Contents

ELEN 133L Prelab 4

```
clc
clear all
close all

% Given parameters
N = 100;
w = 80;
fs = 8000;

fc770 = 770;
fc697 = 697;

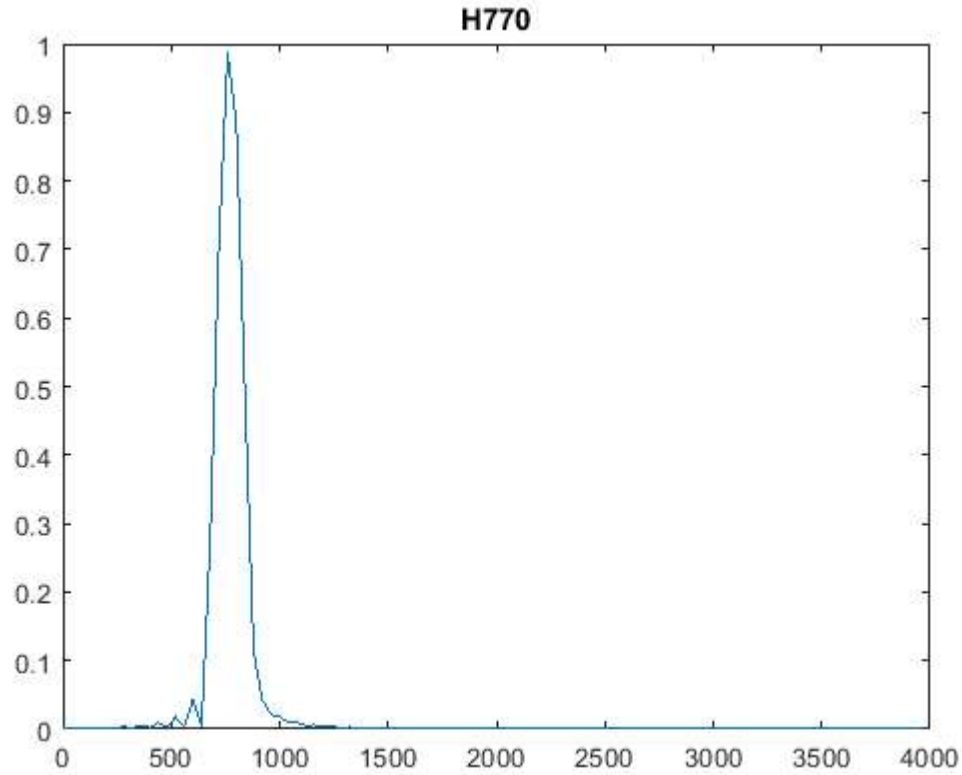
wn770 = [fc770-w, fc770+w]/(fs/2);
wn697 = [fc697-w, fc697+w]/(fs/2);

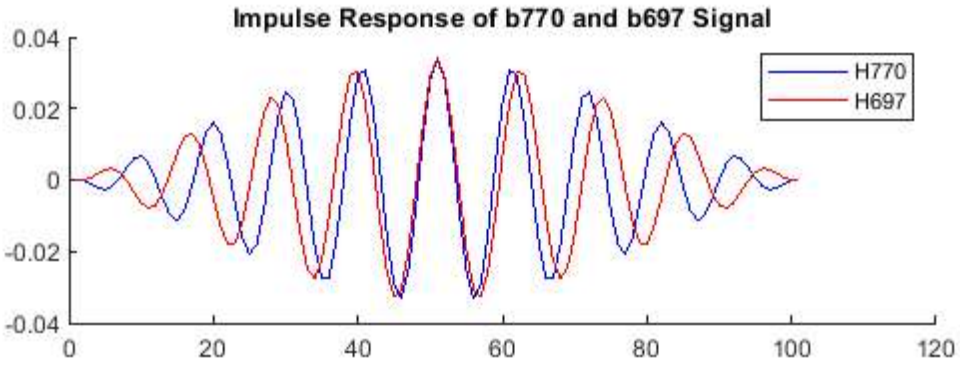
b770 = fir1(N, wn770, rectwin(N+1) );
b697 = fir1(N, wn697, rectwin(N+1) );
[H770, fv] = freqz(b770,1,N,fs);
[H697, fv] = freqz(b697,1,N,fs);

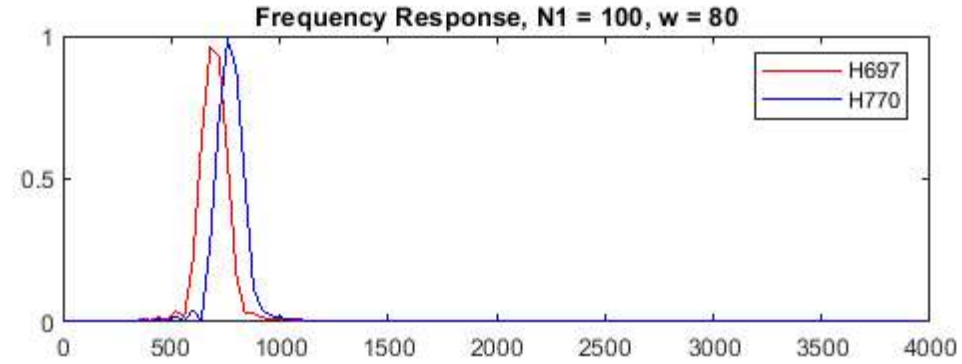
% Plotting
figure(1)
plot(fv,abs(H770))
title('H770')

% The magnitude of the fr is about 1 at 770 Hz.
% The magnitude of the fr is about 0.4 at 851Hz.
% The magnitude of the fr is about 0.4 at 698 Hz.

% Below 770Hz, the plot first hits around zero at 640Hz.
% Above 770Hz, the plot first hits around zero at 1000Hz
% Plotting the one sided spectra for both 770 and 697
figure(2)
subplot(2,1,1)
hold on
plot(b770,'-b')
plot(b697,'-r')
hold off
title('Impulse Response of b770 and b697 Signal')
legend('H770','H697')
subplot(2,1,2)
plot(fv, abs(H697),'-r', fv, abs(H770),'-b')
title('Frequency Response, N1 = 100, w = 80')
legend('H697','H770')
```







