

Assignment 1: Dealing with Time-Domain Audio

CS 4347: Sound and Music Computing

due Wednesday 4 February 2015, 11:59 pm

0. This assignment will make use of the “Music & Speech” dataset of Marsyas:

- http://opihi.cs.uvic.ca/sound/music_speech.tar.gz
- This dataset has two copies of each song; delete the `music/` and `speech/` directories and use the files in `music-wav/` and `speech-wav/` directories. There are 64 music and 64 speech files; each file is 30 seconds of audio stored as 16-bit signed integers, 22050 Hz.

- Ground truth data for this dataset:

http://www.comp.nus.edu.sg/~duanzy/music_speech.mf

Format of the file is `filename \t (tab) label \n (newline)`, one song per line:

```
filename1\tlabel1\n
filename2\tlabel2\n
...
filename128\tlabel128\n
```

The `label` will be `music` or `speech`.

1. Write a python program that will:

- Read the ground-truth `music_speech.mf` file
- Load each wav file and convert the data to floats by dividing the samples by 32768.0. Hint: use `scipy.io.wavfile.read()`
- Calculate 4 features for each file according to the given formulae. Use only one vector per file (don't use multiple buffers for each file).

Given $X = \{x_0, x_1, x_2, \dots, x_{N-1}\}$,

(a) Root-mean-squared (RMS)

$$X_{\text{RMS}} = \sqrt{\frac{1}{N} \sum_{i=0}^{N-1} x_i^2}$$

(b) Peak-to-average-ratio (PAR)

$$X_{\text{PAR}} = \frac{\arg \max_i |x_i|}{X_{\text{RMS}}}$$

(c) Zero crossings (ZCR)

$$X_{\text{ZCR}} = \frac{1}{N-1} \sum_{i=1}^{N-1} \begin{cases} 1 & \text{if } (x_i \cdot x_{i-1}) < 0 \\ 0 & \text{else} \end{cases}$$

(d) Median absolute deviation (MAD)

$$X_{\text{MAD}} = \text{median}_i \left(\left| x_i - \text{median}_j(x_j) \right| \right)$$

Hint: numpy has a built-in `numpy.median()` function!

- Output the data to a comma separated value (CSV) text file in the format:

```
filename1,RMS1,PAR1,ZCR1,MAD1\n
filename2,RMS2,PAR2,ZCR2,MAD2\n
...
filename128,RMS128,PAR128,AC128,MAD128\n
```

Concretely, the beginning and ending of the file should be:

```
music_wav/bagpipe.wav,0.063492,8.149929,0.191660,0.031769
music_wav/ballad.wav,0.029699,7.320233,0.039395,0.012695
...
speech_wav/voice.wav,0.070688,4.163124,0.082435,0.031982
```

To pass our automated grading system, the format of your file must match this exactly. The order of filenames must match the order in the `music_speech.mf` file.

2. Upload your CSV file to:

<http://cs4347.smcnus.org>

This will automatically grade the values you calculated. If any mistake is found, please check your program and resubmit – you are welcome to submit as many versions as you wish before the submission deadline.

Submit a zip file containing your program's source code (as a `.py` file), the CSV file, and an optional `README.txt` file to the same website.

- You may use anything in the python standard library, numpy (including pylab / matplotlib), and scipy libraries. No other libraries are permitted.

If you are familiar with python and understood the lecture, this should take about 1 hour.
Grading scheme:

- **3/6 marks:** correct CSV file (automatically graded by computer).
- **3/6 marks:** readable source code (good variable names, clean functions, comments when needed).