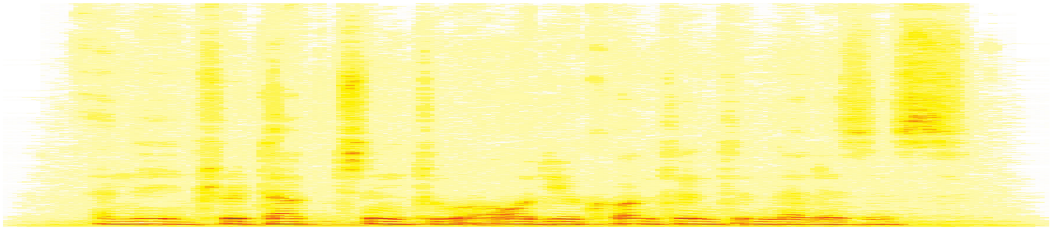
Introduction to Audio Content Analysis

Module 6.3: Downbeat and Bar Length Detection

alexander lerch



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corresponding textbook section

Chapter 6 — Temporal Analysis: pp. 136–137

- **lecture content**
  - quick overview of bar length and downbeat detection
- **learning objectives**
  - discuss systematic differences between tempo & bar length detection
  - discuss systematic differences between beat & downbeat detection

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meter & downbeat detection

problem statement

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- **bar length detection**
  - detect periodicity of group of strong and weak musical events/beats
  - length typically between 3–7 beats
- **downbeat detection**:
  - detect the start location of a bar

meter & downbeat detection

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- relation of *bar length and downbeat* is comparable to relation between *tempo and beat phase*
- meter and downbeat are on a higher hierarchical level

- extraction can be very similar but on *higher hierarchical level*
  1. extraction of novelty function
  2. estimation of bar period
  3. estimation of downbeat

meter & downbeat detection

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bar length detection

overview

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1. extraction of **novelty function**
   - onset probability (see tempo detection)
   - downbeat-specific (may be genre-dependent)
     - bass onset/low frequency energy increase
     - harmonic change $\rightarrow$ pitch chroma change
     - beat and onset match
     - ...
2. possible: **quantization to beat or tatum** (downbeat can only be on a beat)
3. **periodicity estimation**
   - ACF
   - spectral peak analysis
   - ...

bar length detection

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bar length detection

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downbeat detection

overview

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- assumption: downbeat is most prominent reoccurring peak in the novelty functions
  - $\Rightarrow$ delta pulse CCF
  - ...

summary

lecture content

- **bar length detection**
  - same principles as tempo detection
    - higher hierarchical level (different periodicity freq)
    - modified or additional novelty functions
- **downbeat detection**
  - same principles as beat detection
    - higher hierarchical level (different periodicity freq)
    - modified or additional novelty functions