Introducing the Jazzomat project and the MeloPy library

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Introduction

The Jazzomat project comprises three main components:

- Building a large database of high-quality monophonic jazz solo transcriptions (Weimar Jazz Data Base, WJazzD).
- Developing of a open-source analysis library (using Python).
- Conduction music psychological experiments for tool evaluation.

Research Goals

- Description and classification of personal, historical, and genre-based jazz improvisation styles.
- Comparison of jazz improvisation with other music traditions (folk, classic, pop).
- Exploring cognitive foundations of improvisation in jazz.
- Testing existing theories of jazz improvisation:
  - patterns, licks, formulas,
  - chord-scale approach,
  - thematic and motivic improvisation.
- Evaluation of educational approaches to jazz improvisation.
- Improving statistical and computational methods in musicology and music information retrieval.

The Weimar Jazz Database

General features:

- Monophonic instruments (as, ts, ss, tp, tb).
- Representative sample of styles, soloists, genres, forms and tempos (blues, standard, modal, ballad, up-tempo etc.).
- Additional in-depth covering of selected players.
- High-quality, performance-oriented transcription data.
- Use of MIR-tools (Sonic Visualiser, Songs2See).

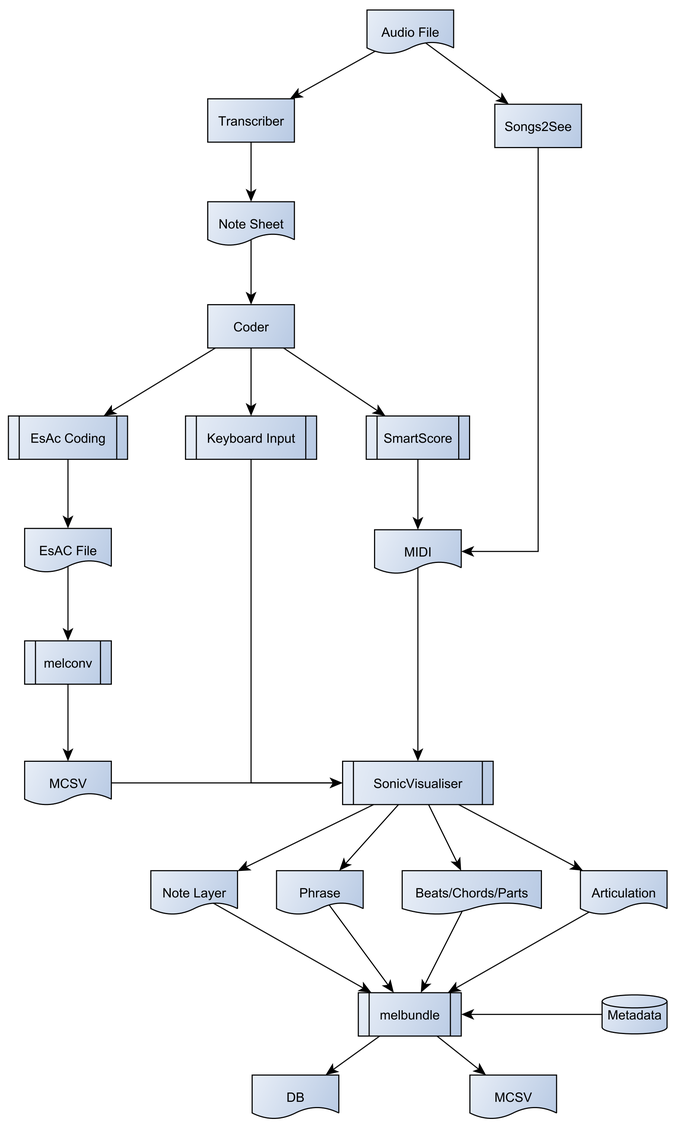

Fig. 1. Transcrition process flow.

Data features:

- Correctly timed onsets and durations (→ Microtiming studies)
- MIDI resolution of pitch.
- Manually annotated phrase structures.
- Metrical annotation with the help of newly developed algorithm.
- Chord and form annotation.
- Comprehensive meta-data.
- Annotated articulation and payling techniques.

MeloPy

General Features:

- Open-Source Python 2.7 Library (first release scheduled Fall 2013).
- Modules:
  - Input/output/conversion,
  - meta-data handling,
  - solo representations,
  - solo annotation (phrases, chords, structure),
  - melodic transformations,
  - fully scriptable "Feature machine",
  - visualisation tools (planned),
  - web application (planned).
- Configuration based on YAML.
- Connectivity to other systems such as Music21 ([2], planned).

Transformations (multiple view points, cf. [1])

- Pitch, pitch classes (absolute, chord-based, key-based).
- Intervals, interval classes, Parson's code.
- Contour representations.
- Durations, IOIs, IOI-ratios, duration classes.
- Metrical positions, metrical weights, metrical circle map.
- Perceptual accents.
- Cartesian products of transformationen.
- N-grams, Markov chains.
- . . . and many more

Segmentation types:

- Chorusses.
- Form parts.
- Phrases.
- Chords and chord types.
- Bars and metrical positions.
- Time windows.

