SIGNALS/AUDIO PRACTICAL

CS4302: PRACTICAL 2

DEADLINE

This practical is due 2nd November 2018 at 9pm. It is worth 35% of the coursework part of the grade.

SUMMARY

This practical consists of writing a Matlab program to solve signal processing tasks and writing a report to describe and discuss your methods and results.

GOALS

The main goal of this practical is to provide practical experience with the processing of signals in the domains of the time and the frequency. As a secondary goal you will gain familiarity with Matlab, a very common programming environment for signal processing.

REQUIREMENTS

You will prepare a report that reflects your solution to the tasks described below. Please relate the task number to the solution in the document. Include all your figures in your report.

The practical requires you to record or capture two of your own audio files (you should have done this for the tutorial):

- A recording of your voice (approximately 10 seconds).
- Approximately 10 seconds of music that you like (you are going to listen to it quite a bit).

The first clip needs to be recorded by yourself (e.g., a microphone in your laptop or on your phone), and both files have to be in a reasonable format (.wav or .mp3).

TASKS

You will need to solve the following problems:

1. What does the note "Middle C" as a single pure tone frequency sound like? Produce a sound wave of a single frequency of middle C which lasts 10 seconds. Plot it in both the time and frequency domains (with x axes of time (seconds) and frequency (Hz)). You may wish to also zoom into regions of interest in the plots to help visual interpretation. Describe these plots and what it sounds like when you listen back to it.
2. What do the audio files look like over time? Plot the sound wave (in the time domain) for both of your files (voice and music), with time (seconds) as the x axis and amplitude as the y axis.
3. What is the frequency content of your files? Produce a plot of the frequency (where the x axis should be Frequency (kHz)) for each of the files and describe what they show and why they have those frequencies.
4. How does frequency filtering affect these files? Filter out a band of frequencies of your choice for these sound files, explain what frequencies you have filtered, show the

frequency plot and audio plot after doing the frequency filtering and describe what the audio files sound like after filtering.

5. I have provided you with an audio file which contains noise (audio_in_noise.wav). For this file what is the frequency of the noise? Show how you identified the noise frequency using a frequency plot and provide an explanation.
6. What does the audio file sound like with noise removed? Remove the noise from the audio file by frequency filtering. Show your steps for frequency filtering including plots in the frequency and time domain. Listen to the audio file and describe the change in the audio file.
7. Extensions: Be creative and experimental, show me something relevant to this practical. Options might be (not limited to): Are there any other methods for removing the noise? Implement one (or multiple) of these methods and/or describe them. Or describe what types of noise there might be in an audio file and ways in which you can reduce them.

DELIVERABLES

You will deliver through MMS the following elements, compressed in a zip with the same folder structure that you used to run them:

- A pdf with your answers to the tasks
- Your Matlab Script
- The audio files that you used (i.e., the voice recording and music detailed above)
- Any additional files (code or otherwise) that you used to complete the assignment.

The standard penalty for late submission applies (Scheme B: 1 mark per 8 hour period, or part thereof): http://info.cs.st-andrews.ac.uk/student-handbook/learning-teaching/assessment.html#lateness-penalties

Please note that the Good Academic Practice also applies: https://info.cs.st-andrews.ac.uk/student-handbook/academic/gap.html

This practical accounts for 35% of the coursework marks in the module.

The marking will conform to the mark descriptors from the student handbook: http://info.cs.st-andrews.ac.uk/student-handbook/learning-teaching/feedback.html#Mark_Descriptors

GENERAL ADVICE

Try to relate what you are doing in the file to the content of the model lectures. Clarity in your answers is more likely to result in higher marks. Do comment your code for readability. Make sure your figures have axis labels (which are legible in the report) and you create figure captions in your report.