BOĞAZİÇİ UNIVERSITY

CmpE 362 Spring 2016
HW3 Description

Instructor: Prof. Dr. Fatih Alagöz
TA: Yekta Said CAN

Due: 13 April, 23:59, sharp

In this homework, you will apply the concepts you learned about frequency domain.

1-) In the first part of the project, you will combine two sounds given which are street.wav and mike.wav using MATLAB. Then you will extract speech from noise by using filter. You have to convert the mixed sound to frequency domain. After that, find human voice spectra (frequency band). You will filter outside the human speech band. Then convert the sound to time domain and listen.Both sounds' durations are the same and 9 sec .By this way, it is easier to compute matrices of sounds. Your script should be named ClearNoise.m.

Output: You will output four figures (Each includes several figures as below)

1-)Frequency Domain Representation of Mike.wav, Street.wav, Mike+Street.wav

2-)Time Domain Representation of Mike.wav, Street.wav, Mike+Street.wav

3-)Frequency Domain Representation of Mike.wav, Filtered Mike+Street.wav

4-)Time Domain Representation of Mike.wav, Filtered Mike+Street.wav

You will calculate the SNR value (see end of the document for computation detail) of recovered signal and original mike.wav.

2-) In the second part, you are asked to write a program in MATLAB that differentiates the sound of clap from finger snapping. You can use the sent .wav files (clap.wav and snap.wav) to train your program. When a wav file that contains a clap or a snap sound (not mixed contains only one type) is given as input to your program, it should determine 'clap' or 'snap' accordingly. If it determines a clap, write 'clap sound detected'. Otherwise, write a 'Snap sound detected' message. Use frequency domain in your application. Your script should be named ClapDifferentiate.m. Basically you are going to model the clap and snap on frequency domain and you will set a reasonable frequency threshold. (Examine spectrogram function in MATLAB)

3-) In the last part, you will design N tap filter. N-tap filter is used for alleviating the effects of delayed versions of the sound. You are asked to write a program in MATLAB that combines mike.wav and mike.wav with delay K miliseconds. K is by default 100 miliseconds. You will use N-Tap filter below:
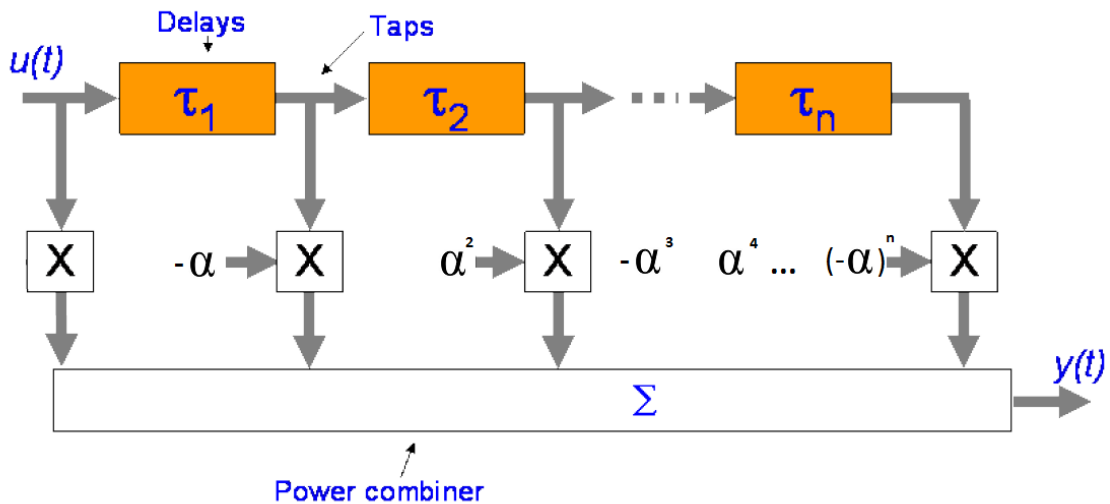
Delays (Γs) will be multiples of K. Second parameter of the function is N. You will change N from 1-50. In your report, explain the effect of N, α and K.

Output: You will output three figures .

1-) Use constant N and K, change α from 0 to 1 and plot SNR of mike.wav and recovered signal.

2-) Use constant α and K, change N from 1 to 50 and plot SNR of mike.wav and recovered signal.

3-) Use constant α and N, change K between 100,200,300,400 miliseconds and plot SNR of mike.wav and recovered signal.

How to Calculate SNR of two audio files:

Signal-to-Noise Ratio (SNR) is used as an objective measure for the metric of imperceptibility. Signal to Noise Ratio (SNR) is a difference metric that is used to calculate the similarity between the original audio signal and the recovered audio signal. The SNR computation is carried out according to equation (1), where I_n is the original audio signal, and E_n corresponds to the recovered audio signal.[5]

$$SNR(dB) = 10 \log \frac{\sum_n I_n{}^2}{\sum_n (E_n - I_n)^2} \qquad (1)$$

REPORT

Prepare a report explains your code briefly. Add the figures and SNR results to report and make comments about created figures for Q1 and Q3. Interpret the results for these questions. Describe your algorithm about Q2 in detail. Compress the report and the code files. Name it as "YourNumber_CmpE362_HW3.zip"(or rar, or 7z etc.). Send the file to yektasaid.can@gmail.com before the deadline. Subject of the mail would be CmpE362 HW3.

NOTES:

Deadline is strict. Do not send after deadline.   When   copying   is detected, both parties will get zero.