Music Performance Analysis

Alexander Lerch, Claire Arthur, Ashis Pati, Siddharth Gururani

Center for Music Technology, Georgia Institute of Technology
music performance

- music exists only with performance
  - performance realizes acoustic rendition of musical ideas
  - each rendition is unique
  - score information is interpreted, modified, added to, or dismissed
  - adds “expressivity”
## Performance Parameters

<table>
<thead>
<tr>
<th>Category</th>
<th>Score Representation/Idea</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tempo &amp; Timing</td>
<td>Explicitly defined rhythmic content</td>
<td>Tempo, micro-timing, ...</td>
</tr>
<tr>
<td>Dynamics</td>
<td>Basic dynamics instructions</td>
<td>Accents, ...</td>
</tr>
<tr>
<td>Pitch</td>
<td>Explicitly defined pitches</td>
<td>Vibrato, intonation, ...</td>
</tr>
<tr>
<td>Timbre</td>
<td>Implicitly defined (instrumentation)</td>
<td>Playing techniques, ...</td>
</tr>
</tbody>
</table>
music performance analysis

- by analyzing the music performance, we learn about
  - the **performance**:
    - general performance characteristics
    - notable stylistic differences (over time, between artists, ...)
  - the **performer**:
    - mapping of intent and projected emotion to measurable parameters
  - the **listener**:
    - what is perceived as (appropriate level of) expressiveness
    - how can different performance parameters impact the listener
    - How is aesthetic perception shaped by performance parameters
insights 1/2: performance and structure

- close relation between tempo/dynamics and structure:
  - ritardandi at phrase boundaries
  - tempo changes at structural boundaries
  - repetitions very similar
- performance sounds unnatural without these general trends
- no clear relation to timbre
insights 2/2: performance perception

- perceptual relevance of “expressive” performance characteristics:
  - *dynamics* highest impact on ratings of *emotional expression*
  - expressive *timing* best predicts ratings of *musical tension*
  - *sharpened intonation* at phrase climax contributes to *perceived excitement*

- measured ≠ perceived
  - e.g., measurable difference between “normative” and “expressive” performance does not necessarily lead to *perception of expressivity*
  - e.g., no correlation between measured and perceived vibrato onsets
challenges

▪ observations
  • style dependent, lacking research beyond western classical music
  • data is manually annotated in most cases
  • most research
    - focused on piano and voice
    - descriptive and explorative

1. datasets small, not general
   - automatic tools not reliable enough?
   - generality: instrument specific, performers, listeners

2. unknown mapping of performance parameters to perception
   - isolation of parameter meaning tricky
   - hard to define expressivity, hard to control variables
music performance analysis @ISMIR

# of papers with "Music Performance" in title: < 1%

other papers
opportunities

▪ understanding why current MIR systems are of limited use to music psychologists and performance researchers
  • wrong measures of success?
  • miscommunication of system capabilities?

▪ score-based and performance-based information should be disentangled
  • lack of separation of core musical ideas and performance characteristics impedes differentiation of relevant and irrelevant information (example: music emotion recognition)

▪ cross-disciplinary approaches and methodologies can help
  • enabling larger scale perceptual studies with music data
  • interpretability of data
    ➢ better understanding of music and its perception
    ➢ better systems for music analysis and music generation
thank you.