

AI-based Audio Analysis of Music and Soundscapes

Introduction

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Seminar Structure

Programming

Python

Foundations

Audio
Processing

Machine
Learning &
Deep Learning

Research Project

Research Question

Computational
Modeling

Analysis

Seminar Structure

- Seminar 1
 - Introduction
 - Python Programming Basics
- Seminar 2 & 3
 - Audio Processing
 - Research Project Introduction & Topics

Seminar Structure

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

Machine Listening

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

Course Website



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



Further Resources: Books



Fig. 1

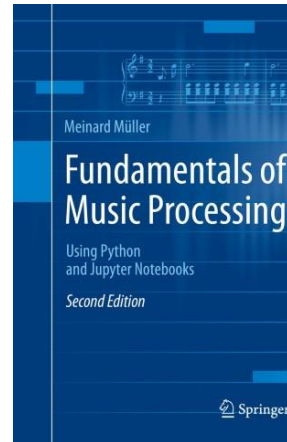


Fig. 2

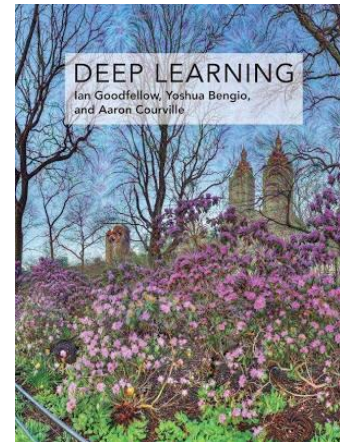


Fig. 3

- 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

- <https://scikit-learn.org/> (tutorials)

- 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)

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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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>