Lecture 14

Introduction to
Music Information Retrieval (MIR)

What Is MIR?

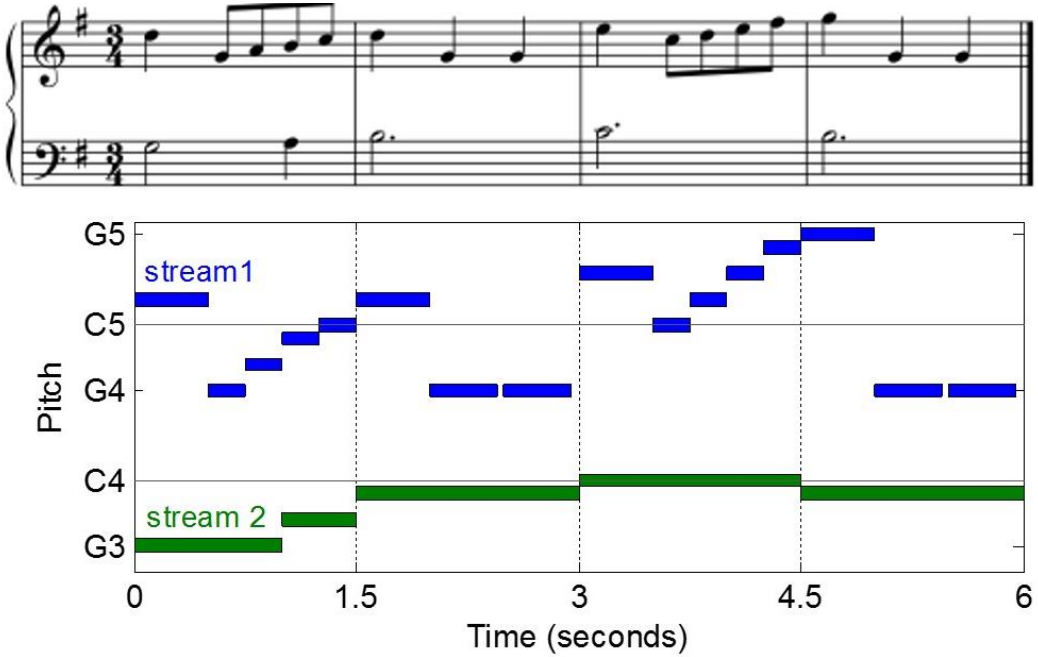
- Retrieving information from music
- Interdisciplinary
  - Signal processing, machine learning
  - Music theory, music cognition
  - Music education, library science
- Emerges since the first international conference in 2000
  - ISMIR: International Society for Music Information Retrieval conference

Why is it important?

- Music is an essential part of human culture
- Huge amount of information in music data
- Supports many applications for both musicians and ordinary people
- Really fun!

