How does the inclusion of explicit phoneme alignment in UniSpeech-derived representations affect phoneme error

Assignee Research

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Abstract

UniSpeech has achieved superior performance in cross-lingual automatic speech recognition (ASR) by explicitly aligning latent representations to phoneme units using multi-task self-supervised learning. While the learned representations transfer well from high-resource to low-resource languages, predicting words directly from these phonetic representations in downstream ASR is challenging. In this paper, we propose TranUSR, a two-stage model comprising a pre-trained UniData2vec and a phoneme-to-word Transcoder. Different from UniSpeech, UniData2vec replaces the quantized discrete representation

1 Introduction

This paper examines: TranUSR: Phoneme-to-word Transcoder Based Unified Speech Representation Learning for Cross-lingual Speech Recognition. Research question: How does the inclusion of explicit phoneme alignment in UniSpeech-derived representations affect phoneme error rate (PER) and word error rate (WER) in cross-lingual zero-shot transfer learning compared to multilingual wav2vec 2.0 on LibriLight and MLS benchmarks?.

2 Methodology

Systematic literature search across multiple databases yielded 14 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 5.5/10.

3 Results

14 papers retrieved. 9 claims extracted; 3 independently verified. Quality review score: 5.5/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
Pre-training on multilingual data, including labeled and unlabeled data from available languages, and subsequent fine-tu	✓	0.20
The UniSpeech method combines a supervised CTC loss and a self-supervised contrastive loss to enhance the quality of the	×	0.10
The JUST method integrates a supervised RNN-T loss with two unsupervised losses.	×	0.04
The UniSpeech method is currently state-of-the-art (SOTA) on the cross-lingual Common Voice dataset.	×	0.10
Using phoneme units could make models more easily learn shared phonetic representations.	×	0.11
UniData2vec reduces PER by 5.3% compared to UniSpeech.	✓	0.22
Transcoder yields a 14.4% WER reduction compared to grapheme fine-tuning.	✓	0.28
The TranUSR framework comprises two modules: UniData2vec and Transcoder.	×	0.09
UniData2vec predicts phoneme probabilities from speech features, and Transcoder for each language converts these probabi	×	0.08

References

- http://arxiv.org/abs/2106.01732v2
- http://arxiv.org/abs/2305.13629v3
- http://arxiv.org/abs/2109.11680v1