Step 5

```
N=100;
w = 40;
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```
wn770 = [fc770-w, fc770+w]/(fs/2);
wn697 = [fc697-w, fc697+w]/(fs/2);
b770 = fir1(N, wn770, rectwin(N+1) );
b697 = fir1(N, wn697, rectwin(N+1) );
[H770, fv] = freqz(b770,1,N,fs);
[H697, fv] = freqz(b697,1,N,fs);

figure(3)
subplot(2,1,1)
hold on
plot(b770,'-b')
plot(b697,'-r')
hold off
title('Impulse Response of b770 and b697 Signal')
legend('H770','H697')

subplot(2,1,2)
plot(fv, abs(H697),'-r', fv, abs(H770),'-b')
title('Frequency Response, N1 = 100, w = 40')
legend('H697','H770')
% Each peak is at a defined value but there is a lot of overlap.

N = 100;
w = 20;

wn770 = [fc770-w, fc770+w]/(fs/2);
wn697 = [fc697-w, fc697+w]/(fs/2);
b770 = fir1(N, wn770, rectwin(N+1) );
b697 = fir1(N, wn697, rectwin(N+1) );
[H770, fv] = freqz(b770,1,N,fs);
[H697, fv] = freqz(b697,1,N,fs);

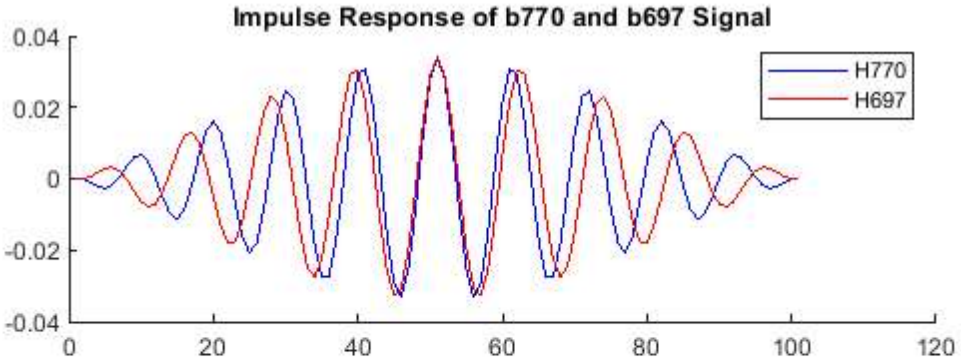
figure(4)
subplot(2,1,1)
hold on
plot(b770,'-b')
plot(b697,'-r')
hold off
title('Impulse Response of b770 and b697 Signal')
legend('H770','H697')
subplot(2,1,2)
plot(fv, abs(H697),'-r', fv, abs(H770),'-b')
title('Frequency Response, N1 = 100, w = 20')
legend('H697','H770')
% Each peak is at a defined value but there is a lot of overlap.

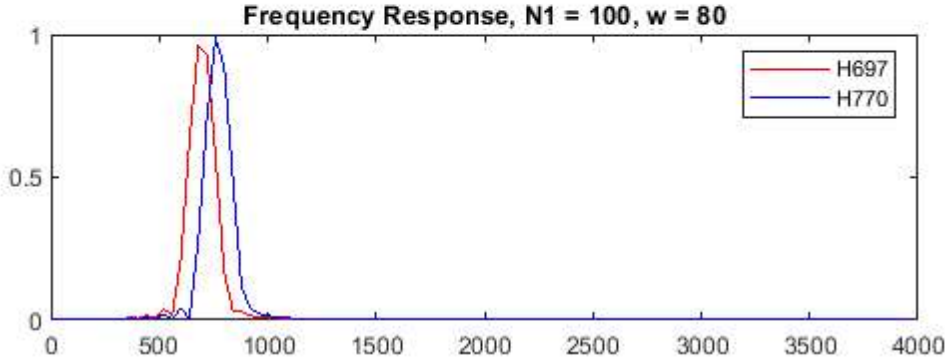
N = 200;
w = 20;

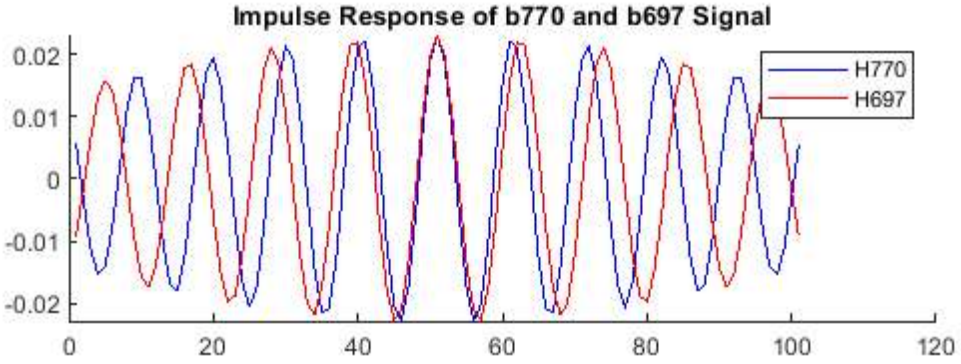
wn770 = [fc770-w, fc770+w]/(fs/2);
wn697 = [fc697-w, fc697+w]/(fs/2);
b770 = fir1(N, wn770, rectwin(N+1) );
b697 = fir1(N, wn697, rectwin(N+1) );
[H770, fv] = freqz(b770,1,N,fs);
[H697, fv] = freqz(b697,1,N,fs);

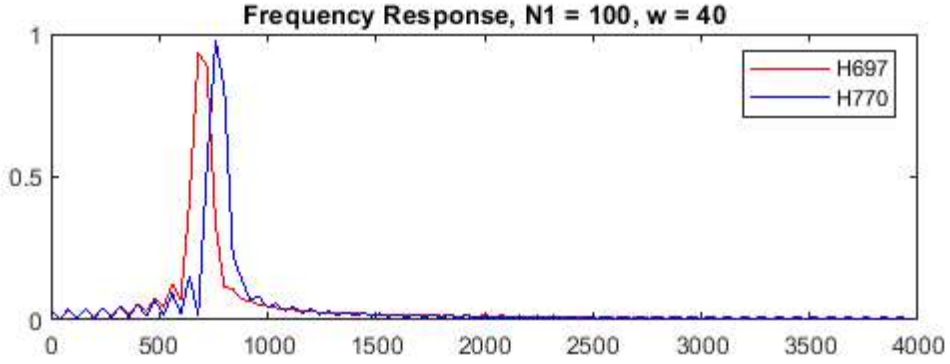
figure(5)
subplot(2,1,1)
hold on
plot(b770,'-b')
plot(b697,'-r')
```

