Abstract

Syllabification by Phone Categorization

Jacob Krantz, Maxwell Dulin, Paul De Palma
Gonzaga University
Spokane, WA
jkrantz@zagmail.gonzaga.edu

Abstract

Syllabification plays an important role in speech synthesis, speech recognition, and spoken document retrieval. A novel, low cost, and language agnostic approach to dividing words into their corresponding syllables is presented. A hybrid genetic algorithm constructs a categorization of phones optimized for syllabification. This categorization is used on top of a hidden Markov model sequence classifier to find syllable boundaries. The technique shows promising preliminary results when trained and tested on English words.

Background

Methods of Syllabification

Terminology

Phone: a unit of sound (t in the English tip)
Syllable: a single segment of uninterrupted phones (syl / la - bles)
Syllabification: the process of breaking a word (a sequence of phones) into its corresponding syllables

Methods of Syllabification

1. Rule-based: Involves numerous handwritten rules about a given language. A prominent example would be the tsylb syllabification software based on Daniel Kahn’s elaborate phonological algorithm [1].
2. Probabilistic: Statistical approaches based on training examples to provide learned insight. High order hidden Markov models (HMMs) and support vector machines (SVMs) have shown to perform this task at a state of the art level [2].

Training Advantage

There are 54 phones in the IPA. With there being either a syllable boundary or not for each time step, the hidden state space is 54 x 2 = 108. Using 12 phonetic categories, we reduce the hidden state space to 12 x 2 = 24. Thus, the model achieves high accuracy with limited training data.

Conclusions and Future Work

Conclusions

1. Our sequence classifier can accurately predict syllable boundaries at a word-level accuracy of 92.54% (using 10-fold cross-validated on CELEX).
2. Genetically-optimized phonetic mappings alongside the hidden Markov model show promise as a method of automatic syllabification.

Future Work

- Test language independence against German, Dutch, and other languages.
- Investigate why certain phones pattern well in syllabification. Interestingly, the genetically-optimized categories do not pattern well with conventional, natural phonetic categorizations.
- Release the data and system of syllabification to benefit both researchers in linguistics and computational linguistics.

References


