

Homework 3 - Student Report

CMPE 362 Spring 2016

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1 Questions & Answers

1.1 Question 1 :

ClearNoise.m In this question after combining two sound and getting noisy sound i applied filter. The filter i used a 'buttord' filter try to cut the noisy sound.

As seen in the frequency domain figures noisy magnitudes of the noisy sound is lower than human voice. So after combine of sounds by designing this filter i tried to disable street sound. Input SNR value i found is **2.0641**

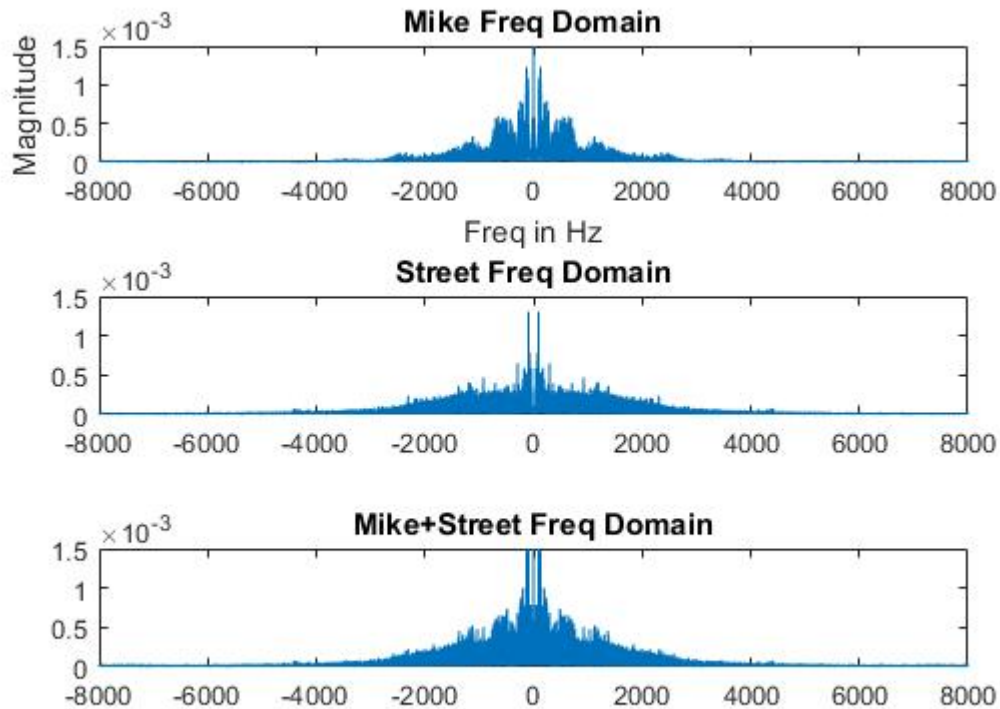


Figure 1: Frequency Domain Representations

```
1 [y1,F]=audioread('mike.wav');
2 [y2,F]=audioread('street.wav');
3
4 %%%Create mike+street sound
5 y3 = [y1+y2];
6 audiowrite('noisy.wav',y3,F);
7
8 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
9 %%% FILTERING %%%%%%%%%%
10 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
11 Ws = 250/(F/2);
12 Wp = 3500/(F/2);
```