Music Data

- Score sheets
- Symbolic data
  - MIDI, MusicXML

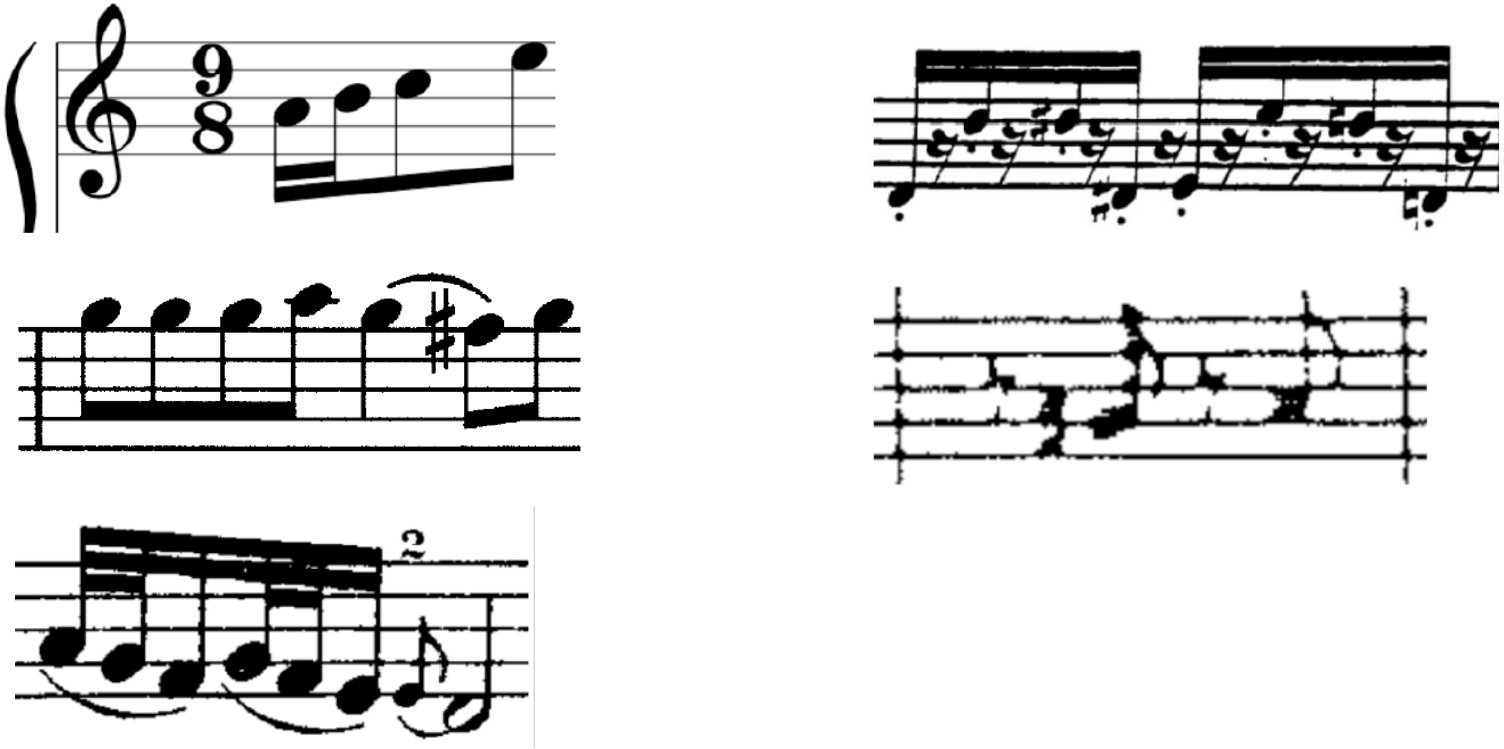


- Audio
- Video

- Meta data
  - Artist, album, tags, etc.
- User data
  - User profile, play lists, listening history

MIR Tasks – Score Sheets

- Optical Music Recognition (OMR)
  - Converts sheet music into symbolic music scores
  - Similar to optical character recognition (OCR)



MIR Tasks – Symbolic Data

- Meter, harmony, key, stream structure
- Harmonic analysis
  - Labeling chords
  - Study how a chord is related to the key and other chords in a phrase
- Musicological research
  - Melodic/rhythmic/harmonic relations/differences between different music pieces

