Phonemizer: Text to Phones Transcription for Multiple Languages in Python

Mathieu Bernard¹ and Hadrien Titeux¹

1 LSCP/ENS/CNRS/EHESS/Inria/PSL Research University, Paris, France

DOI: 10.21105/joss.03958

Summary

Phones are elementary sounds the speech is made of, on which syllables and words are built. The transcription of texts from their orthographic form into a phonetic alphabet is an important requirement in various applications related to speech and language processing, for instance for text to speech systems. Phonemizer is a Python package addressing precisely this issue: it transcribes a text from its orthographic representation into a phonetic one. The package is user-friendly and exposes a single high-level `phonemize` function, a lower level API, and is also available as a command-line interface. It supports about a hundred different languages and provides end-user functionalities such as punctuation preservation, phones accentuation, tokenization at phone/syllable/word levels, as well as parallel processing of large input texts.

Statement of Need

Whereas the high-level features introduced above are implemented directly by phonemizer, the phonetic transcription itself is delegated to third party backends, wrapped in an homogeneous interface by the package. The default backend used by phonemizer is eSpeak (Dunn & Vitolins, 2019), a text to speech software built on linguistic expertise and hand written transcription rules. It transcribes text into the International Phonetic Alphabet and supports more than a hundred languages. Using MBROLA voices (Tits & Vitolins, 2019), available for about 35 languages, the eSpeak backend transcribes text in the SAMPA computer readable phonetic alphabet. Festival (Black et al., 2014) is another text to speech software used as a backend for phonemizer. It is available for American English only, and uses a non standard phoneset for transcription, but this backend is the only one to meet the requirement of some applications by preserving syllable boundaries of transcribed texts. The third phonemizer backend is Segments (Forkel et al., 2019), a Python package providing Unicode Standard tokenization routines and orthography segmentation. It relies on a grapheme to phoneme mapping to generate the transcription. This backend is mostly useful for low-resource languages, for which users with linguistic expertise can write their own mappings. Six languages are provided as examples with phonemizer: Chintang, Cree, Inuktitut, Japanese, Sesotho, and Yucatec.

Text to phones transcription is a critical need in different applications related to natural language and speech processing. So far, the phonemizer package has been used in the preprocessing pipeline of various deep learning text to speech systems (Ideas Engineering, 2021; Mozilla, 2021; Watanabe et al., 2018). It has also been used as a preprocessing step in word segmentation studies regarding the role of speech prosody in segmentability (Ludusan et al., 2017) and the psychology of child development (Bernard et al., 2020; Cristia et al., 2019). A phonetic transcription generated by the package was used to evaluate a phone discrimination...
task for the Zero Speech Challenge 2017 (Dunbar et al., 2017). The phonemizer is also very suitable to prepare datasets for their use with the Kaldi speech recognition toolkit (Povey et al., 2011), where a phonetic transcription of text is a requirement for various algorithms. The package can also be used to generate forced alignments of speech corpora, an important part of the speech-related research pipeline whereby an acoustic signal is segmented and aligned with a text transcript. The most impactful software in this field (McAuliffe et al., 2017; Rosenfelder et al., 2014) requires a pronunciation dictionary to transcribe words into phonemes. Such dictionaries, when available, can be non-exhaustive, thus requiring experimenter transcription, model training, and/or data exclusion. Replacing the dictionary by the use of the phonemizer can therefore improve the overall pipeline and alignment quality for supported languages. Finally, the phonemizer shows promises for the linguistic analysis of low-resource languages, where a major problem is the lack of grapheme to phoneme mapping (Barth et al., 2020) or comprehensive pronunciation dictionaries (Cristia et al., 2020; Johnson et al., 2018). In such cases, compiling a grapheme to phoneme map to be used by the Segments backend would be easier and more efficient than compiling an exhaustive pronunciation dictionary.

Acknowledgements

We are thankful to Alex Cristia, who initiated this project, and to Emmanuel Dupoux for his support and advice. We also thank the phonemizer users for their bug reports and features requests. This work is funded by the European Research Council (ERC-2011-AdG-295810 BOOTPHON), the Agence Nationale pour la Recherche (ANR-17-EURE-0017 Frontcog, ANR-10-IDEX-0001-02 PSL, ANR-19-P3IA-0001 PRAIRIE 3IA Institute), and grants from CIFAR (Learning in Machines and Brains), Facebook AI Research (Research Grant), Google (Faculty Research Award), Microsoft Research (Azure Credits and Grant), and Amazon Web Service (AWS Research Credits).

References


