4. Processing audio files

Throat singing

5/5 points (graded)

Tibetan throat singing is a technique of using the resonance of your mouth to sing two notes at the same time. Here is an audio file of throat singing.

Throat singing example

0:00 / 0:15

Download

First download the audio file in MATLAB Online. (Use short cut commands for copy and paste: ctrl-c and ctrl-v on windows, and cmd-c, cmd-v on a MAC.)

```
url = 'https://courses.edx.org/asset-v1:MITx+18.03Fx+3T2018+type@asset+block@audio_1803_musicdata_voice_2pitches.wav'
websave('1803_musicdata_voice_2pitches.wav',url)
```

Download the MATLAB script using the following commands.

```
url = 'https://courses.edx.org/asset-v1:MITx+18.03Fx+3T2018+type@asset+block@throat_singing_plots.m';
websave('throat_singing_plots.m',url)
```

Running this script will play a movie of the frequency spectrum of this audio signal over time.

Because this signal is changing in time, a better way to analyze this system is using a spectrogram. We have done that here in an interactive live script which you can download into MATLAB Online by typing the following into the MATLAB online consol.

```
url = 'https://courses.edx.org/asset-v1:MITx+18.03Fx+3T2018+type@asset+block@throat_singing_BA_version2.mlx';
websave('throat_singing_BA_version2.mlx',url)
```

Enter the frequencies of the five largest fundamental pitches (in hz) at time 1049 in the live script. To do so, go to line 9 in the live script, and move the slider labeled tmePnt to the point 1049.

. 1593.8 ✔ **Answer:** 1710

. 210.9 ✔ **Answer:** 210

. 1710.9 ✔ **Answer:** 330

. 328.1 ✔ **Answer:** 1590

. 1382.8 ✔ **Answer:** 1380

Solution:

Using the slider of the live script, we find that the largest frequencies correspond to 210hz, 328hz, 1710hz, 1590hz, and 1380hz. Note that the sliders do not always correspond to the actual largest frequencies! And in particular, this list is missing the fundamental frequency of the note being sung, which is somewhat interesting.

Submit You have used 1 of 4 attempts

Answers are displayed within the problem

Find the notes

1.92/2 points (graded)
What is the note corresponding to the fundamental frequency?

(You may need to look at more than one time in the signal to help you identify the base note, and you can compare to pure sine waves if needed.)

- ( ) A
- ( ) A#
- ( ) B
- ( ) C
- ( ) C#
- ( ) D
- ( ) D#
- ( ) E
- ( ) F
- (•) F#
- ( ) G
- ( ) G#

Find the (closest) notes corresponding to the 5 largest frequencies at time point 1049 in the interactive live script. (In the case that a frequency falls in between two notes, choose the lower of the two notes, or choose no note at all.)

- [ ] A
- [ ] A#
- [ ] B
- [ ] C
- [ ] C#
- [ ] D
- [ ] D#
- [x] E
- [ ] F
- [ ] F#
- [x] G
- [x] G#

Submit You have used 3 of 5 attempts

✱ Partially correct (1.92/2 points)

4. Processing audio files

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Is there a systematic way of doing this?

discussion posted about a month ago by elarX

I feel like I got the answer to "which note is this" more by a lucky guess - I looked at multiple snapshots in time for the FFT, but I felt the frequencies were all over the place, making it difficult to identify the v, 2v, 3v that is reviewed in lecture. Is there a way to use the spectrogram to help with this? I will go read over the spectrogram section again, but was wondering how others tackled this question.

This post is visible to everyone.

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2 responses

Steve_Nicodemus (Community TA)
about a month ago

I didn't feel too confident with it either. For the fundamental tone, I noticed a somewhat low frequency that kept showing up and checked the ratios of some some of the higher frequencies with it. Most of the other values that came up were at least close to multiples of half that number. (I also tried listening to the recording and finding the note on the piano, but it was off by more than a full step from the correct answer. I hope my piano isn't that badly out of tune.)

For the other frequencies, I tried several methods. I looked them up in a table from the internet giving frequencies for notes. I also tried finding the ratio to the next lowest power of two of the fundamental frequencies (octaves) and seeing how many times $2^{1/12}$ had to be multiplied together to get that ratio. Both of those methods worked reasonably well, but I found that I did better sometimes by finding the nearest note rather than the nearest lower one as suggested.

Using the $2^{\frac{1}{12}}$ method and python, and picking the nearest lower one, I only got three different notes in the chromatic scale. In two occasions, I got something that was one or more octaves away from another note of the same "letter".

As I'm also a music buff and amateur musician, this is kind of a fun diversion, but I have to say I find this is a bit on the ambiguous side as an exercise for a mathematics course.

David

posted 19 days ago by **davidstuartbruce**

Add a comment

FFoulenIT

14 days ago

I also used a table of musical notes with their respective frequencies which was very helpful.

Keyboard and Frequencies

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