

ECHO-AWARE signal processing for audio scene analysis

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Introduction

Image animation here

Sound recorded by microphones carries

Semantic information about source nature and content

Temporal information

Spatial information about due to *sound propagation*

Audio Scene Analysis

- extraction and organization of all the information in the sound
- typical *problems*
 - *Sound Source Separation*
 - *Speech Enhancement*
 - *Sound Source Localization*
 - *Room Geometry Estimation*
 - *Acoustic Measurements*
 - *Speaker Diarization*
 - *Automatic Speech Recognition*
 - *etc.*

Signal Processing

Microphone recordings x_i and sound sources s_j are (digital) signals

$$x_i(t) = (h_{ij} s_j)(t)$$

It is the role of mathematics and computer science

General Pipeline

- Models
- Representation
- Estimation
- Adaptive Processing

Acoustic Echoes

- Product of the sound propagation
- Sound repetition
 - “same” content: can be integrated
 - “different” sounds: carry info about the reflection
 - different direction of arrival: spatial information

Compromise

Between the full simplification and the full model

Thesis objective

1. provide new methodologies and data to process and estimate acoustic echoes
2. extend previous classical methods for audio scene analysis

Echo-aware signal
processing
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Introduction

Motivation

Outline

Modeling

From Physics to Digital Signal Processing

The Echo Model

Acoustic Echo Estimation

Literature Review

blaster

lantern

interim conclusion

Echo-aware Application

Projects

Modeling

Sound propagates and Green equation

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Acoustic Reflection

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Room Impulse Response

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Signal model in time domain

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Signal model in the discrete time domain

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Signal model in the frequency domain

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Approximations

Time Domain

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Frequency Domain

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Approximations

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Approximations

Echoes are off-grid by nature Sampling and quantization make them hard

Acoustic Echo Estimation

Image of taxonomy

Toxonomy

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Existing Approaches

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Echo-aware Application
