

# AI-based Audio Analysis of Music and Soundscapes

## Introduction

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# Lectures

- Dr.-Ing. Jakob Abeßer
  - Senior scientist @ Fraunhofer IDMT
  - Ongoing habilitation (machine listening)
  - <https://jakobabesser.github.io/>



- Prof. Dr. Martin Pfeleiderer
  - ...



# Seminar Structure

## Foundations

Audio  
Processing

Machine  
Learning &  
Deep Learning

## Programming

Python

## Research Project

Research Question

Computational  
Modeling

Analysis

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# Seminar Structure

- Seminar 1
    - Introduction
    - Fundamentals of Python Programming
  - Seminar 2 & 3
    - Audio Processing
    - Introduction to Research Project Topics
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# Seminar Structure

- Seminar 4
    - Machine Learning
  - Seminar 5
    - Deep Learning
  - Seminar 6 & 7
    - Project Work
  - Seminar 8
    - Project Presentation
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# Machine Listening

Combine **signal processing** and  
**machine learning** to **extract**  
**information** from and to **make**  
**sense of audio signals**

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# Course Website

<https://machinelisting.github.io/>

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# Further Resources: Books

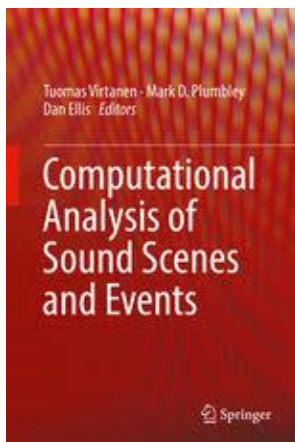


Fig. 1

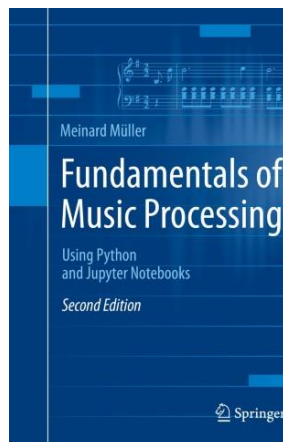


Fig. 2

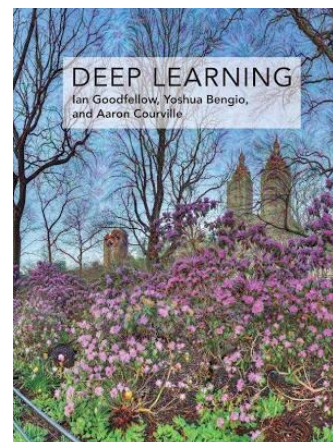


Fig. 3

- 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.
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# 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/>
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# 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)
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# Further Resources: Webpages

- Environmental / Everyday Sound Analysis
  - <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, madmom, libfmp, synctoolbox, libtsm (audio & music processing)
    - Music21, MeloSpyLib (symbolic music processing)
    - (MIR Toolbox – Matlab)
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# Acknowledgements

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

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