Introduction to Audio Content Analysis

Module 16: Music Performance Analysis

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corresponding textbook section

Section 16

- **lecture content**
  - musical communication
  - music performance
  - music performance analysis

- **learning objectives**
  - give examples for score-inherent and performance-inherent musical characteristics
  - describe typical challenges in music performance analysis

introduction

overview

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  - give examples for score-inherent and performance-inherent musical characteristics
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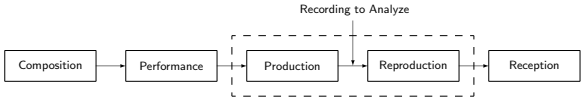
music performance
introduction

- 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”



music performance
parameters

category	**score representation/idea**	**performance**
tempo/timing	explicitly defined rhythmic content	tempo, micro-timing
dynamics	basic dynamics instructions	accents,...
pitch	explicitely defined pitches	vibrato, intonation,...
timbre	implicit definitions (instruments, ..)	playing techniques

music performance analysis
goals

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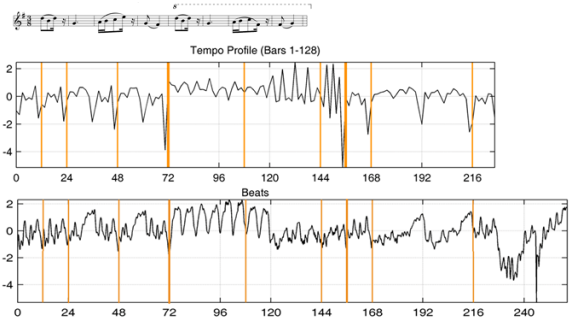
by analyzing the music performance, we learn about

- 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

performance analysis
insights 1/3

- 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

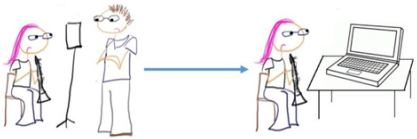


performance analysis
insights 2/3

- 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 $\neq$ 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

performance analysis
insights 3/3

- Humans rate performances regularly (schools, auditions, competitions) but specific criteria are often badly defined
- use cases
  - music education
  - computer-assisted practice
  - pre-screening of candidates for music programs
  - provide insights into **technical and aesthetical descriptors** of human judgments
- most models still lack generalizability and reliability beyond simple note matching



music performance analysis
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
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

summary
lecture content

- **performance**
  - all music needs to be performed
  - while the general performance characteristics are clear, their analysis is less clear

- **performance analysis**
  1. describes and formalizes commonalities and differences of performances

- **challenges**
  1. tricky to disentangle variables
  2. unclear impact on listeners
  3. hard to find reliable ground truth data