Machine Listening for Music and Sound Analysis

Dr.-Ing. Jakob Abeßer
Fraunhofer IDMT

Jakob.abesser@idmt.fraunhofer.de

Fraunhofer IDMT

Machine Listening

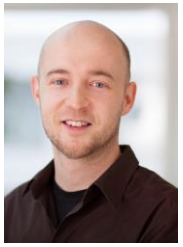
Combine **signal processing** and

machine learning to **extract**

information from **sound & music**

About Us

- Lecture
  - Dr.-Ing. Jakob Abeßer
    - Senior Scientist @ Fraunhofer IDMT
    - https://jakobabesser.github.io/

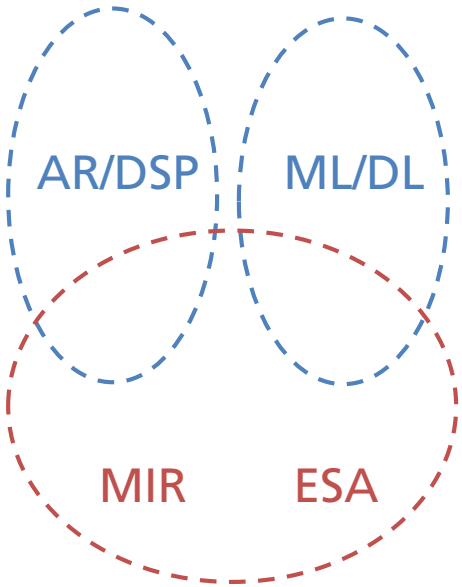


- Seminars
  - Dipl.-Ing. Christian Kehling
    - PhD Student @ TU Ilmenau / Fraunhofer IDMT

  - Dipl.-Inf. Michael Taenzer
    - PhD Student @ Fraunhofer IDMT

Overview

- Lecture Structure
  - Fundamentals
    - L1 - Audio Representations & DSP
      - 24.11.2021
    - L2 - Machine Learning & Deep Learning
      - 01.12.2021
  - Applications
    - L3 & L4 - Music Information Retrieval
      - 08.12.2021 & 15.12.2021
    - L5 & L6 - Environmental Sound Analysis
      - 05.01.2022 & 12.01.2021



Own

Overview

- Additional Content
  - Insights into projects & current research @ Fraunhofer IDMT
  - Open student topics

Overview

- Seminar Structure
  - S1 – Introduction to Python programming (19.11.2021)
  - S2 – Basics: Audio processing, machine learning, and deep learning (03.12.2021)
  - S3 – Music classification (17.12.2021)
  - S4 – Sound classification (14.01.2022)
- Notes
  - Programming in IPython notebooks / Google Colaboratory
  - Additional course material (audio samples, libraries)

Course Website

https://www.machinelistening.de

Further Resources: Books

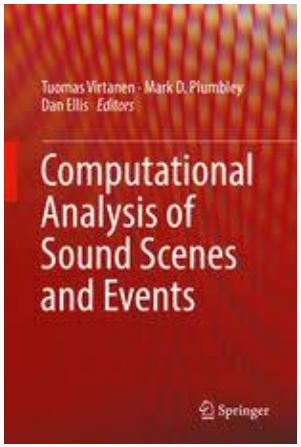


Fig. 1

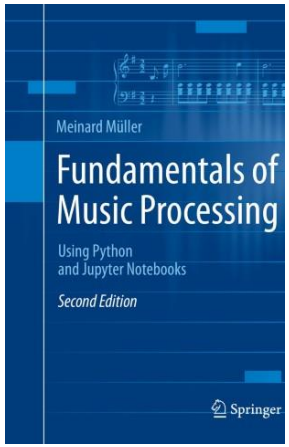


Fig. 2

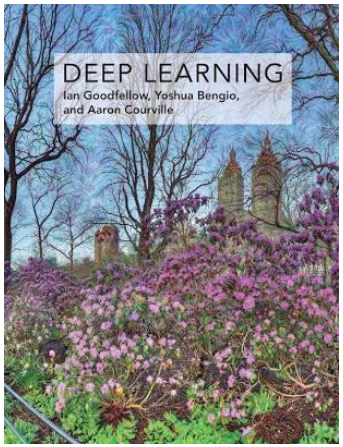


Fig. 3

- Virtanen, T., Plumbley, Mark D., and Ellis, Dan: Computational Analysis of Sound Scenes and Events, Springer, 2018.
- Müller, M.: Fundamentals of Music Processing – Using Python and Jupyter Notebooks, Springer, 2021.
- Goodfellow, I., Bengio, Y., and Courvill, A.: Deep Learning, The MIT Press, 2016.

Further Resources: Webpages

- Machine Learning / Deep Learning
  - https://www.deeplearningbook.org/
  - http://www.coursera.org (online courses)
  - http://www.udemy.com (online courses)
  - https://machinelearningmastery.com/deep-learning-books/

Further Resources: Webpages

- Music Information Retrieval
  - https://www.audiolabs-erlangen.de/FMP (iPython notebooks)
  - https://musicinformationretrieval.com (iPython notebooks)
  - https://audiolabs-erlangen.de/PCP (Preparation Course Python Notebooks)
  - https://github.com/meinardmueller/libfmp (Python package for music processing)
  - https://github.com/meinardmueller/synctoolbox (Music synchronization)
  - https://github.com/meinardmueller/libtsm (Time-scale modifications & pitch shifting)

Further Resources: Webpages

- Environmental Sound Recognition
  - http://dcase.community/ (DCASE challenges & workshop)

Further Resources: Programming Libraries

- General
  - numpy, scipy, scikit-learn, matplotlib, pandas
- Machine Learning / Deep Learning
  - scikit-learn, tensorflow, keras, (pytorch)
- Audio & Music Processing (Python)
  - pysox, soundfile (audio I/O & manipulation)
  - librosa, madmon, libfmp, synctoolbox, libtsm (audio & music processing
  - Music21, MeloSpyLib (symbolic music processing)
  - (MIR Toolbox – Matlab)

Acknowledgments

- Meinard Müller (International Audio Laboratories)
- Sebastian Stober (Otto-von-Guericke-University Magdeburg)
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- Christian Dittmar (Fraunhofer IIS)
- Estefanía Cano Ceron (AudioSourceRE)
- Christof Weiß (International Audio Laboratories)
- Daniel Gärtner (MusicDNA)

Images

Fig. 1: https://media.springernature.com/w306/springer-static/cover-hires/book/978-3-319-63450-0

Fig. 2: https://media.springernature.com/w306/springer-static/cover-hires/book/978-3-030-69808-9

Fig. 3: https://mitpress.mit.edu/books/deep-learning