Dig that Lick: Exploring Patterns in Jazz Solos

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Digging into Data Conference, 29 January, 2020
The *Dig that Lick* Project (2017-2019)

- Full title: *Dig that lick: Analysing large-scale data for melodic patterns in jazz performances*
- Enhance existing **infrastructures** for the deployment of semantic audio analyses over large collections
- Facilitate access to large audio and metadata collections via **interfaces** for content selection, semantic analysis, and aggregation
- Use the developed infrastructure to **analyse the use of melodic patterns in a large jazz corpus**
- Relate analytic results to background knowledge to **trace and interpret musical influence** across time, space, cultures and societies
- Convince musicologists (!)
Data: Audio and Metadata

Data

Audio Datasets
- U.Columbia: ~10,000 tracks
- U.Illinois: ~30,000 tracks
- Jazz Encyclopedia: ~10,000 tracks

Discographies
- Up to 70,000 sessions

Linked Open Data
- LinkedJazz
- Wikipedia
- LoC
- Smithsonian
- VIAF

9,000 musicians + relationships
Metadata Ontology for Jazz
## Named Entity Resolution

<table>
<thead>
<tr>
<th>Name</th>
<th>ID</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlie Parker</td>
<td>39805</td>
<td>b</td>
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<tr>
<td>Charley Parker</td>
<td>3371</td>
<td>el-b</td>
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<td>Чарли Паркер</td>
<td>76</td>
<td>synt-b</td>
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<tr>
<td>Charlie “Bird” Parker</td>
<td>70</td>
<td>fretless-b</td>
</tr>
<tr>
<td>Charlie Parker and Dizzy Gillespie</td>
<td>10</td>
<td>string-b</td>
</tr>
<tr>
<td>Charlie Parker Quartet</td>
<td>9</td>
<td>fretless-el-b</td>
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<tr>
<td>Charlie Parker Quintet</td>
<td>8</td>
<td>el-fretless-b</td>
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<tr>
<td>Charlie Parker and his Orchestra</td>
<td>8</td>
<td>keyboard-b</td>
</tr>
<tr>
<td>Charlie Parker All Stars</td>
<td>5</td>
<td>amplified-b</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>bass</td>
</tr>
</tbody>
</table>

ca. early spring 1946

## Disambiguation

Bill Evans (p) ≠ Bill Evans (ss)

## Reconciliation

Armstrong, Louis, 1901-1971

Armstrong, Louis, 1900-1971
Automatic Main Melody Extraction

- Task: estimate the notes of the **main melody** from the complex mixture of melody and accompaniment
  - e.g. in jazz, the part played by the soloist
  - Useful for transcription, pattern extraction, recognising tunes, searching collections

- Main melody estimation algorithms usually have two stages:
  - **Computing a salience representation**: a time-frequency representation where the main melody pitches are salient
  - **Exploiting temporal information** to track pitch over time

- We trained a neural network to recognise main melody notes (convolutional-recurrent neural network with source-filter non-negative matrix factorisation pretraining)

- Results: generally successful, with some missed and extra notes, octave errors and semitone errors — Orig: 🎶 Est: 🎶 Mix: 🎶
Importance of **patterns** to **jazz** is well evidenced

- Ethnographic: how musicians learn and use licks
- Psychological: role of licks in improvisation
- General: fan-generated YouTube videos illustrate patterns, e.g. the remarkably popular 7-note pattern known simply as “The Lick”

Patterns can be melodic (absolute pitch, relative pitch – i.e. relative to key or local chords), rhythmic (absolute durations or relative to metrical structure), or both; here we focus on pitch

Expressed as **n-grams**

- Must meet minimum criteria (played multiple times, in multiple tracks, by multiple people)
- Levenshtein (edit) distance used for exact or inexact matching
DTL1000 Dataset

- 1000 tracks selected randomly from jazz collections (100 per decade from 1920-2019)
- Note tracks automatically extracted from monophonic solos
- 1700 solos, 6M pitch n-gram instances, 5.6M interval n-grams
- Metadata expressed in RDF using a bespoke ontology and accessed via SPARQL requests
- Metadata used to filter searches and shown in results
- Similarity search combines DTL1000 with the Weimar Jazz Database, Charlie Parker Omnibook and Essen Folk Song Collection
Pattern Search: List Results

Dixon et al.

Dig That Lick

Pattern Similarity Search

Similarity search
Pattern
-1,2,-1,3,3,3,-1,2
Transformation
Semitone Intervals

Pin pattern elements
First Last

Search

Options
Minimum similarity (80%)
60 70 80 90 100

Maximum length difference
Maximum edit distance
Minimum frequency

Keep overlapping instances
Within single phrase
Preserve contour (ascending)
Preserve pitch range (9)

Databases
Dig That Lick
Weimar Jazz Database
Charlie Parker Omnibook
EsAC Folksong Database

Found 82 similar (15 unique) pattern instances:

(44) (38)

<table>
<thead>
<tr>
<th>#</th>
<th>Pattern</th>
<th>Performer</th>
<th>Title</th>
<th>Recording year</th>
<th>Instrument</th>
<th>Style</th>
<th>Similarity</th>
<th>Edit distance</th>
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<tbody>
<tr>
<td>1</td>
<td>-1,2,-1,3,3,3,-1,2</td>
<td>Abraham Burton</td>
<td>Without a song</td>
<td>2013</td>
<td>Tenor saxophone</td>
<td>Hardbop</td>
<td>1.00</td>
<td>0</td>
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<td>2</td>
<td>-1,2,-1,3,3,3,-1,2</td>
<td>Art Pepper</td>
<td>How high the moon</td>
<td>1980</td>
<td>Alto saxophone</td>
<td>Cool</td>
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<td>Donna Lee</td>
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<td>Charlie Parker</td>
<td>Ko-Ko</td>
<td>1945</td>
<td>Alto saxophone</td>
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<td>Dexter Gordon</td>
<td>Cheese Cake</td>
<td>1962</td>
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<td>Hardbop</td>
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<td>Dexter Gordon</td>
<td>Society Red</td>
<td>1961</td>
<td>Tenor saxophone</td>
<td>Hardbop</td>
<td>1.00</td>
<td>0</td>
</tr>
</tbody>
</table>
Conclusions

- Data and interfaces for exploring melodic patterns in jazz solos
  - Multiple databases (human and automatic transcriptions, collections)
  - Audio and symbolic data
  - Metadata filters to constrain cultural context

- Challenges: data coverage and reliability
  - Limited availability of data, especially contextual metadata
  - Current methods only address monophonic instruments
  - Automatic transcription and metadata processing are error-prone

- Useful tools for case studies
  - To discover and trace the history of patterns
  - To investigate how jazz musicians draw on each other
  - To draw conclusions about influence of race, class, and value
Publications and Presentations


K. Gabbard, *What we are digging out of the data?*, 6th Rhythm Changes Conference, 2019.


Acknowledgements

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