

Augmentation-based Test-Time Adaptation for Speech Enhancement

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Thesis FA/MA
Supervisor Tobias Raichle
Examiner Prof. Dr.-Ing. Bin Yang

Motivation

Speech enhancement (SE) studies improving the quality of spoken language and finds applications as a front-end in automatic speech recognition, telecommunication or hearing aids. Generally, speech enhancement covers multiple types of corruptions (noise, reverberations, echoes, compression artifacts etc.) but most previous works focus on denoising.

SE models perform well in practical deployments as long as the target data distribution matches the training distribution. However, if there is a distribution shift between the domains, a drop in performance can be observed. Test-time adaptation (TTA) [1] aims to mitigate this by unsupervised adaptation to the target domain.

Whereas TTA has been an active field of research for image classification, it remains underexplored for other use-cases like SE. Due to the widely different task structure, methods from TTA for classification cannot be easily transferred to SE. A common TTA technique is to enforce consistency under augmentations to help the model to become more robust within the target domain [2]. However, as SE models modify their input, they cannot be invariant to augmentations that affect the speech component. Designing an output preserving augmentation is therefore non-trivial, as assuming general invariance to small perturbations is not valid. This thesis proposal aims at addressing this challenge by developing a TTA for SE approach that leverages consistency based adaptation.

Objectives

- Evaluate if existing consistency based TTA methods can be (in-part) used for SE
- Design augmentations that can be used for effective TTA for SE
- Optimize the TTA approach for the particular SE use-case

Prerequisites

- Took the Deep Learning exam with good results
- Good programming skills in Python
- Experience in ML-frameworks (Preferably PyTorch)
- *Optional*: Participated in the ISS Deep Learning Lab

If this topic has sparked your interest, write me an email and we can discuss the proposal in more detail. Please include your current transcript and CV.

References

- [1] Dequan Wang et al. "Tent: Fully test-time adaptation by entropy minimization". In: *arXiv preprint arXiv:2006.10726* (2020).
- [2] Qin Wang et al. "Continual test-time domain adaptation". In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2022, pp. 7201–7211.