Clustering Beat-Chroma Patterns in a Large Music Database

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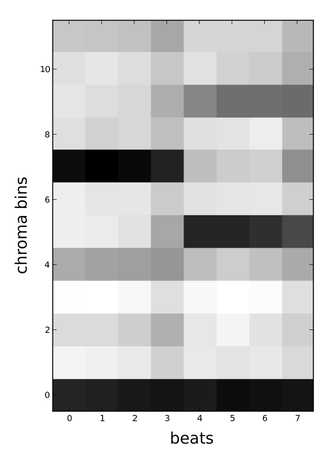
Introduction

- Availability of very large collections of music audio: can we infer anything about the underlying structure and common features of e.g. commercial pop music?
- Our interest: tonal content of the music – i.e. the harmony and melody.
- Beat-synchronous chromagrams: rich enough to generate musically-relevant results, simplified enough to abstract away instrumentation and other stylistic details.
- This paper identifies common patterns in beat-synchronous chromagrams by learning codebooks from a large set of examples. The individual codewords consist of short beat-chroma patches of between 1 and 8 beats, optionally aligned to bar boundaries.



- Goal: identify meaningful information about the musical structure represented in the entire database by examining individual entries in this codebook.
- Prior work: "shingles" of [1], beat-synchronous analysis to indeitfy the chorus by [2], and cover recognition by [3].
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Audio Features - Echo Nest

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Vector Quantization

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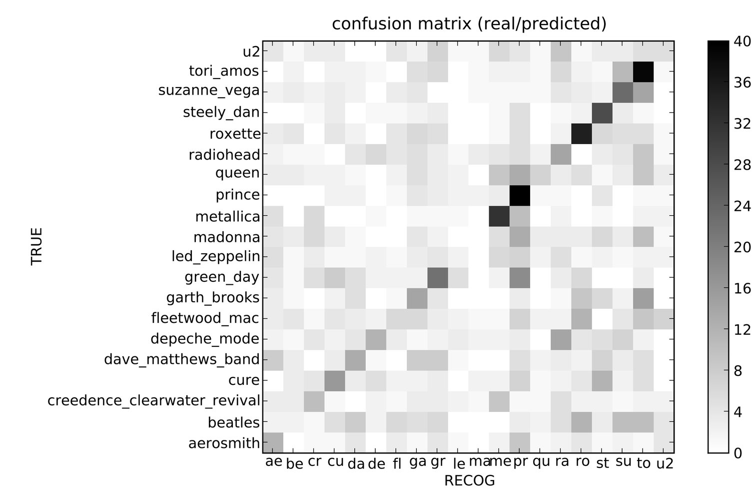
Pattern Analysis

Experiments

We present two applications of the beat-chroma codebooks to illustrate how the "natural" structure identified via unsupervised clustering can provide useful features for subsequent supervised tasks.

Artist recognition task. We use the *artist20* data set: 1402 songs from 20 artists, mostly rock and pop of different subgenres. Previously published results using GMMs on MFCC features achieve an accuracy of 59%, whereas using only chroma as a representation yields an accuracy of 33% [4].
We get an accuracy of **23.4**%, random baseline is around 5%. The confusion matrix is shown here, note that certain artists are recognized at an accuracy far above the average.



Bar alignment task. Since the clustering described is based on the segmentation of the signal in to bars, the codewords should contain information related to bar alignment, such as the presence of a strong beat on the first beat.

Offset	% of times chosen
0	**62.6**
1	16.5
2	9.4
3	11.5

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Conclusion

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References

[1] M. Casey and M. Slaney, "Fast recognition of remixed music audio," in *Proceedings of the International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2007.

[2] M. A. Bartsch and G. H. Wakefield, "To catch a chorus: using chroma-based representations for audio thumbnailing," in *Proc. IEEE Workshop on Applications of Signal Processing to Audio and Acoustics*, Mohonk, New York, October 2001.

[3] D. Ellis and G. Poliner, "Identifying cover songs with chroma features and dynamic programming beat tracking," in *Proceedings of the International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2007.

[4] D. Ellis, "Classifying music audio with timbral and chroma features," in *Proceedings of the 8th International Conference on Music Information Retrieval (ISMIR)*, 2007.

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