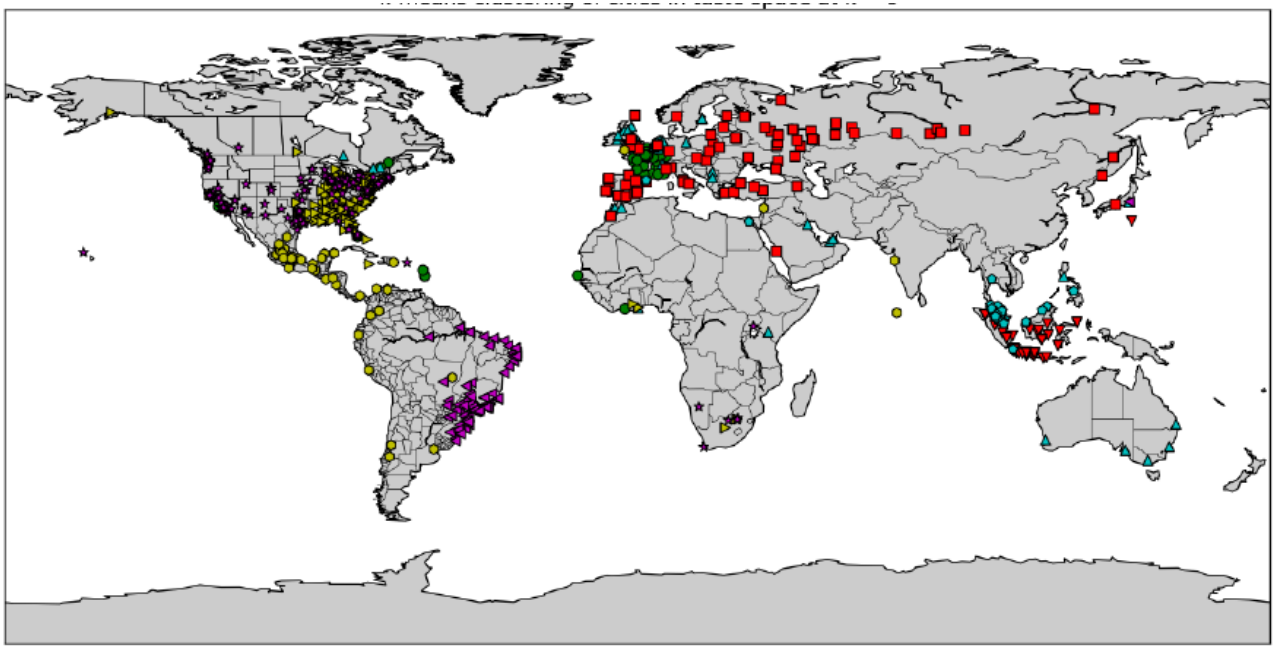
MIR Tasks – Meta Data and User Data

- Music recommendation
  - Collaborative filtering: "customers who bought this also bought…"



MIR Tasks – Meta Data and User Data

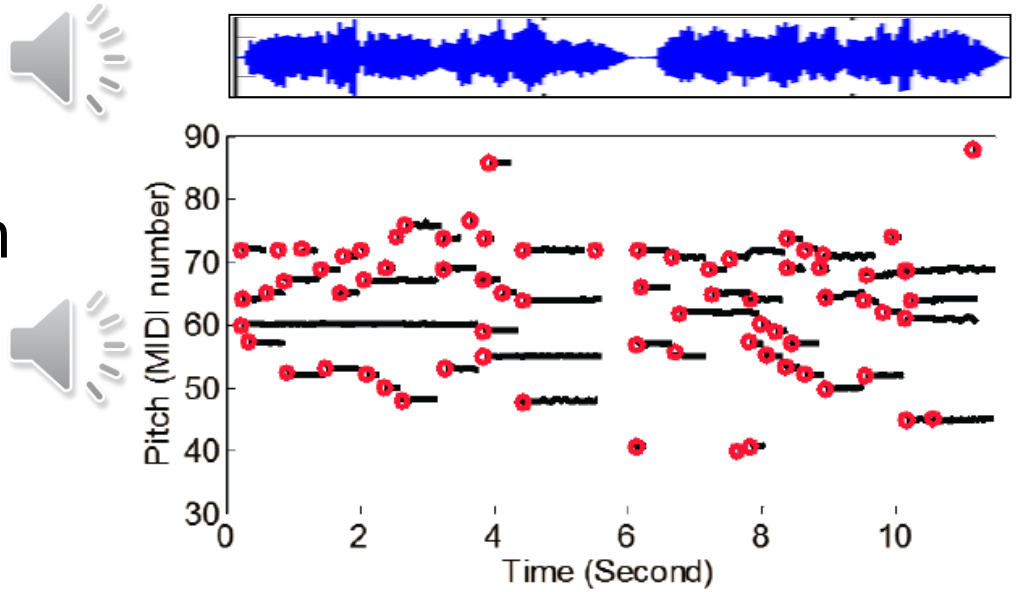
- Music social network analysis
  - Artist/music network
  - Listener network



