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Phonemizer: Text to Phones Transcription for Multiple Languages in Python

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Software

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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 lovel 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.

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