



Learning about music with MIR

WIMIR Workshop 2019
Delft, The Netherlands

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Research Interests

- Sound source separation
- MIR in music education
- Computational musicology

Saxophone

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Research Interests

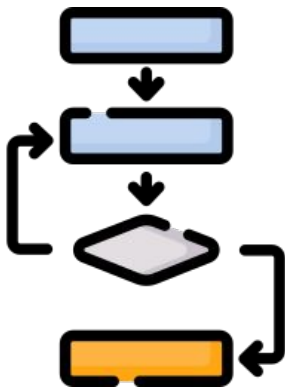
- MIR in music education
- Machine Listening
- Semi-supervised Learning

Bass guitar, Percussion

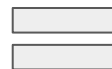
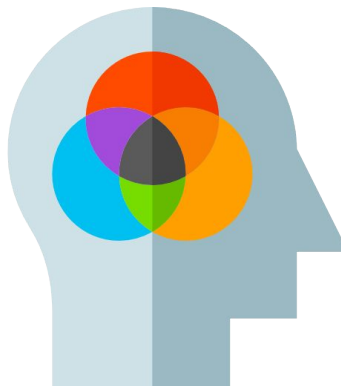
Goals

- Explore ways in which we can gain new knowledge about music using MIR techniques and human musical expertise.

MIR techniques



Human musical expertise



Music knowledge

Our proposed workflow



Start with a research question

What does John Coltrane have in common with Cannonball Adderley?

What are the tuning characteristics of the harpsichord?

Which cues do musicians use to control ensemble intonation?

What characterizes lilt in Shetland fiddle music?



Find the most suitable data

Audio files

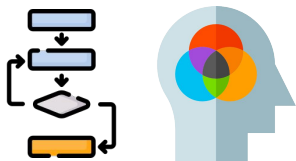
Transcriptions

MIDI files

Scores

Videos

Our proposed workflow



Define the method to process the data

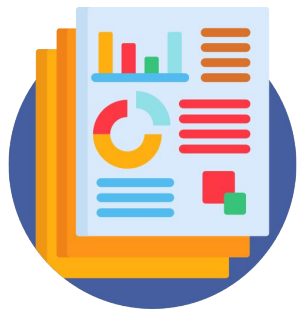
Do I need a computational tool for every step?
Are existing computational tools reliable enough?
Where is expert knowledge required?
Do my collaborators find the methods suitable and efficient?
Is this the most efficient yet reliable way of processing my data?
What are possible sources of error?



Analyze your results

Statistical analysis
Validate with users
Metrics
Error analysis

Our proposed workflow



Report your findings

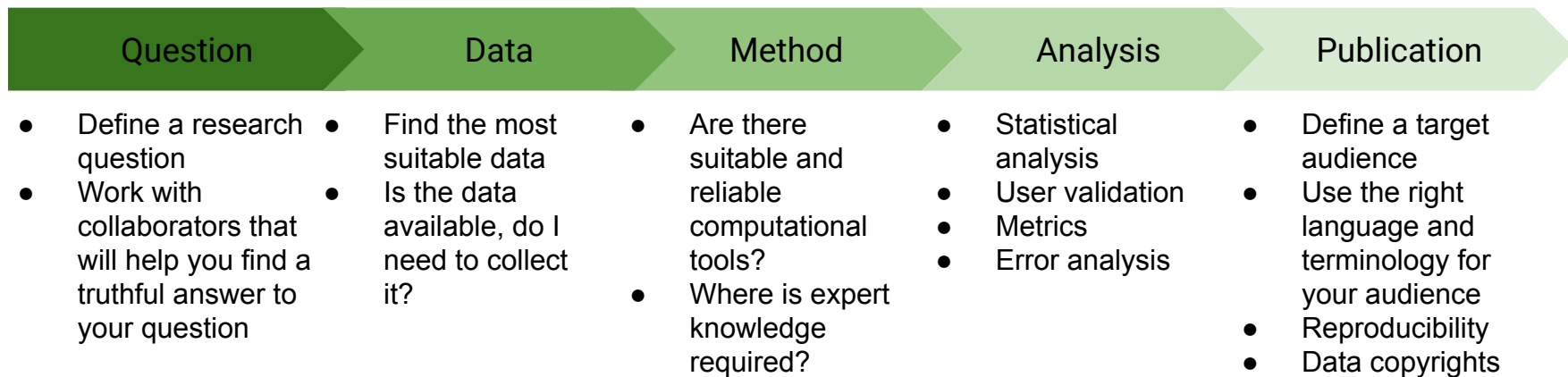
Who is my audience? Musicians, engineers, data scientists, artists?

How can I guarantee longevity for my research?

Is reproducibility an issue/requirement?

Are there any copyrights considerations with my data?

In summary



Past experiences - Music Performance Analysis

Task: Microtiming analysis of Shetland fiddle music [1]

Data: Fiddle recordings from the Tobar and Dulchais platform ([here](#))

Method:



Lessons learned:

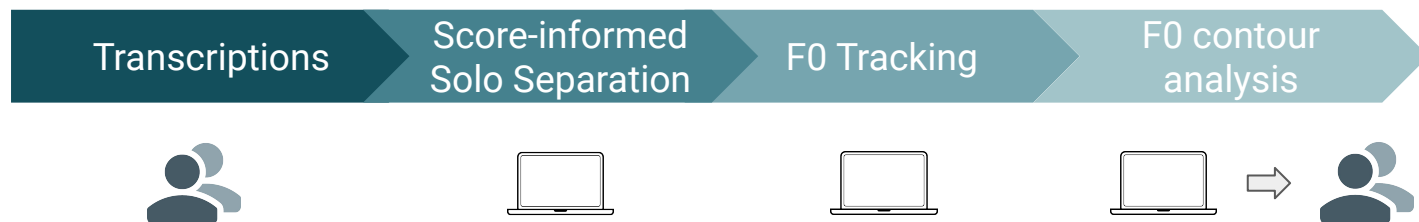
- MIDI-audio synch tools are reliable for this type of analysis
- There are characteristic patterns of beat duration, usually in the form of a long-short sequence

