

“Human Perception and Computer Extraction of Music Beat Strength” is to investigate the human perception of music beat through user study and propose the concept of Beat Strength.

Generally speaking, beats in music is formally characterized by its frequency, phase, and a confidence measure about its detection. The authors address there is no previous work on how to distinguish the rhythmic character if two pieces of music having the same tempo. Thus they define this as the concept of beat strength.

The paper first describes the user experiments they did to quantify the human recognition on music beat strength. 32 subjects were reported taken such experiments. Only part of the subjects had formal musical training. The authors claim that formal training has little effect on test outcome. But they do not present more reference or experiments result on it. I would be quite doubt on this issue. I would think with formal music training, subjects would be easier to distinguish the rhythm of the music, which is the concept in beat strength.

Subjects were asked to listen to 50 musical excerpts and categorize them to 5 beat strength categories. The order of the excerpts is random, and subjects were asked to listen to the excerpts in two passes. The first pass is to familiarize the beat strength range of the excerpts and the second is to categorize these excerpts. Experiment result shows subjects have a common agreement about beat strength judgment. They categorize the beat strength very similar to the pre-categories chosen by the authors. They mentioned to use the staircase function to pre-categorize the excerpts. I am quite interested in what method it is. If it is done by human being, will it be any bias which would also happen in subjects? If so, the result will of course be very similar. Another interesting point is that subjects agree more on the strong range of the spectrum. An intuitive explanation of it is that beats need some “peak” in amplitude for people to percept. Weak beat strength lacks of such “peak”.

The authors then propose the measure of beat strength based on Beat Histogram (BH). BH is to collect statistic data about the amplitude envelope periodicities of multiple frequency bands. They mentioned the Discrete Wavelet Transform used in BH, which is a more efficient way to extract the features in signals than Discrete Fourier Transform. Examples show that HipHop naturally have strong rhythmic structure than any other music genre. The authors then use the sum of all histogram bin (SUM) and the ratio of the amplitude of the highest peak of the BH to the average amplitude (PEAK) as two candidates to represent the beat strength. The results of these two measures show a reasonable trend in detection of music beat strength, but the variation of these two measures in the experiments with regard to the scale is a bit too high (1.08~1.12 /5, over 20%). I think they still need to refine these measurements with more accuracy.

This paper presents the first step work investigating the rhythmic difference with music having the same tempo. User study and measurement are presented. However, it lacks of some formal reasoning in the measurement and need to investigate more accurate aspect to describe the music beat strength.