Tarsos

Automated Tone Scale Extraction Applied to African Oral Music Traditions

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Background

At first sight, pitch organization in music seems to rely on well-defined rules. For Western music this is indeed the case. These rules were established over time. A framework for music theory and notation became a practical necessity for compositional needs and for music practice. Tuning in an equal temperament was needed for music that began to include modulations within a piece. Nowadays almost all Western music relies on this tuning, which divides the octave in 12 equal parts.

In non-Western classical music the pitch organization often leans on a theoretical system with a very different approach than the Western equal temperament. One striking difference is that not all pitch intervals have an equal size, e.g. the seven tone gamelan pélog scale.

Oral music traditions have no well-established, written music theory to fall back on. The freedom created by the smaller impact of music theory defines the characteristics of the music itself: e.g. lesser harmonic impact, instruments with varying tuning and no harmonic modulation. The authenticity of these oral music cultures is fragile. The influence of western music imported by colonization, missionary expeditions, trade, mass-media is undeniable. It has e.g. been proven that the scales of oral cultures in Africa are rapidly becoming more similar to the Western equal temperament[4].

Aims

The aim of our research is to develop an easy to use system to detect and represent the tone scale used in a musical piece. Because of the large variability in African music both detection and representation should use a culture-independent method, it should work equally well for e.g. Western, African and Indonesian music. More to the point, this means that no predispositions towards a certain music theory should be made. Our goal is to document an aspect of the endangered musical heritage of African oral cultures, namely the tone scale diversity.

Main Contribution

The main contribution is Tarsos, a modular software platform to extract pitch organisation of a musical piece. The process consists of two basic steps: i) detect the fundamental frequencies using a pitch detection algorithm; ii) process the annotations and present them in a useful way. To detect pitch, Tarsos includes platform independent implementations of YIN[1] and MPM[3]. Also Tarsos can be configured to use external poly- or monophonic pitch detectors.

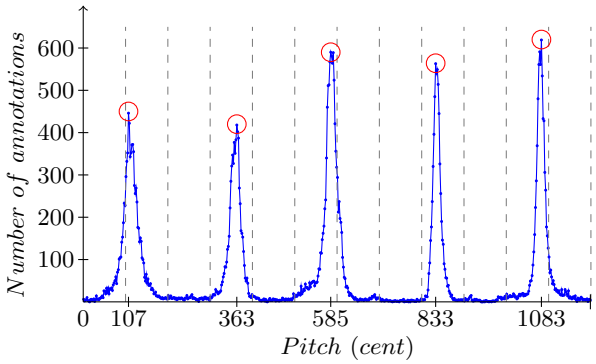

Fig. 1. An Indonesian Slendro scale. The circles mark different pitch classes. For reference, the dashed line represents the Western equal temperament.

Different representations of the annotations are possible. One of the most interesting is the pitch class histogram seen in figure 1. To construct the histogram all pitch annotations are converted to cent and assigned to one of 1200 bins, annotations are collapsed to one octave. Automatic peak detection finds the scale or pitch classes present in the music, the circles in figure 1.

Implications

Tarsos offers a decent foundation for further research on pitch organization in music. It creates opportunities for automated analysis of large sets of audio. The gathered data in raw (annotations) or processed form (pitch class histograms or interval data) could serve as a basis for pattern recognition and cluster analysis. Tarsos could boost pitch histogram based research similar to [2] and [4] and will be used to further document tone scale variability in African oral music traditions.

References

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