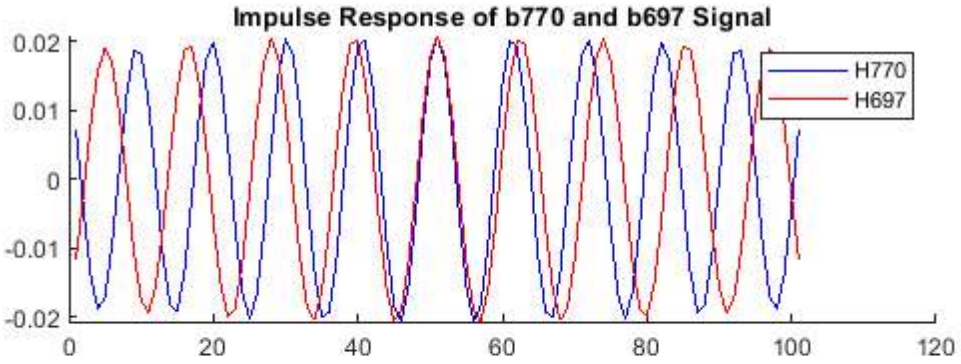
```
hold off
title('Impulse Response of b770 and b697 Signal')
legend('H770','H697')
subplot(2,1,2)
plot(fv, abs(H697),'-r', fv, abs(H770),'-b')
title('Frequency Response, N1 = 200, w = 20')
legend('H697','H770')
% Each peak is at a defined value but there is a lot of overlap.
```

