Clave patterns in Uruguayan Candombe drumming

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Summary

Uruguayan Candombe drumming has deep African roots, and like other musics of the Afro–Atlantic world, its rhythm is timeline–based. The timeline pattern of Candombe, called *madera*, has many traits in common with similar patterns in Afro–American music, like the *son* clave. It presents, however, significant differences with the more common uses of timeline patterns in other musics of the same tradition. For instance, instead of a single timeline pattern as in other Afro–Latin–American musics, the *madera* pattern allows for different variants. In this paper, Music Information Retrieval techniques are applied to a dataset of Candombe recordings in order to analyse the characteristics of the *madera* pattern, and group and classify its most recurrent variations.

Uruguayan Candombe drumming

Llamada de tambores

- drum call parade
- groups of ca. 20 to 60 players
- three types of drum: *chico*, *repique*, *piano*

Fig. Group of Candombe drummers (*cuerda de tambores*) during a *llamada de tambores*.

Rhythmic structure

- 4–beat cycle, 16 pulses
- *chico*: high pitch, timekeeper
- *repique*: medium pitch, improviser
- *piano*: low pitch, rhythmic cycle

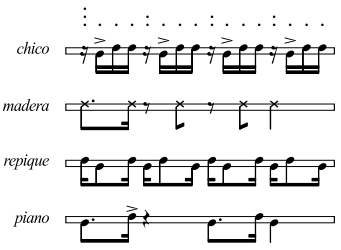


Fig. Simplified primary patterns of the three drums and *madera* with metric structure

Madera pattern

The *madera* (or *clave*) pattern is produced by hitting the wooden shell of the drum with the stick. Played by all the drums as an introduction to and preparation for the rhythm; during the *llamada* only by the *repique* drum in between phrases.

Dataset

- 14 complete performances (45 mins)
- multitrack audio recordings in studio
- ensembles of three to five players
- five different renowned players
- rhythm cycles manually labeled (i.e. beat and downbeat annotations)
- ca. 500 cycles are *madera* patterns

Audio feature extraction

Spectral features used for both onset detection and *madera* sound classification.

Spectral flux (SF)

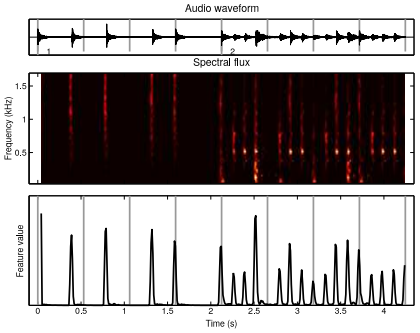
- Short-Time Fourier Transform
- mapped to MEL scale bands
- first-order difference
- half-wave rectified

Onset detection

- SF summed along all sub-bands
- fixed and adaptive thresholds

Sound classification

- first 40 MEL bands (< 1500 Hz)
- SVM trained on isolated sounds



Detection of madera pattern sections

- proportion of onsets classified as *madera* within each rhythm cycle
- threshold computed using Otsu's method for a two-state classification
- hysteresis post-processing to avoid some spurious transitions

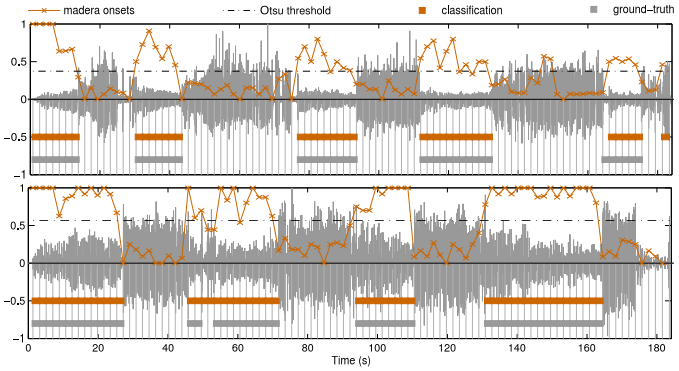


Fig. Detection of *madera* pattern sections for two *repiques* playing simultaneously

Analysis of madera cycles in a recording

- feature signal is time quantized to the 16 rhythm subdivisions
- a map of the feature vectors of each rhythm cycle is computed
- the detected *madera* patterns are clustered and aurally checked

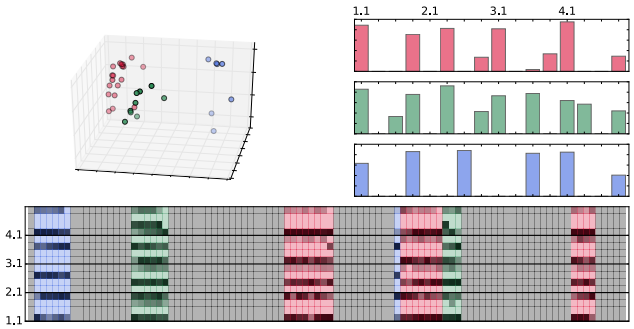


Fig. Analysis of *madera* patterns in a single recordings. The feature map of the recording (below), the centroid of each cluster (top-right) and a 3D Isomap representation of patterns (top-left).

Dataset analysis

All the cycles with *madera* pattern in the dataset ordered by cluster, with transcription in music notation. There are four main groups, two of which can be subdivided in two variations.