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://machinelistening.github.io/

Further Resources: Books

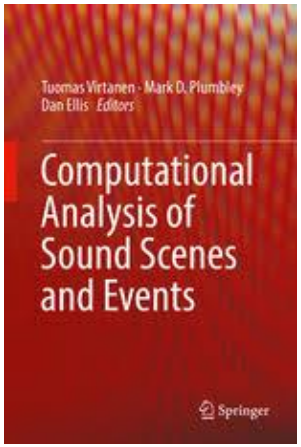

Fig. 1

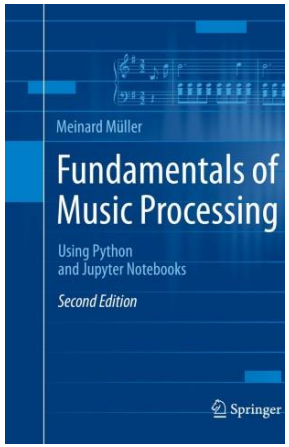

Fig. 2

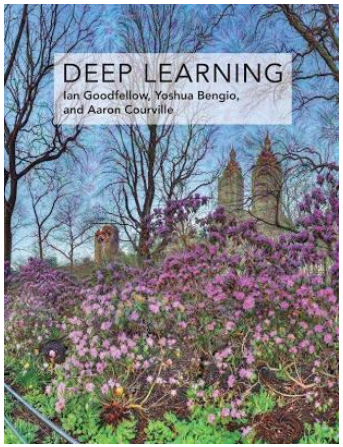

Fig. 3

- 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/

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, madmon, libfmp, synctoolbox, libtsm (audio & music processing
  - Music21, MeloSpyLib (symbolic music processing)
  - (MIR Toolbox – Matlab)

Acknowledgements

- Meinard Müller (International Audio Laboratories)
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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