Sensor, Signal & Information Processing (SenSIP) Center
Ira A. Fulton School of Engineering, Arizona State University
SenSIP Center
GWC 411 | PO Box 875706
Arizona State University
Tempe, AZ 85287-5706
480 965 5311 (Phone)
480 965 8325 (Fax)
sensip@asu.edu

SenSIP Seminar Series

Unsupervised Audio Source Separation using Generative Priors

Presenter: Vivek Narayanaswamy, PhD Student in ECEE

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Abstract

State-of-the-art under-determined audio source separation systems rely on supervised end-end training of carefully tailored neural network architectures operating either in the time or the spectral domain. However, these methods are severely challenged in terms of requiring access to expensive source level labeled data and being specific to a given set of sources and the mixing process, which demands complete re-training when those assumptions change. This strongly emphasizes the need for unsupervised methods that can leverage the recent advances in data-driven modeling, and compensate for the lack of labeled data through meaningful priors. To this end, we propose a novel approach for audio source separation based on generative priors trained on individual sources. Through the use of projected gradient descent optimization, our approach simultaneously searches in the source-specific latent spaces to effectively recover the constituent sources. Though the generative priors can be defined in the time domain directly, e.g. WaveGAN, we find that using spectral domain loss functions for our optimization leads to good-quality source estimates. Our empirical studies on standard spoken digit and instrument datasets clearly demonstrate the effectiveness of our approach over classical as well as state-of-the-art unsupervised baselines.

Biography:

Vivek Sivaraman Narayanaswamy received his bachelor's degree in electronics and communication engineering from S.S.N College of Engineering, Anna University, Tamil Nadu, India, in 2017. He is currently a Ph.D. student in the school of electrical, computer and energy engineering at ASU, Tempe, AZ. He has interned with Lawrence Livermore National Laboratory (LLC) during the summers of both 2019 and 2020 where he worked upon developing solutions for inverse problems and explainable AI respectively. He also interned with Qualcomm R&D during the summer of 2018. His research interests include applications of machine learning for signal processing applications. In particular, he works in using machine leaning for speech and audio applications, inverse problems, and explainable AI. He is also keenly interested in working upon machine learning tools that can be utilized for solar array monitoring.

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