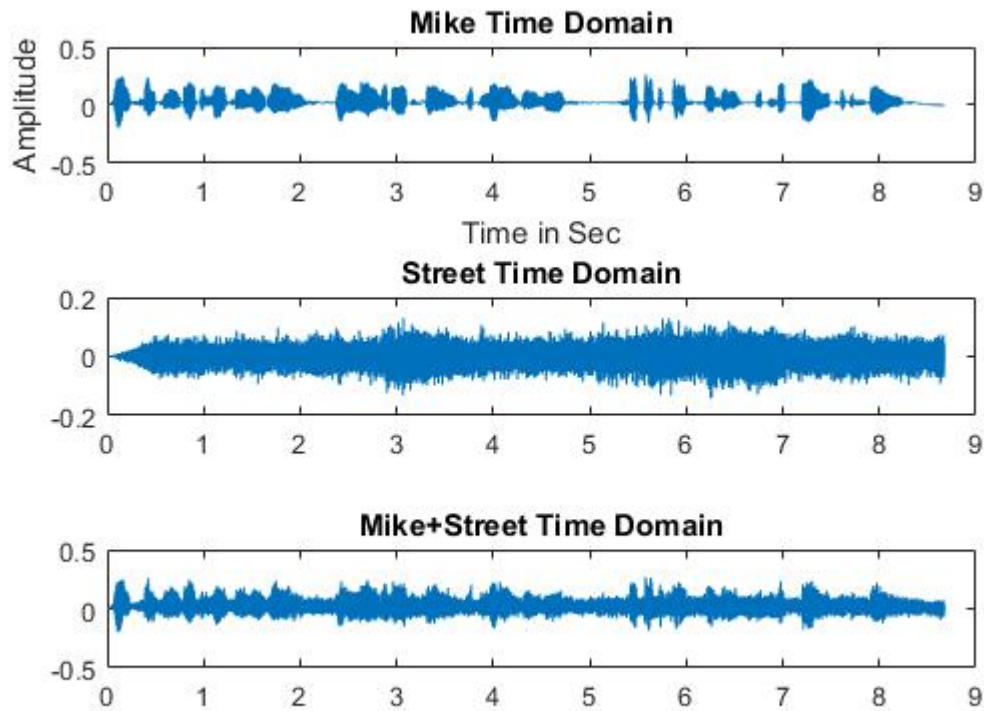


Figure 2: Time Domain Representations

```

13 [N,Wn] = buttord(Wp,Ws,0.5,50);
14 [b,a] = butter(N,Wn);
15 fout = filter(b,a,y3);
16
17 % Wn = 250/(F/2); % Normalized cutoff frequency
18 % [z,p] = butter(11,Wn,'high'); % Butterworth filter
19 %
20 % fout = filter(z, p, y3);
21
22 % sound(y3,F);
23 % pause(9);
24 % sound(fout,F);
25
26 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
27 % 1- FREQUENCY Domain %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
28 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
29 figure
30
31 N = size(y1,1);
32 df = F / N;
33 w = -(N/2):(N/2)-1)*df;
34 y_1 = fft(y1(:,1), N) / N; %//For normalizing, but not needed for our analysis
35 yy = fftshift(y_1);
36 subplot(3,1,1)
37 plot(w,abs(yy));
38 xlim([-0.8e4 0.8e4]);

