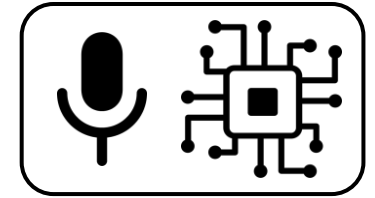# Computational Analysis of Sound and Music
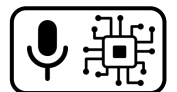
Audio Domains

Dr.-Ing. Jakob Abeßer
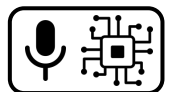
Fraunhofer IDMT

jakob.abesser@idmt.fraunhofer.de

Outline

- Audio Domains

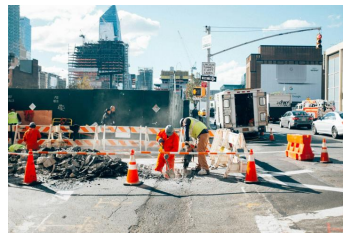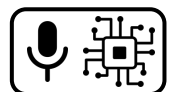- Tools

Audio Domains

Fig-A1-1

Fig-A1-3

Fig-A1-5

Aud-A1-1

Fig-A1-2

Fig-A1-4

Audio Domains

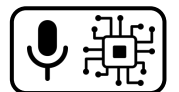## Music Information Retrieval

- Tasks

  - Music Transcription

  - Instrument Recognition

  - Beat Tracking

Fig-A1-2

- Main challenges

  - Overlapping harmonic components (consonant intervals)

  - Temporal overlap (shared rhythmic structure)

  - Variability within instrument recordings (playing techniques)
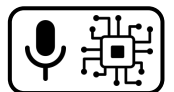
Audio Domains

Everyday Sounds/Scenes

- Tasks

  - Sound Event Detection

  - Acoustic Scene Classification

- Main challenges

  - Large variability of sound sources characteristics

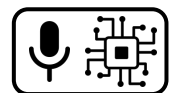 - Generalization across geographical locations

Fig-A1-3

Audio Domains

Urban Sound Analysis

- Tasks

    - SED

    - Vehicle detection & classification

- Main challenges

    - Complex & dynamic soundscapes

    - Strong sound overlap

    - Sound composition depends on time of day / weather
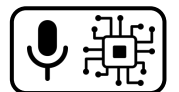

Fig-A1-4

Audio Domains

Bioacoustics

- Task

    - Animal species classification

- Main challenges

    - High sound variability between and within species

    - Background noise (climate, environmental sounds)

    - Data scarcity (annotation requires domain knowledge)
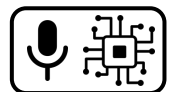

Fig-A1-5

Audio Domains

Industrial Sound Analysis

- Tasks

  - Classify operating condition

  - Acoustic anomaly detection

- Main challenges

  - Location-dependent background noises

  - High sound variability (machinery type & operating condition)

