Echo-aware signal processing for audio scene analysis

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Echo-aware Dataset

Summary of contributions

How to estimate them?

In passive stereo scenario:

- Learning-based method
  - off grid estimation
  - depends on source and # echoes
- Analytical method
  - estimation on first echo' TDOAs
  - only on synthetic data

How to use them?

- Source Localization
  - allow 2D DoA estimation with 2 mic
  - depends on the echo estimator
- Source Separation
- Speech Enhancement
  - in theory early echoes helps
  - needs to be accurately estimated
- Room Geometry Estimation

Where to find them?

- `dEchorate`
  Echo-aware database for both estimation and application
  - echo annotation $\Leftrightarrow$ geometry annotation
  - synthetic $\Leftrightarrow$ real RIRs

Echo-aware perspective

Directions for future work:

- on **estimation**
  - develop theoretical guaranties for off-grid acoustic echo retrieval
  - for DNN: extended physic-based learning or other learning paradigm (i.e., unfolding or curriculum learning)
- on **application**
  - other field of echoes: (Seismology, Underwater acoustic, Volcanology, Sniper Detection, etc.)
- on `dEchorate`
  - Synthetic to Real RIRs (style transfer, new types to acoustic simulators)
- **"close the loop":** audio analysis $\Leftrightarrow$ echo estimation

List of publications and artifacts

Publications

- Estimation
  - deep learning method in [Di Carlo et al., 2019]
  - `Blaster`— analytical methods in [Di Carlo et al., 2020]
- Application
  - `Mirage`: sound source localization in [Di Carlo et al., 2019]
  - `Separake`: sound source separation in [Scheibler et al., 2018]
- Data
  - `dEchorate`: database (journal in progress)
- Other
  - Signal Processing CUP 2019 [Deleforge et al., 2019]
  - LOCATA Challenge 2019 [Lebarbenchon et al., 2018]
  - Collaboration with Honda on multichannel `Mirage`

Code

- `dEchorate`: GUI and code for `dEchorate`
- `Risotto`: library for ReTF estimation
- `Brioche`: library for Spatial filtering
- `pyMBSSLocate`: MBSSLocate in Python
- `Separake`: Multichannel NMF in Python

Thank you!

References i

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