[Moore et al., ISMIR'14]

MIR Tasks – Audio

- Music transcription
  - Pitch analysis
  - Beat tracking, rhythm analysis
  - Melody extraction: link to demo



- Key challenge: Polyphonic!
  - Sources overlap in both time and frequency domain

MIR Tasks – Audio

- Source Separation
  - Singing voice / accompaniment separation



  - Harmonic / percussive sound separation

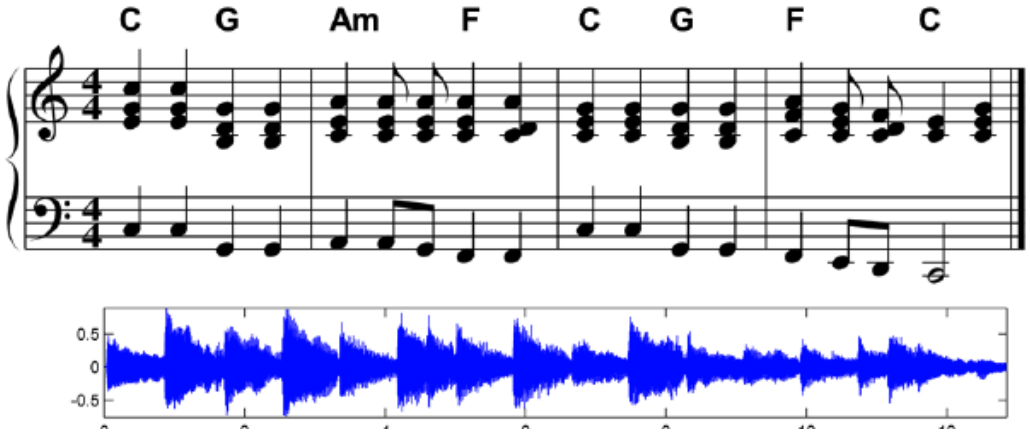


  - Speech / background music separation

- Closely related to polyphonic music transcription
- (Over-)determined / under-determined
- Supervised / unsupervised

MIR Tasks – Audio

- Other fundamental analysis tasks
  - Chord recognition:



