

MIREX 2012 - MUSIC STRUCTURAL SEGMENTATION TASK: IRCAMSTRUCTURE SUBMISSION

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ABSTRACT

This extended abstract introduces the music structure algorithm submitted by Ircam to the MIREX 2012 structural segmentation task. The algorithm estimates structural information that relate to both timbral and harmonic context variations. Homogeneous sections within this description of the audio signal are then estimated by means of the Non-negative Matrix Factorization of the corresponding similarity matrix and a structural segmentation is produced.

1. SIGNAL DESCRIPTION

Low level audio features are first extracted on the audio signal. Timbral information is described by means of the following descriptors of the spectral content:

- MFCCs
- Spectral Centroid, Spread and Skewness
- Spectral Flatness

These features are normalized and embedded in a similarity matrix computing the features pairwise distance by means of the cosine distance. A second similarity matrix that relate to the harmonic content is then computed. Therefore chroma feature frames are extracted over the whole audio signal and split into subsequences of frames of a couple of seconds, usually between 4 and 10s. Each subsequence is then modeled by means of a Multi-Probe Histogram (MPH) that probes dominant pitch classes transitions between adjacent feature frames [4]. Such a temporal modeling of the chroma vectors allows to describe the evolution of the tonal context in the audio piece that is highly relevant for the structural segmentation task. The length of the chroma subsequences for the Multi-probe Histograms computation is automatically adapted over the audio signal [2]. Therefore, time instants of potential strong harmonic changes are estimated in order to reduce the length

of the subsequences when needed. The method thus allows to model musical patterns of variable lengths within a same music piece.

Histograms are then embedded in a similarity matrix and the timbre-related and harmony-related similarity matrices are merged together.

2. STRUCTURAL SEGMENTATION

Temporal segmentation of the audio signal is first estimated applying the audio novelty measure [1] on the similarity matrix. Temporal segments are then merged together according to the musical structure with the algorithm proposed in [3]. The method is based on the observation that information in similarity matrices is highly redundant over time in the hypothesis of high homogeneity in the acoustical content of structural sections. An ideal musical structure of homogeneous structural entities is indeed represented in the similarity matrix as a sequence of uniform blocks. The whole structural information is then contained in a few rows or columns, i.e. since similarity matrices are symmetric. Intuitively, the similarity matrix is thus ideally spanned by a much lower dimensional basis, with a dimensionality that relates to the number of states in the musical structure. The task of music structural segmentation then becomes a dimension reduction of the similarity matrix problem that we perform by means of its Non-negative Matrix Factorization (NMF). Structural segmentation is obtained by applying hierarchical clustering on the temporal segments projected on this new basis.

3. SUBMISSION CONFIGURATION

For the MIREX 2012 Evaluation four different configurations of the algorithm are submitted. All submitted algorithms make use of timbral features. This description can be combined with harmonic features with the calculation of Multi-Probe Histograms. The number of sections to be formed for the structural segmentation is also chosen as either 4 sections, 6 sections or 8 sections. The submitted parameter combinations are reported in Table 1.

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	Adaptive MPH	4 sections	6 sections	8 sections
_vt1		•		
_va1	•	•		
_mph1	•		•	
_va2	•			•

Table 1. Submission Configuration

4. ACKNOWLEDGMENTS

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5. REFERENCES

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