Past Experiences - Music Performance Analysis

Task: Intonation analysis in monophonic jazz improvisations [2,3]

Data: Weimar Jazz Database (audio + manual melody transcriptions) ([here](#))

Method:



Lessons learned:

- Score-informed F0 tracking is more promising for analysis of audio mixtures
- Intonation (sharp vs. flat), vibrato rate, and tone intensity (vs. pitch, duration, and position within a phrase) depend on the artist & instrument

Past Experiences - Feature Analysis

Task: Cauca Flutes Analysis - Instrument characterization

Data: Field and studio recordings from the Músicas Regionales Archive, Colombia

Method:



Lessons learned:

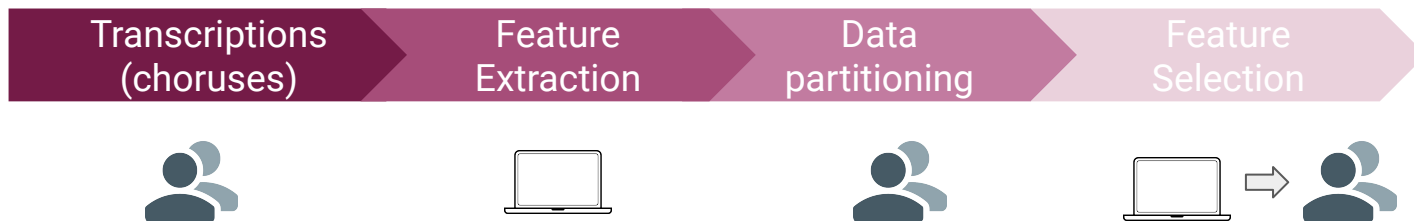
- Workflow needs to be optimized for a large-scale analysis
- Clear deviations from equal temperament observed

Past Experiences - Feature Analysis

Task: Finding distinctive features for jazz improvisation subsets (style, artist ...)[4]

Data: Weimar Jazz Database (melody transcriptions + metadata) ([here](#))

Method:



Lessons learned:

- Extensive metadata allow for various dataset partitions
- Symbolic features (pitch, intervals, rhythm, meter, lines) facilitate musicological interpretation of feature selection results

Available Tools

Feature Extraction

- Essentia
 - <https://essentia.upf.edu/documentation/>
- Madmom
 - <https://madmom.readthedocs.io/en/latest/introduction.html>
- Jazzomat tools (symbolic feature extraction & pattern mining)
 - <https://jazzomat.hfm-weimar.de/download/download.html>

Available Tools

Transcription

- Melodia VAMP plugin (Predominant f_0 estimation)
 - <https://www.upf.edu/web/mtg/melodia>
- Silvet VAMP plugin (Polyphonic music transcription)
 - <https://code.soundsoftware.ac.uk/projects/silvet>
- Fraunhofer IDMT MusicBricks (Real-time pitch detection, music transcription, time stretching)
 - https://www.idmt.fraunhofer.de/en/business_units/m2d/musicbricks.html

Available Tools

Sound Separation

- Music Separation: OpenUnmix
 - <https://open.unmix.app/#/>

Segmentation

- Segmentation of field recordings Speech/Music: SEFIRE
 - <http://lgm.fri.uni-lj.si/portfolio-view/sefire/>

Machine Learning (Classification, Regression, etc.)

- Sci-kit Learn
 - <https://scikit-learn.org/stable/>

Available Tools

Various

- Sonic Visualizer Plugins
 - <https://www.vamp-plugins.org/download.html>
- Comp Music - MTG
 - <https://github.com/MTG/pycompmusic>
- Music21
 - <http://web.mit.edu/music21/doc/index.html>

References

- [1] Cano, E. & Beveridge, Scott (2019). [Microtiming Analysis in Shetland Fiddle Music](#). In Proceedings of the 20th Conference of the International Society for Music Information Retrieval ISMIR, Delft, The Netherlands.
- [2] Abeßer, J., Frieler, K., Cano, E., Pfeleiderer, M., & Zaddach, W.-G. (2017). [Score-Informed Analysis of Tuning, Intonation, Pitch Modulation, and Dynamics in Jazz Solos](#). IEEE/ACM Transactions on Audio, Speech and Language Processing, 25(1), 168-177. doi: 10.1109/TASLP.2016.2627186
- [3] Abeßer, J., & Frieler, K. (2017). [Score-informed audio analysis of jazz improvisation](#), in Pfeleiderer, M., Frieler, K., Abeßer, J., Zaddach, W.-G., & Burkhard, B. (Eds.). [Inside the Jazzomat. New Perspectives for Jazz Research](#). Mainz: Schott Campus (Open Access), pp. 97-129
- [4] Pfeleiderer, M., Abeßer, J. (2017). [Statistical Feature Selection: Searching for Musical Style](#), in Pfeleiderer, M., Frieler, K., Abeßer, J., Zaddach, W.-G., & Burkhard, B. (Eds.). [Inside the Jazzomat. New Perspectives for Jazz Research](#). Mainz: Schott Campus (Open Access), pp. 85-95

References

- All material available here: https://github.com/jakobabesser/WIMIR_2019
 - Slides
 - Jupyter Notebook (Feature Selection for Jazz Improvisation)