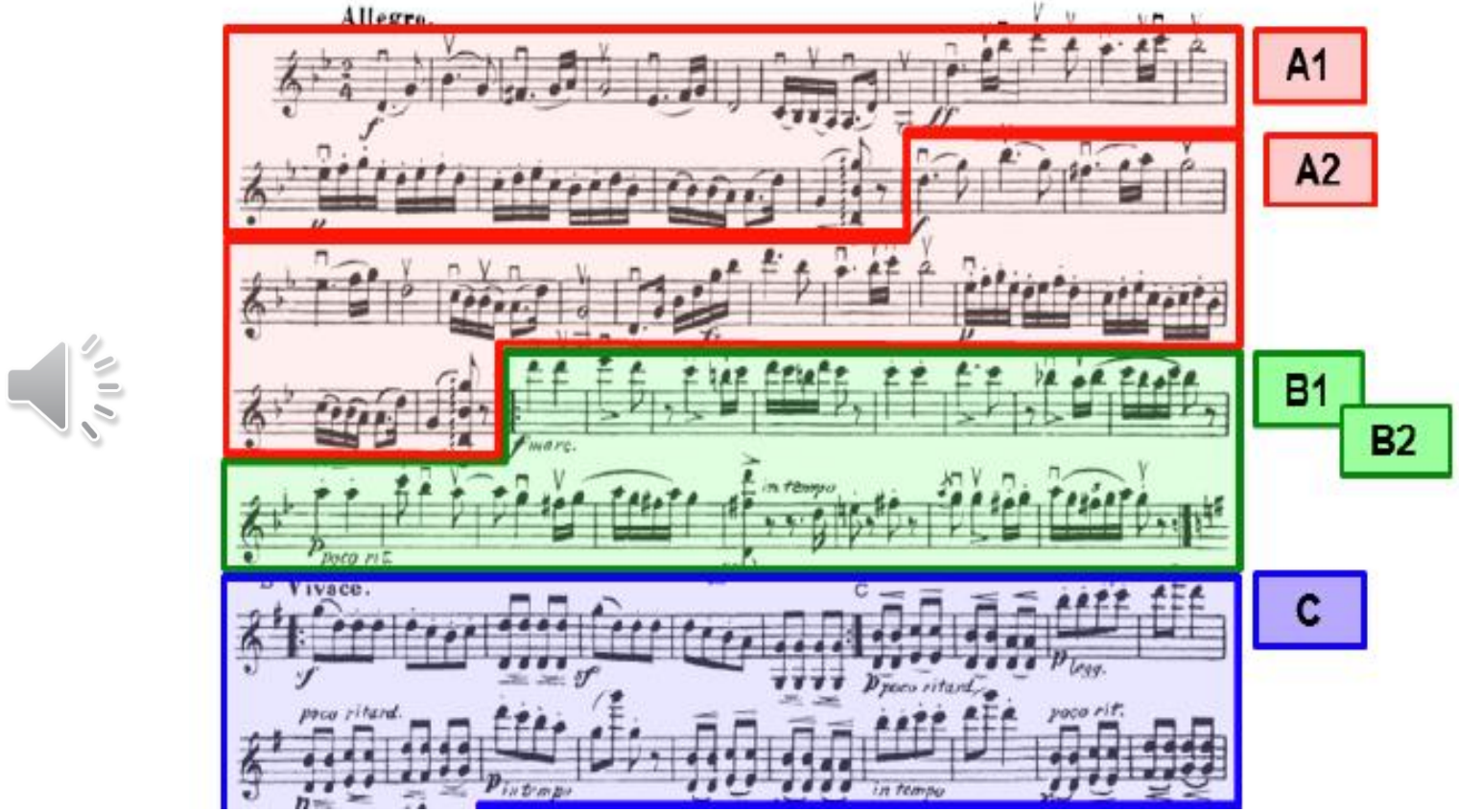


  - Key detection
  - Onset detection
  - Tempo estimation
  - Instrument identification



MIR Tasks – Audio

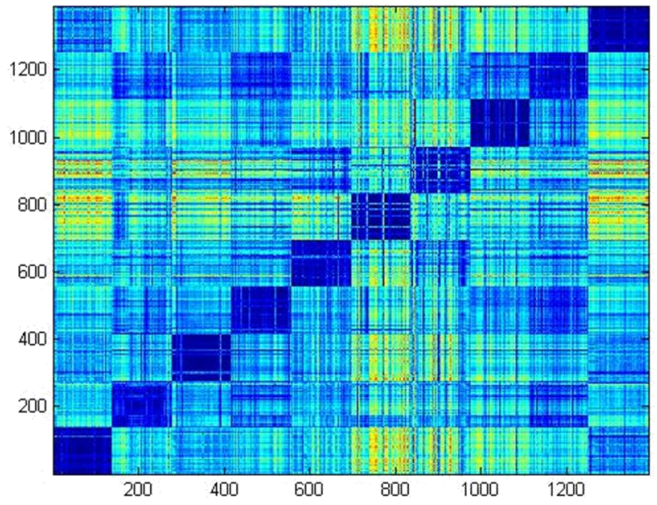
- Other fundamental analysis tasks
  - Music structure analysis



MIR Tasks – Audio

- Query-by-humming
- Query-by-tapping
- Query-by-example

- Audio fingerprinting
- Cover song identification
- Music similarity measure
- Music recommendation
- Playlist generation

