

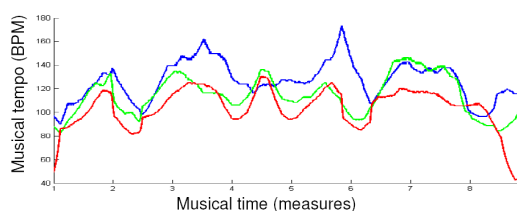
# Music Processing

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## 1 Organization

- Winter term 2009/2010, biweekly Thu. 15-18
- Preparatory Meeting: Thu. 06.08.2009, Room 24, E1 4, 13-15
- First seminar talk: Thu. 26.11.2009
- [http://www.mpi-inf.mpg.de/departments/d4/teaching/ws200910/smp\\_mm/index.html](http://www.mpi-inf.mpg.de/departments/d4/teaching/ws200910/smp_mm/index.html)
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## 2 Content

In this seminar, we discuss a number of current research problems in the fields of music information retrieval (MIR) and music processing.

## 3 Course Prerequisite

The seminar particularly addresses students, who have successfully participated in the course *Music Processing* that was offered in the summer term 2009 and who have acquired a good understanding of the lecture's content. Requirements are a solid mathematical background, a good understanding of fundamentals in digital signal processing, as well as a general background and personal interest in music. The seminar is accompanied by readings from textbooks or the research literature. Furthermore, the students are required to experiment with MATLAB.

## 4 Topics

### 4.1 Analysis of Beat, Tempo, and Rhythm

In this seminar block, we address the musical aspects of note onsets, tempo, and rhythm. We discuss various onset detection strategies incorporating musical knowledge on note onsets, which often go along with a sudden change of the signal's energy and spectral content. This property allows for extracting some kind of novelty curve from a music signal, the peaks of which yield good indicators for note onset candidates. Much more challenging is the detection of onsets in the case of non-percussive music, where one often has to deal with soft onsets or blurred note transitions. As a consequence, more refined methods have to be used for computing the novelty curves, e. g., by analyzing the signal's spectral content, pitch, or phase. Furthermore, to extract tempo and beat related information, we discuss how novelty curves can be further analyzed with respect to reoccurring or quasi-periodic patterns using different concepts based on autocorrelation, comb and resonance filters, or Fourier-based methods. Finally, we indicate how rhythmic patterns can be utilized for tasks such as music segmentation as well as genre or dance style classification.

Literature: [1, 3, 4, 6, 8, 9, 18, 19, 20]

### 4.2 Audio Matching and Cover Song Identification

The identification and retrieval of semantically related music data is of major concern in the field of music information retrieval. Loosely speaking, one can distinguish between two different scenarios. In the *global* matching scenario one compares and relates entire instances (on the document level) of a piece of music such as entire audio recordings or MIDI files. For example, in *cover song identification* the goal is to identify all performances of the same piece by different artists with varying interpretations, styles, instrumentation, and tempos [2, 5, 23]. In the *local* matching scenario one compares and relates different subsegments contained in the same or in different instances of a piece. For example, in *audio matching* the goal is to automatically retrieve all passages (subsegments) from all audio documents that musically correspond to a given query excerpt [15, 17]. Of course, the two scenarios seamlessly merge into each other. For example, in the cover song detection algorithm described in [23], a local matching strategy is used for global document retrieval task. In this seminar block, we discuss various aspects that have a crucial impact on the properties of the respective matching procedure including the underlying feature representation, the cost measure used to compare two feature vectors, as well as the distance function used to relate the various feature sequences.

Literature: [2, 5, 15, 17, 23]

### 4.3 Performance Analysis

In *performance analysis* one compares different performances of the same piece of music with regard to performance aspects such as tempo, dynamics, or articulation. Generally spoken, there the following two main goals. On the one hand, one tries to discover similarities between different performers from which one may derive general performance rules. On the other hand, one investigates, if it is possible to automatically recognize a particular performer by his or her own playing style.

Literature: [10, 16, 21, 22, 25, 26]

## 4.4 Chord Recognition

In *chord recognition* the goal is to automatically extract the harmonic structure of a piece of music by recognizing the played chords.

Literature: [7, 11, 12, 13, 14, 24]

## 5 Course Requirement

- Reading assignments
- MATLAB experiments
- Meetings with tutors
- Seminar Talk (maximal 45 minutes, using PowerPoint template)
- Summary (2 pages, using L<sup>A</sup>T<sub>E</sub>X template)
- Participation in seminar

## 6 Evaluation Criteria

- Content of presentation
- Style of presentation
- Quality of summary
- Degree of participation in seminar
- Impression by tutor and fellow students

## References

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