Impact of Visual Modality on Robustness of Self-Supervised Speech Representations Against Adversarial Attacks

Assignee Research

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Abstract

The intuitive interaction between the audio and visual modalities is valuable for cross-modal self-supervised learning. This concept has been demonstrated for generic audiovisual tasks like video action recognition and acoustic scene classification. However, self-supervision remains under-explored for audiovisual speech. We propose a method to learn self-supervised speech representations from the raw audio waveform. We train a raw audio encoder by combining audio-only self-supervision (by predicting informative audio attributes) with visual self-supervision (by generating talking faces from au

1 Introduction

This paper examines: Learning Speech Representations from Raw Audio by Joint Audiovisual Self-Supervision. Research question: What is the impact of incorporating visual modality into self-supervised learning for speech representations on the robustness of neural source-filter models against adversarial attacks, as evaluated using metrics like adversarial accuracy and perturbation resilience?.

2 Methodology

Systematic literature search across multiple databases yielded 11 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.8/10.

3 Results

11 papers retrieved. 12 claims extracted; 10 independently verified. Quality review score: 7.8/10.

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
The LRW dataset contains 500 different isolated words primarily from BBC recordings.	✓	0.22
The LRW dataset is an audiovisual speech dataset.	×	0.13
A subset of the LRW dataset with nearly frontal videos (yaw, pitch, and roll restricted to a maximum of 10 degrees) cont	✓	0.31
The Speech Commands (SPC) dataset contains 64,727 total utterances of 30 different words by 1,881 speakers.	✓	0.26
The proposed method uses a 1D Resnet18 encoder as the backbone for all proposed methods.	×	0.08
The audio encoder takes as input a 16 kHz raw audio waveform and converts it into a 512-D audio feature vector for every	✓	0.28
The output sample rate of the audio encoder is 25 audio feature vectors per second.	✓	0.22
The output sample rate of the audio encoder matches that of 25 FPS video in the LRW dataset.	✓	0.22
The proposed method uses a 1D Resnet18 audio encoder operating directly on raw audio waveforms.	✓	0.16
The proposed method performs end-to-end self-supervised representation learning without starting from an intermediate fe	✓	0.24
The visual self-supervision model is comprised of three components: the audio encoder, the identity encoder, and the fra	✓	0.27
The visual self-supervision model operates on 1-second long segments from an audiovisual speech dataset.	✓	0.16

References

- http://arxiv.org/abs/2304.11976v1
- http://arxiv.org/abs/2007.04134v1
- http://arxiv.org/abs/1910.08108v2