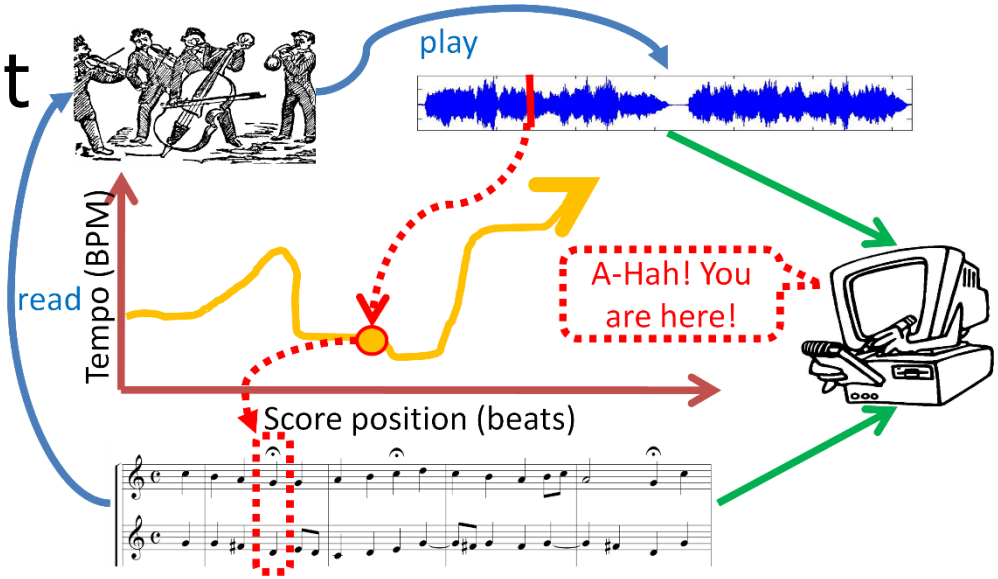


MIR Tasks – Audio

- High-level classification problems
  - Genre
  - Artist / composer
  - Mood
  - Auto tagging

MIR Tasks – Symbolic and Audio

- Audio-score alignment
  - Real time version: Score following



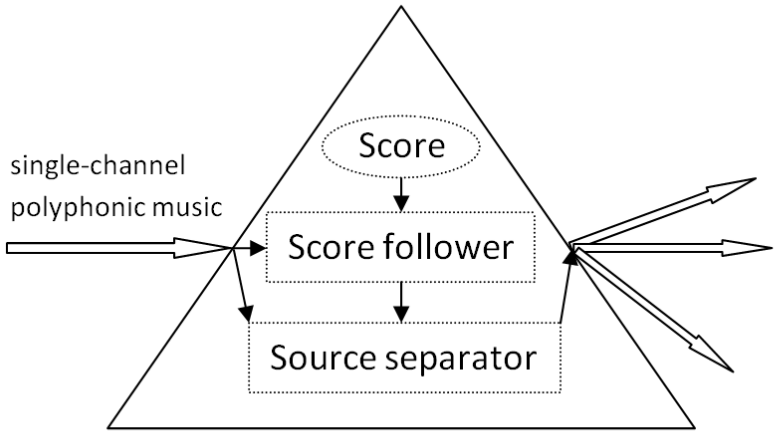
- Multimodal music library construction
  - Score, audio, video, all synchronized

MIR Tasks – Symbolic and Audio

- Automatic music accompaniment

- Score-informed source separation

Single-channel polyphonic music



MIR Tasks – Audio and Video

- Audio-visual analysis for music transcription and source separation
- Automatic music selection for video
- Automatic video generation for music

New Tasks – You Name It

- Music Information Retrieval Evaluation eXchange (MIREX)
  - Annual competition organized by ISMIR
  - New tasks proposed every year!

- An interesting, exciting, and fast-growing area welcomes you to come!