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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**

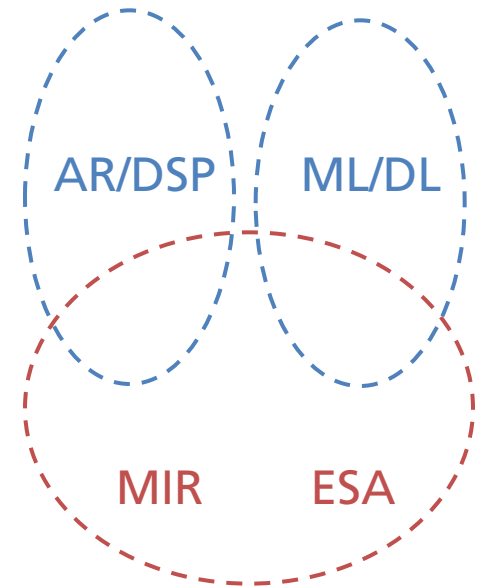
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# Overview

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- Lecture Structure
  - **Fundamentals**
    - L1 - Audio Representations & DSP
      - [14.11.2023](#)
    - L2 - Machine Learning & Deep Learning
      - [15.11.2023](#)
  - **Applications**
    - L3 & L4 - Music Information Retrieval
      - [21.11.2023](#) & [22.11.2023](#)
    - L5 & L6 - Environmental Sound Analysis
      - [28.11.2023](#) & [29.11.2023](#)



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# Overview

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- Seminar Structure
  - S1 – Intro to Python programming, Audio Processing ([16.11.2023](#))
  - S2 – Music classification ([23.11.2023](#))
  - S3 – Sound classification ([30.11.2023](#))
  
- Notes
  - Programming in IPython notebooks / Google Colaboratory
  - Additional course material (audio samples, libraries)

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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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# Course Website

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[\*\*https://machinelearning.github.io\*\*](https://machinelearning.github.io)

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# Further Resources: Books

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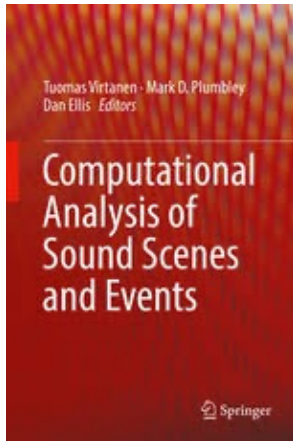


Fig. 1

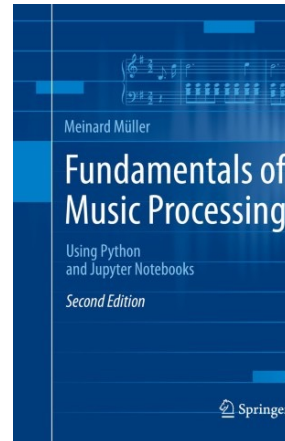


Fig. 2

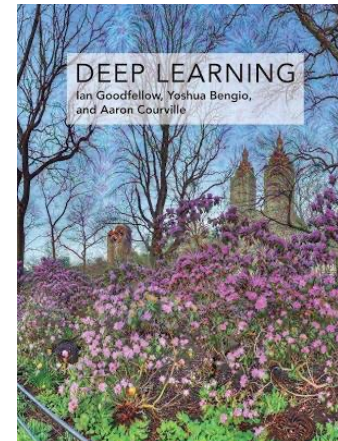


Fig. 3

- 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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- Python
  - <https://audiolabs-erlangen.de/PCP> (Preparation Course Python)
- Digital Signal Processing
  - <https://brianmcfree.net/dstbook-site/content/intro.html> (Digital Signals Theory – online book)

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# Further Resources: Webpages

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

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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)
- 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, pytorch
- Audio & Music Processing (Python)
  - pysox, soundfile (audio I/O & manipulation)
  - librosa, madmon
  - libfmp, synctoolbox, libtsm (audio & music processing)

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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>