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# Machine Listening for Music and Sound Analysis

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# About Us

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## ■ Lecture

- Dr.-Ing. Jakob Abeßer

- Senior Scientist @ Fraunhofer IDMT

- <https://jakobabesser.github.io/>



## ■ Seminars

- Dipl.-Ing. Christian Kehling

- PhD Student @ TU Ilmenau / Fraunhofer IDMT



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# Machine Listening

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Combine **signal processing** and  
**machine learning** to extract  
**information from sound & music**

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# Overview

## ■ Lecture Structure

### ■ Fundamentals

#### ■ L1 - Audio Representations & DSP

■ 15.11.2022

#### ■ L2 - Machine Learning & Deep Learning

■ 16.11.2022

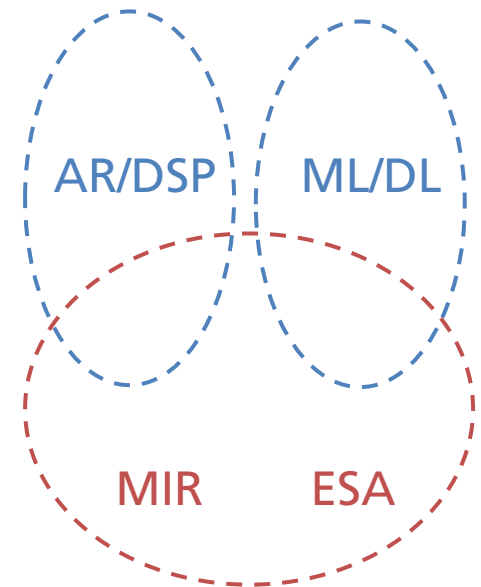
### ■ Applications

#### ■ L3 & L4 - Music Information Retrieval

■ 22.11.2022 & 23.11.2022

#### ■ L5 & L6 - Environmental Sound Analysis

■ 29.11.2022 & 30.11.2022



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# Overview

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

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# Overview

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## ■ Seminar Structure

- S1 – Introduction to Python programming, Audio Processing ([18.11.2022](#))
- S2 – Music classification ([25.11.2022](#))
- S3 – Sound classification ([02.12.2022](#))

## ■ Notes

- Programming in IPython notebooks / Google Colaboratory
  - Additional course material (audio samples, libraries)
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# Course Website

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<https://machinelisting.github.io>

# Further Resources: Books



Fig. 1

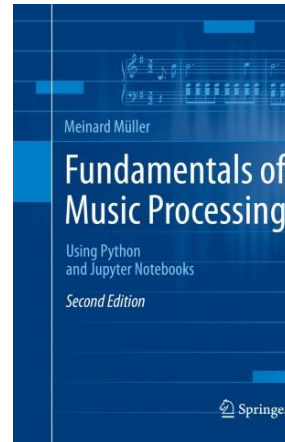


Fig. 2

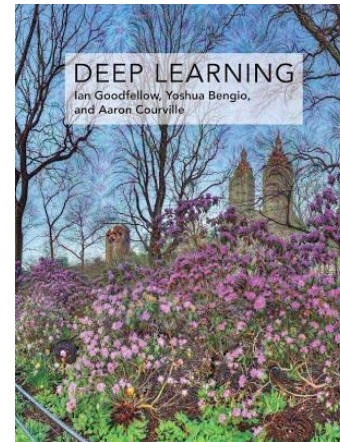


Fig. 3

- 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.



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# Further Resources: Webpages

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- 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

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- 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)

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# Further Resources: Webpages

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

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# Further Resources: Programming Libraries

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- 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)

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# Images

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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>