**Introduction**

**Motivation:** The main motivation behind this paper is to find the degree of importance of each articulator in speech production.

**Proposed approach:**
- In articulatory space, critical articulators of specific sound exhibit minimal variance at target position based on which articulators can be critical or non-critical. [1]
- In this work, instead of assigning a binary decision on articulators being critical or not, we attempt to assign an articulatory importance value between 0 to 1 in a data driven manner.

**Key findings:**
- The Critical Articulators comparatively have high importance values and are consistent across subjects.

**Data Collection**

**Articulatory movement data recorder:** → EMA AG501. [2]

**Speech Stimuli:** 460 phonetically balanced English sentences from the MOCHA-TIMIT corpus are chosen as the stimuli for data collection.

**Six sensors are connected:** UL-Upper Lip, LL-Lower Lip, Jaw-Jaw, TT-Tongue Tip, TB-Tongue Body, TD-Tongue Dorsum.

From the six sensors, we obtain 12-dimensional articulatory features (AFs) namely, $UL_x, UL_y, LL_x, LL_y, Jaw_x, Jaw_y, TT_x, TT_y, TB_x, TB_y, TD_x, TD_y$.

We collect data from 38 speakers comprising 24 males and 14 females in an age group of 21-28 years.

**Articulatory Importance Function**

Importance of an articulator is calculated using negative logarithm of the ratio of phoneme specific variance to the global variance as given by

$$I^a = -\log\frac{\sigma^a}{\sigma^g}$$  

where $\sigma^a$ and $\sigma^g$ are the phoneme specific and global variance calculated from the collection of samples from the mid point of a/all phoneme segment(s).

**Normalized Articulatory Importance Function**

The spread of importance function across subjects for critical articulators is minimum.

**Results and Discussion**

Normalized articulatory importance function values (color-coded from 0-1) for different consonants and vowels for each of 38 subjects (x-axis shows subject index, y-axis indicates different articulators)

These average AIF values across all the subjects are observed to be consistent with the critical articulators reported in [3]

The critical articulators comparatively have high importance values and is consistent across subjects.

The spread of importance function across subjects for critical articulators is minimum.

**Conclusion**

This work gives a better understanding about the importance of various articulators in phoneme production.

This analysis could benefit to the understanding of inter speaker variability in speech production mechanisms and provide articulatory feedback in language learning tasks.

**References**


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