Automatic Error Recovery for Pronunciation Dictionaries

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1. Overview

Motivation

- Quality of pronunciation dictionary is important for Speech Recognition
- Dictionaries may be of different quality depending on the creation process

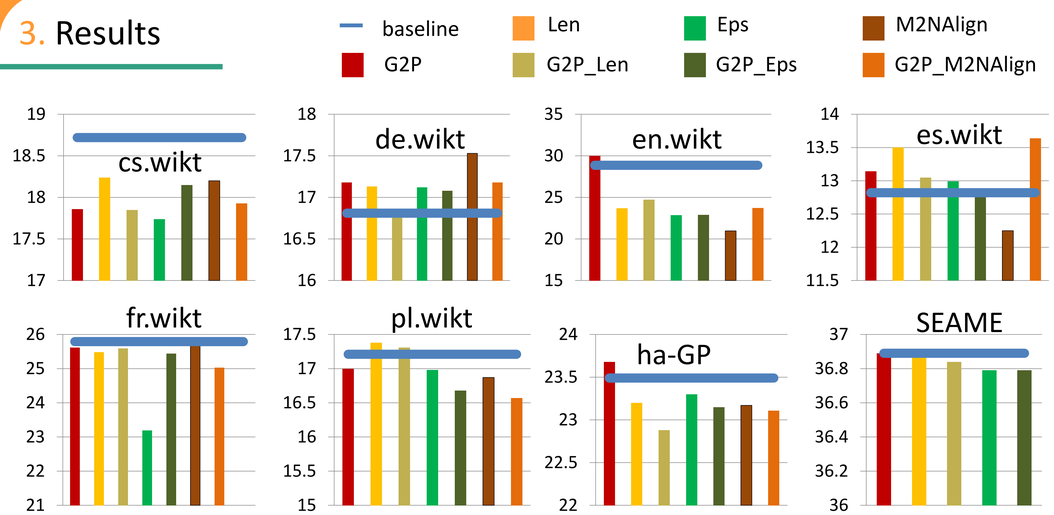
Goal

- Propose completely automatic methods to detect, remove, and substitute inconsistent and flawed dictionary entries

Data

1. *Wiktionary* word-pronunciation pairs (provided by Internet community) that are used to build grapheme-to-phoneme (g2p) models
   - Languages: English (en), German (de), Polish (pl), Spanish (es), Czech (cs), French (fr)
2. *GlobalPhone* Hausa (ha-GP) pronunciation dictionary (created by native speakers)
3. Singaporean English pronunciations (that have been generated with rules) to complement our Mandarin-English *SEAME* code-switch dictionary

3. Results



- WER reduction of 27.3% relative on *en.wikt* word-pronunciation pairs with *M2NAlign*. Without this outlier, the avg. improvement in *wikt* is 2.5% relative.
- On *ha-GP,* WER reduction with all filtered dictionaries but *G2P* by 1.5% relative on average. *G2PLen* performs best with 2.6% relative improvement.
- On *SEAME*, we are able to slightly reduce the mixed error rate by 0.2% relative on average with a decoding using the filtered new pronunciations

2. Automatic rejection of inconsistent and flawed entries

- Our investigated methods to filter erroneous entries fall into the following categories:

1. Length Filtering (*Len*)

Remove a pronunciation if the ratio of grapheme and phoneme tokens exceeds a certain threshold.

2. Epsilon Filtering (*Eps*)

a. Perform a 1-1 g2p alignment *(Martirosian and Davel, 2007) (Black et al., 1998)* which involves the insertion of graphemic and phonemic nulls (epsilons) into the lexical entries of words.

b. Remove a pronunciation if the proportion of graphemic and phonemic nulls exceeds a threshold.

3. m-n Alignment Filtering (*M2NAlign*)

a. Perform an m-n g2p alignment *(Martirosian and Davel, 2007) (Black et al., 1998)*.

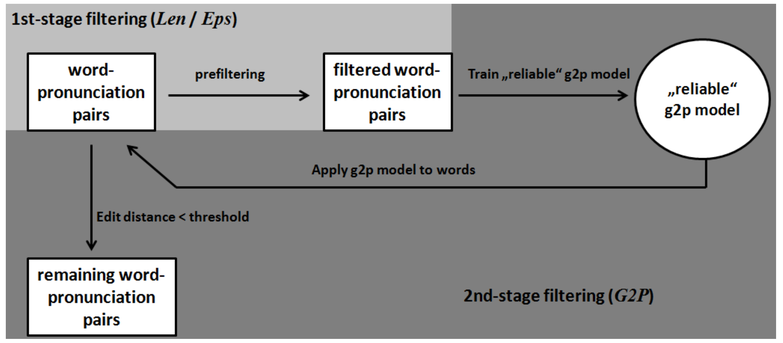
b. Remove a pronunciation if the alignment score exceeds a threshold.

4. g2p Filtering (*G2P*)

a. Train g2p models with „reliable“ word-pronunciation pairs.

b. Apply the g2p models to convert a grapheme string into a most likely phoneme string.

c. Remove a pronunciation if the edit distance between a synthesized phoneme string and the pronunciation in question exceeds a threshold.



- The threshold for each filtering method depends on
  - the *mean* (μ) and
  - the *standard deviation* (σ) of the measure in focus.
- Those word-pronunciation pairs whose resulting number is shorter than $\mu - \sigma$ or longer than $\mu + \sigma$ are rejected.
- We built new g2p models with the remaining word-pronunciation pairs and applied them to the words with rejected pronunciations.