

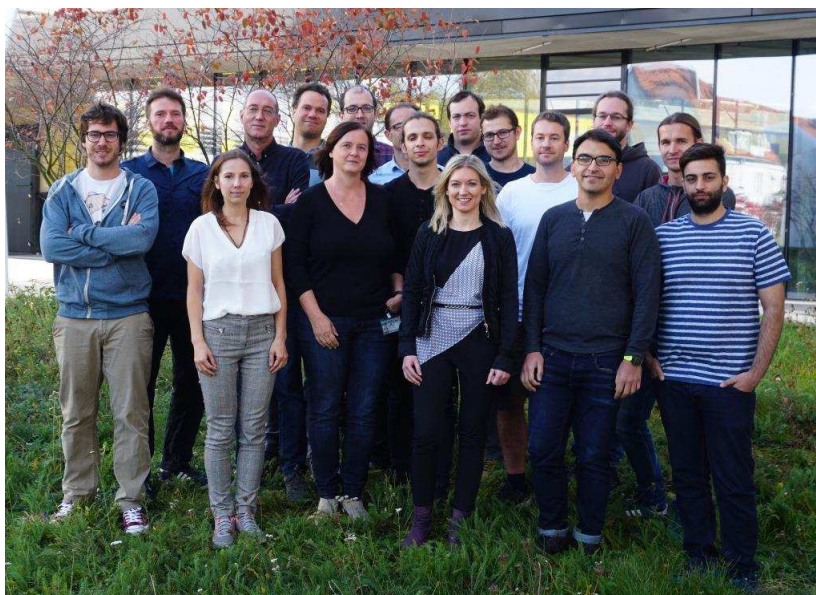
Completing a PhD at CP.JKU



Gerhard Widmer
Institute of Computational Perception
Johannes Kepler University (JKU) Linz



The Institute for Computational Perception (CP.JKU)



RECENT (AND (SOON-TO-BE-)SUBMITTED) PhD THESES

Andreas **Arzt** (2016). Flexible and Robust Music Tracking.

Bruce **Ferwerda** (2016). Improving Music Recommender Systems through Personality and Cultural Information.

Sebastian **Böck** (2016). Event Detection in Musical Audio. Beyond Simple Feature Design. 2016.

Florian **Krebs** (2016). Metrical Analysis of Musical Audio Using Probabilistic Models. 2016.

Reinhard **Sonnleitner** (2017).
Audio Identification via Fingerprinting. Achieving Robustness to Severe Signal Modifications. 2017.

Jan **Schlüter** (2017).
Deep Learning for Event Detection, Sequence Labeling and Similarity Estimation in Music Signals. 2017.

Carlos **Cancino Chacon** (2018, submitted).
Computational Modeling of Expressive Music Performance with Linear and Non-linear Basis Function Models.

Filip **Korzeniowski**. (2018, submitted). Harmonic Analysis of Musical Audio Using Deep Neural Networks.

Matthias **Dorfer** (2018, submitted).
Multimodal Deep Representation Learning and its Application to Audio and Sheet Music.

Bernhard **Lehner** (2018, submitted). Singing Voice Detection in Mixed Music Signals.

Richard **Vogl**. (2018, in prep). Drum Transcription and Drum Pattern Variation. Deep Learning-based Methods.

Stefan **Lattner**.

A PROTOTYPICAL EXAMPLE

Florian Krebs

- PhD research period: 2011-2016



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UNIVERSITY LINZ

Submitted by
Florian Krebs
Submitted at
Department of Computational Perception
Supervisor and
First Examiner
Gerhard Widmer
Second Examiner
Geoffroy Peeters
November 2016

Metrical Analysis of Musical Audio Using Probabilistic Models



Doctoral Thesis
to obtain the academic degree of
Doktor der technischen Wissenschaften
in the Doctoral Program
Technische Wissenschaften

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Florian Krebs: Metrical Analysis of Musical Audio Using Probabilistic Models (2011-2016)

Scientific Career:

- M.Sc. in Electrical Engineering and Sound Engineering
(Graz University of Technology and University of Music and Performing Arts Graz)
(had also studied Medicine for a couple of semesters)
- PhD research at CP.JKU: 2011-2016
- Now with Joanneum Research Graz (Austria), working on audio analysis (e.g., for traffic surveillance and safety)



Florian Krebs: Metrical Analysis of Musical Audio Using Probabilistic Models (2011-2016)

Progress of Thesis Work:

- Started out without a thesis proposal, but with a broad topic:
"Look at probabilistic models of modelling and extracting rhythm from music (audio)"
- Started by reproducing the state of the art (the probabilistic models by Whiteley, Cemgil & Godsill, originally designed for MIDI)
- Gradually and systematically extended this into powerful beat tracking and rhythm identification systems that redefined the state of the art
- Wrote a very clear and well-structured thesis
- ... and in the process became an expert in probabilistic models, also helping me with teaching ...



Florian Krebs: Metrical Analysis of Musical Audio Using Probabilistic Models (2011-2016)

International Cooperation:

- Research visit at the Department of Computer Engineering, Bogaziçi University Istanbul (Ali T. Cemgil)
- Result: joint work and joint journal article:
F. Krebs, A. Holzapfel, A. T. Cemgil, and G. Widmer. Inferring Metrical Structure in Music Using Particle Filters. *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, 23(5):817–827, 2015.

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Florian Krebs: Metrical Analysis of Musical Audio Using Probabilistic Models (2011-2016)

Participation in Scientific Challenges and Competitions:

- 2012-2016 Audio Beat Tracking evaluation exchange (MIREX):
3 times first place, two times second place and four times third place.
- 2012 Audio Tempo Extraction evaluation exchange (MIREX): First place
- 2014-2016 Audio Downbeat Estimation evaluation exchange (MIREX): 9 times first place.
- IEEE Beat Tracking Challenge 2017: Second Place

Best Paper Award (collaboration):

T. Collins, S. Böck, F. Krebs, and G. Widmer: Bridging the Audio-symbolic Gap: The Discovery of Repeated Note Content Directly from Polyphonic Music Audio. *AES 53rd International Conference on Semantic Audio*, London, 2014.

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Contribution of Open Data and Software:

- Published beat and downbeat annotations for the Ballroom dataset (685 audio recordings, total length of 5h 57m, 43,838 beat annotations)
- Published his code (Matlab, Python)
- Made contributions to audio analysis library *madmom*

Other Service to the Scientific Community:

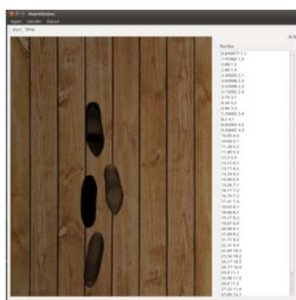
- Reviewer for conferences and journals
- Task Captain in the MIREX evaluation exchange from 2014-2016

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FLORIAN KREBS: Metrical Analysis of Musical Audio Using Probabilistic Models (2011-2016)

Science Communication to the General Public:

- Automatic Dance Instructor
- Drumotron 3000 (listening drum robot, for demos to children and students)
- Contributions to RoboD (for *Be Open Science & Society Festival Vienna*, 2018)



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A FEW PIECES OF ADVICE

Be patient and thorough

- First: master and reproduce the state of the art
- Don't think of revolutionising the field before understanding what already exists
- Start from something you know, and start with a small step

Be ambitious

- Compete with the best – participate in challenges

<https://www.jku.at/en/institute-of-computational-perception/about-us/awards/>

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A FEW PIECES OF ADVICE

Be open

- to collaboration with colleagues (and benefitting from their knowledge)
- to your scientific community: share your code and your data

<https://github.com/CPJKU/madmom>

<https://transactions.ismir.net/articles/10.5334/tismir.12/>

- to the general public (which ultimately supports your research)

Be aware of your privileges – and enjoy them.

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