Feature machine:

- Easy feature definition using YAML files.
- Arbitrary chaining of transformations and operators.
- Large selection of process modules (arithmetic, logic, thresholder, N-grams, statistics, pattern extraction etc.).
- Aggregation over segments.
- Machine-writable for automated feature generation and selection.
- Visual user-interface (planned).
- Customized R scripts for postprocessing and machine learning.

Research Focus: Patterns

- Patterns, formulas and licks are thought to be essential for jazz improvisation.
- Research questions:
  - How can patterns be defined?
  - How widely are they used?
  - Are there common traceable patterns between players?
  - Can patterns serve as feature for stylistic classification?
  - Is there something like a pattern archeology?
- **Example:** Absolute pitch patterns ("Finger paterns") in a solo by Michael Brecker (Fig. 2).

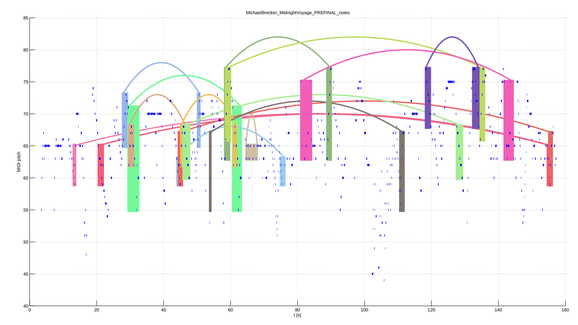

Fig. 2. Pitch patterns of Michael Brecker's solo on Midnight Voyage.

Research Focus: Descriptive Statistics

- Comparison of jazz solos and other melodic corpora using statistical features.
- Definition and mining of features for machine learning and classification.
- Melodic expectation and information dynamics.
- **Example:** Distribution of semitone intervals for a sample of 15 jazz solos (Fig. 3).

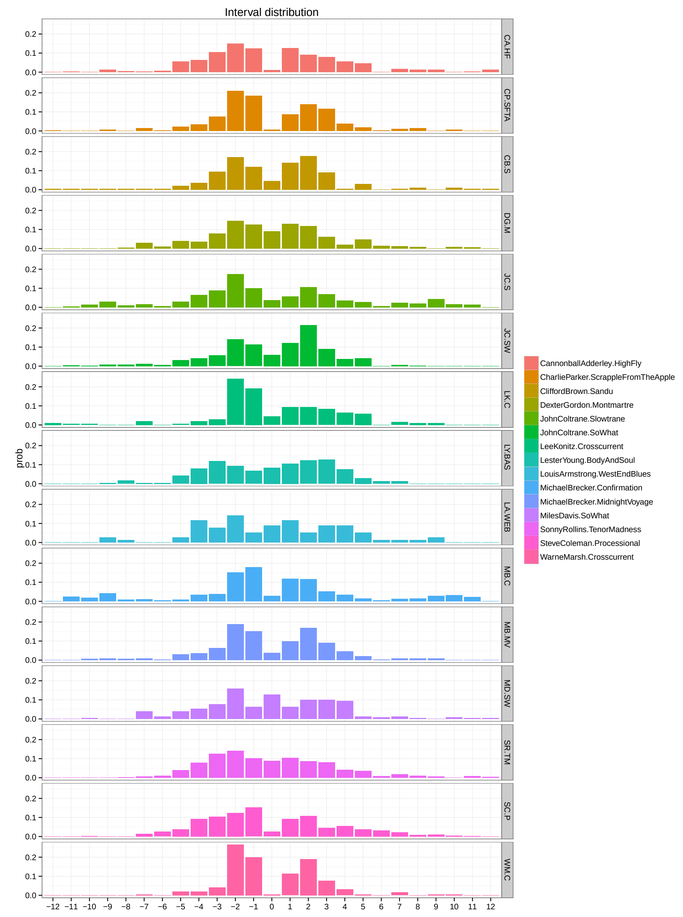

Fig. 3. Distributions of semitone intervals of 15 jazz solos.

Conclusion & Outlook

- Alread working pre-release version of the MeloPy library.
- Currently (May 2013) 50 jazz solo transcriptions in database.
- Over 6000 EsAC folk songs and 14.000 pop song melodies at hand.
- Connection to Music21 will open full `**kern` access and to many corpora more.
- Web site for online data analysis and retrieval planned for the future.

References

[1] Darrell Conklin and Christina Anagnostopoulou. Representation and discovery of multiple viewpoint patterns. In *Proceedings of the 2001 International Computer Music Conference*, San Francisco, 2001. ICMA.

[2] Michael Scott Cuthbert and Christopher Ariza. music21: A toolkit for computer-aided musicology and symbolic music data. In *Proceedings of the 11th International Symposium on Music Information Retrieval*, pages 637–642, 2010.