  - Real-time processing requirements
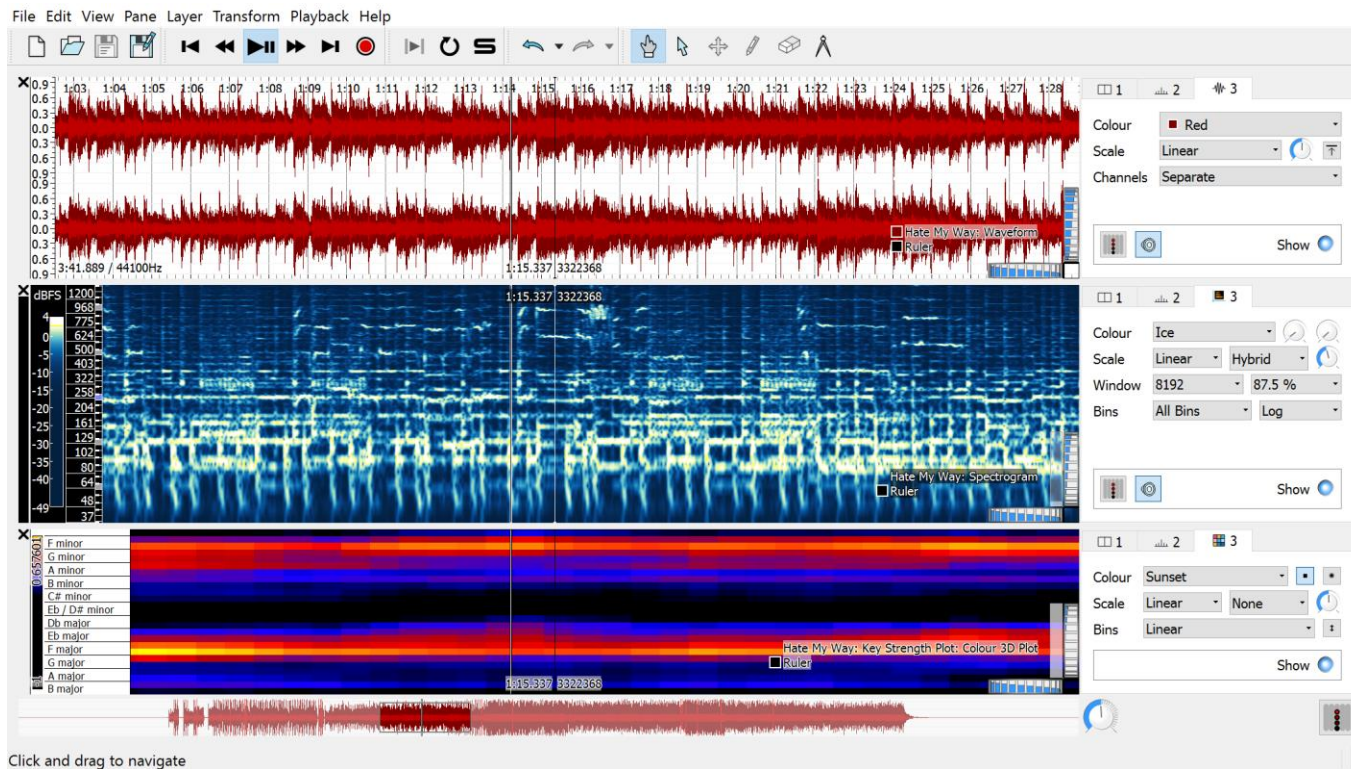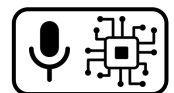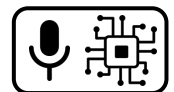

