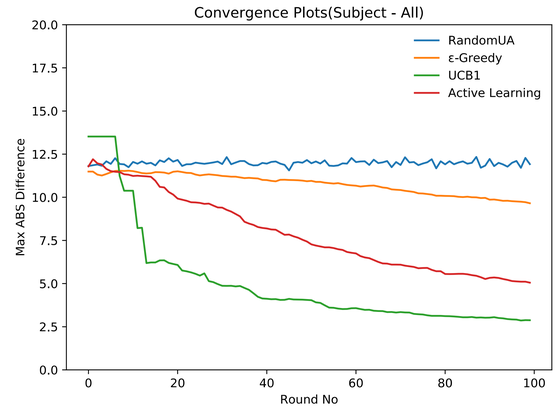
Combining Population Data with User Feedback

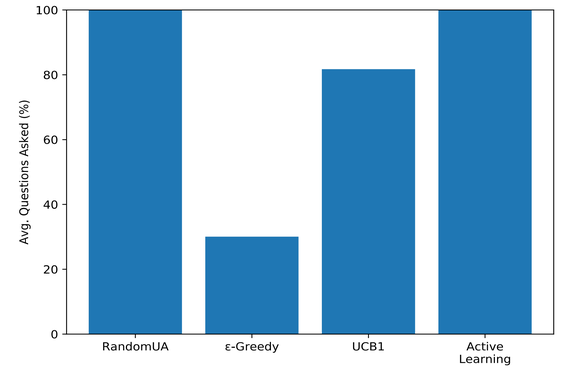
- Reduced the space of possible frequency-response settings to a small number of discrete choices using clustering.
- 15 presets would fit 95.3% of older adults with mild-to-moderate hearing loss within +/- 5dB.





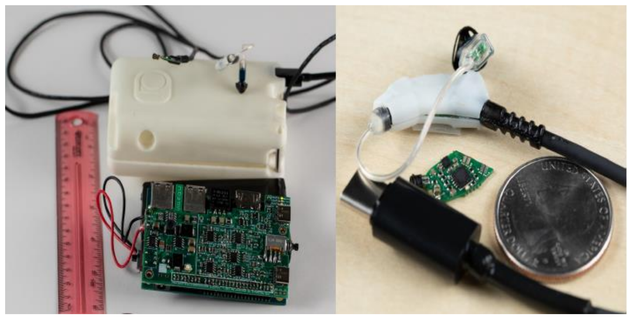
- Identify the best preset using machine learning.
- Balance two criteria: user burden and performance.





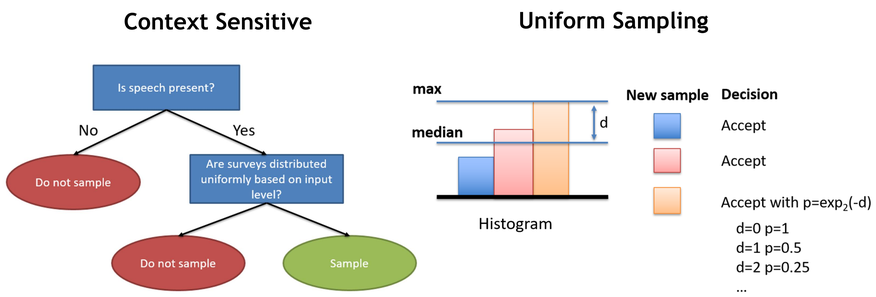
PORTABLE OPEN SPEECH PLATFORM

- Open-source software includes adjustable parameters for frequency response, compression, noise reduction, and feedback cancellation.
- Capable of 96 kHz, 24-bit audio processing at low latency.
- Custom BTE-RICs with wired connection to Real Time Master Hearing Aid.
- Configurable via web-based interface using JavaScript and HTML.



CONTEXT SENSITIVE ECOLOGICAL MOMENTARY ASSESSMENT

- Smartphone or web-app based user interaction that collects user feedback about listening environment, context, and listening effort.
- Surveys can be triggered by analyzing audio from the user's environment, i.e. is the user in the presence of speech in quiet, speech in noise, or music?
- Can be used as a validation measure for changes made by the real-time HA optimization algorithm.



FUTURE DIRECTIONS

- Develop the preset selection algorithm to be dynamic and able to handle variable numbers of presets or HA configurations, including compression parameters that significantly increase the search space.
- Expand presets to cover parameters (e.g., compression)
- Conduct field trials of environment-triggered EMA surveys to further the development of the real-time optimization algorithm.

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CONTACT

Contact octav-chipara@uiowa.edu for more information