```

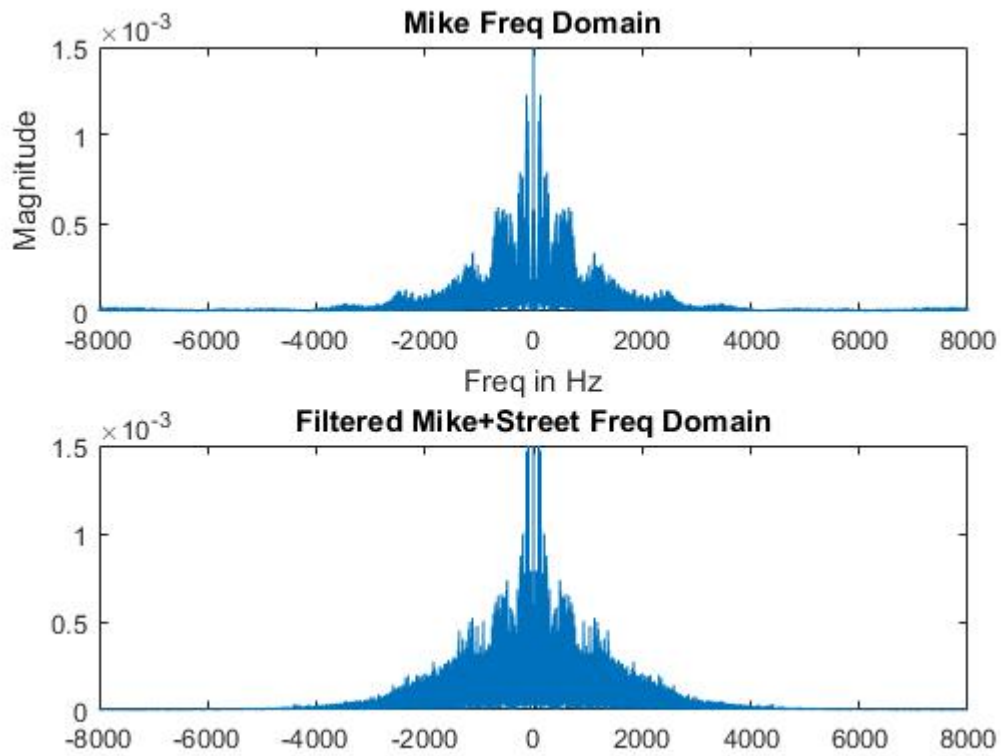


Figure 3: Actual and Filtered Freq. Domains

```

39 ylim([0 1.5e-3]);
40 xlabel('Freq in Hz');
41 ylabel('Magnitude');
42 title('Mike Freq Domain')
43 hold on;
44
45 N2 = size(y2,1);
46 df2 = F / N2;
47 w2 = (-(N2/2):(N2/2)-1)*df2;
48 y_2 = fft(y2(:,1), N2) / N2; %//For normalizing, but not needed for our analysis
49 yy2 = fftshift(y_2);
50 subplot(3,1,2)
51 plot(w2,abs(yy2));
52 xlim([-0.8e4 0.8e4]);
53 ylim([0 1.5e-3]);
54 title('Street Freq Domain')
55 hold on;
56
57 N3 = size(y3,1);
58 df3 = F / N3;
59 w3 = (-(N3/2):(N3/2)-1)*df3;
60 y_3 = fft(y3(:,1), N3) / N3; %//For normalizing, but not needed for our analysis
61 yy3 = fftshift(y_3);
62 subplot(3,1,3)
63 plot(w3,abs(yy3));
64 xlim([-0.8e4 0.8e4]);

```

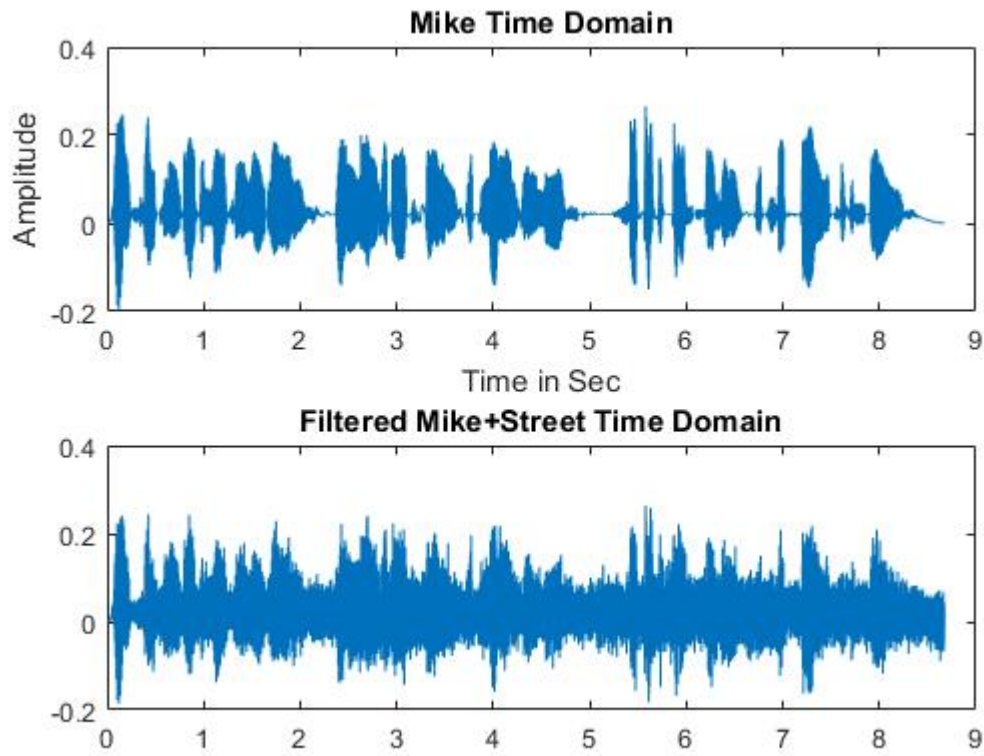


Figure 4: Actual and Filtered Time Domains

```

65 ylim([0 1.5e-3]);
66 title('Mike+Street Freq Domain')
67 hold on;
68
69
70
71 #####
72 *** TIME Domain ***
73 #####
74 figure
75
76 t=0:1/F:(length(y1)-1)/F;
77 subplot(3,1,1)
78 plot(t,y1)
79 title('Mike Time Domain');
80 xlabel('Time in Sec');
81 ylabel('Amplitude');
82 hold on;
83
84 t1=0:1/F:(length(y2)-1)/F;
85 subplot(3,1,2)
86 plot(t1,y2)
87 title('Street Time Domain');
88 hold on;
89
90 t2=0:1/F:(length(y3)-1)/F;