Fig-A1-6

Tools

Sonic Visualiser

- https://www.sonicvisualiser.org/

Fig-A1-11

Tools

Audacity

- https://www.audacity.de/
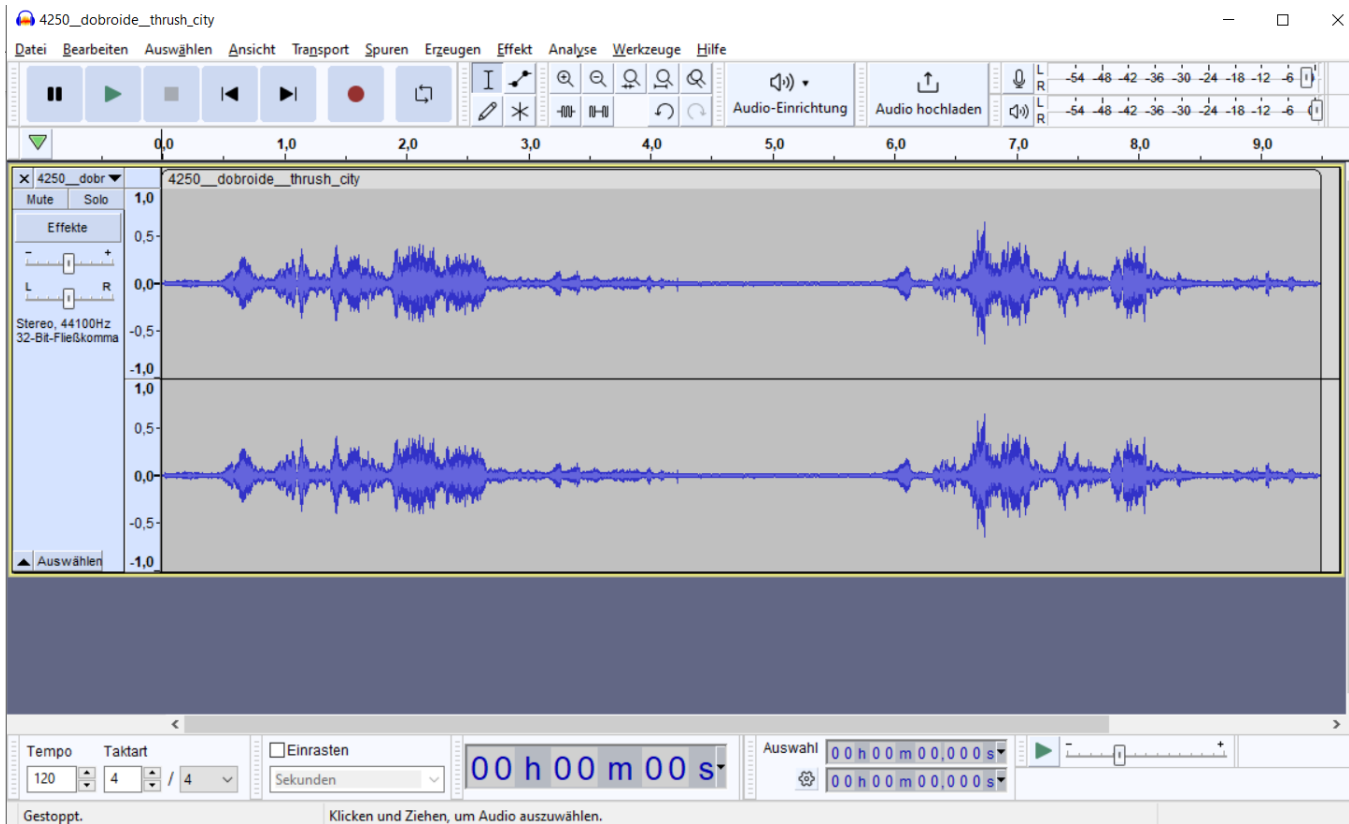

Own

References

Images

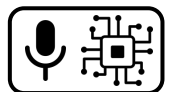Fig-A1-1: https://unsplash.com/de/fotos/junge-sitzt-auf-weissem-tuch-umgeben-von-spielzeug-p0hDztR46cw

Fig-A1-2: https://unsplash.com/de/fotos/menschen-die-tagsuber-bechertrommeln-spielen-OJ4m4_yIgjY

Fig-A1-3: https://unsplash.com/de/fotos/personen-die-tagsuber-auf-der-strasse-vorbeifahren-UIigFW4P7L8

Fig-A1-4: https://unsplash.com/de/fotos/bauarbeiter-auf-der-strasse-WJg2bynUWOk

Fig-A1-5: https://unsplash.com/de/fotos/tierfotografie-flamingoschwarm-ub1sSvJ_Tbs

Fig-A1-6: https://unsplash.com/de/fotos/mann-in-blauer-jacke-neben-braunem-holzpfosten-hkJNx0EDbjE

References

Audio

Aud-A1-1: Medley

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– GR3AVE5Y , Djembe Loop, CC BY 4.0, https://freesound.org/people/GR3AVE5Y/sounds/149109

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– trouby, flamingos, CC BY 4.0, https://freesound.org/people/trouby/sounds/362387