CmpE 362: Homework 3: Frequency Domain Filtering and Processing
Due by 23:59 Sunday, May 26

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1 Introduction

In this homework, you will implement some simple frequency domain exercises with MATLAB.

1.1 Advanced Peak Finder

In this part, you will improve your peak detection algorithm that you developed in the first homework. You will design a low pass lter (See Chapter 6 : Frequency Response of FIR Filters for detailed description) For this lter, you will change the limit frequency of the low pass filter between 1000Hz, 2000Hz, 3000Hz and 4000Hz. You will apply these four different low pass filters with cut off frequencies (1k,2k,3k,4k) and plot number of peaks versus changing cut off frequencies. (Add no filter also). Add these plots to your pdf report. Name your script as AdvancedPeakFreqFilter.m.

1.2 Converting a Hubble Deep Space Image Into Space Sound

In this part, you will convert a Hubble deep space image into space sound. The image is provided in HW3materials.zip file as Hubble Massive Panorama. You will examine the image as columns. Starting with the first column you will examine each pixel whether it is black or not. There are 900 pixels in each column. If a pixel in the column is not black, it means there is a celestial body in the pixel. Divide 900 pixel in the column into 10 parts. Starting from the bottom of the picture, index parts in decreasing order from 10 to 1. If a non-black pixel exists in any part, create an amplitude in the nth pixel frequency with index of the part amplitude. As an example, if there is a non-black exist in 68th pixel of a column, you will create 10 amplitude in 68Hz. If a pixel is black, create a zero amplitude in the corresponding frequency. By applying these rules, you will have different amplitudes from 0 to 900 Hz.

After you create 1024 spectra that have different amplitudes from 0-900Hz, convert each of them into time domain. Duration of each spectrum must be 1 second. Concatenate each one-second wav files one after another and create a wav signal that has length of 1024 seconds. Name your script as SonifiedDeepSpace.m. In the last line of your MATLAB script, play the created sound. (Hint: You can use Fourier Transform and Inverse Fourier Transform when converting between time and frequency domains.)

1.3 Report and Notes

Prepare a report explains your code briefly. Add the figures and codes to the pdf report. Explain your code with comments. Compress the report and the code files. Name it as "YourNumber_CmpE362_HW3.zip".

Upload the file to canvas before the deadline. Deadline is strict. When copying is detected, both parties will get zero.