```

```

91 subplot(3,1,3)
92 plot(t2,y3)
93 ylim([-0.2 0.4]);
94 title('Mike+Street Time Domain');
95 hold on;
96
97 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
98 %%%%%%%%% 3- FREQUENCY domain%%%%%%%%
99 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
100 figure
101
102 subplot(2,1,1)
103 plot(w,abs(yy));
104 xlim([-0.8e4 0.8e4]);
105 ylim([0 1.5e-3]);
106 xlabel('Freq in Hz');
107 ylabel('Magnitude');
108 title('Mike Freq Domain');
109 hold on;
110
111 subplot(2,1,2)
112 NN3 = size(fout,1);
113 dff3 = F / NN3;
114 ww3 = (-NN3/2):(NN3/2)-1)*dff3;
115 fout_1 = fft(fout(:,1), NN3) / NN3; %//For normalizing, but not needed for our analysis
116 ffout= fftshift(fout_1);
117 plot(ww3,abs(ffout));
118 xlim([-0.8e4 0.8e4]);
119 ylim([0 1.5e-3]);
120 title('Filtered Mike+Street Freq Domain')
121 hold on;
122
123 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
124 %%%%%%%%% 4- TIME domain%%%%%%%%
125 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
126 figure
127
128 subplot(2,1,1)
129 plot(t,y1)
130 title('Mike Time Domain');
131 xlabel('Time in Sec');
132 ylabel('Amplitude');
133 hold on;
134
135 subplot(2,1,2)
136 t_fout=0:1/F:(length(fout)-1)/F;
137 plot(t_fout,fout)
138 title('Filtered Mike+Street Time Domain');
139 hold on;
140
141 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
142 %%%%%%%%% SNR Value%%%%%%%%
143 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
144
145 s = mean(y1.^2)/mean((fout-y1).^2);
146 snr = 10.^log(s);

```

1.2 Question 2 :

ClapDifferentiate.m Since i couldn't know the exact wav file to read, i read as '*.wav' but my program can only determines for 1 wav file. So this should be taken into consideration.

In the question, i first looked at frequency of the sound and then by trial and error method i determined that a clap contains high frequencies than snap. So i designed a highpass filter using *buttord* and *butter* functions. And then i look for max frequency in the domain. I determined my threshold as 60 Hz after filtering. If max frequency of the sound is below, it must be a snap, i say.

```
1  [stereo1, F] = audioread('*.wav');
2
3  mono1 = mean(stereo1,2);
4
5  % sound(stereo1,F);
6
7  figure
8  N = size(mono1,1);
9  df = F / N;
10 w = (-(N/2):(N/2)-1)*df;
11 y = fft(mono1(:,1), N) / N; %//For normalizing
12 yy = fftshift(y);
13 plot(w,abs(yy));
14 xlabel('Freq in Hz');
15 ylabel('Magnitude');
16 title('Freq Domain | Before')
17
18 % pause(2);
19
20 Ws = 5/(F/2);
21 Wp = 2200/(F/2);
22 [N,Wn] = buttord(Wp,Ws,0.5,10);
23 [b,a] = butter(N,Wn);
24 fout = filter(b,a,mono1);
25
26 % sound(fout,F);
27
28 figure
29 N = size(fout,1);
30 df = F / N;
31 w = (-(N/2):(N/2)-1)*df;
32 y = fft(fout(:,1), N) / N; %//For normalizing
33 yy = fftshift(y);
34 plot(w,abs(yy));
35 xlabel('Freq in Hz');
36 ylabel('Magnitude');
37 title('Freq Domain | After')
38
39 [max_value,idx] = max(fout);
40
41 if max_value<0.006
42     disp('Snap sound detected')
43 else
44     disp('Clap sound detected')
45 end
```

1.3 Question 3 :

Nand Despite of nearly hours of research on the Internet , i couldn't find particular solution to what we asked for, so i couldn't do this one.