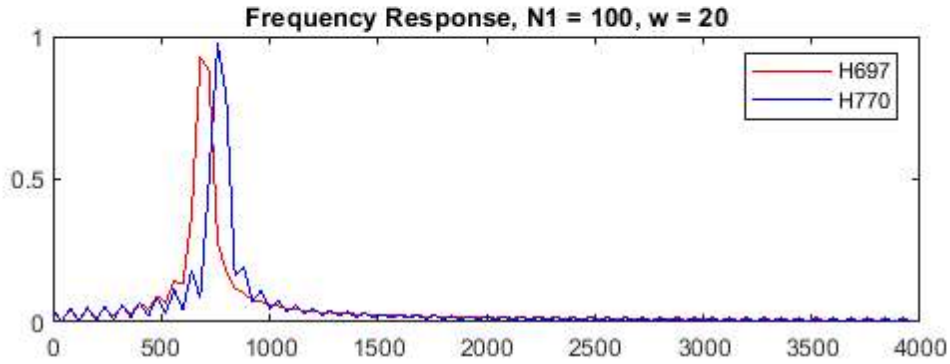

Impulse Response of b770 and b697 Signal
H770
H697
0.04
0.02
0
-0.02
-0.04
0
20
40
60
80
100
120

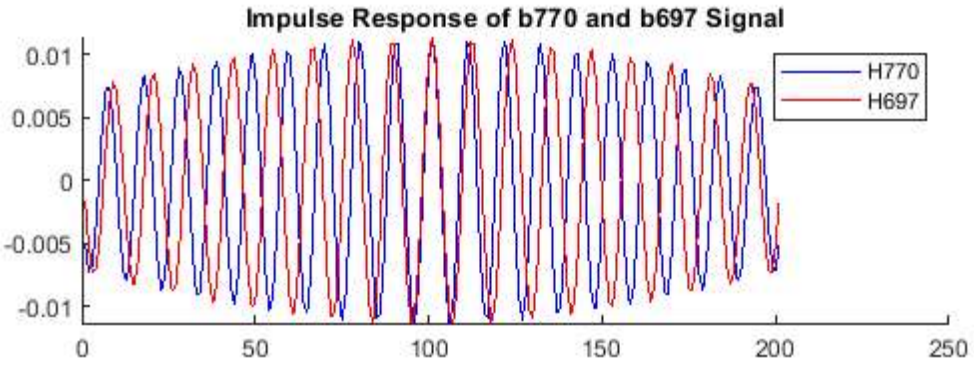

Frequency Response, N1 = 100, w = 80
H697
H770
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
4000

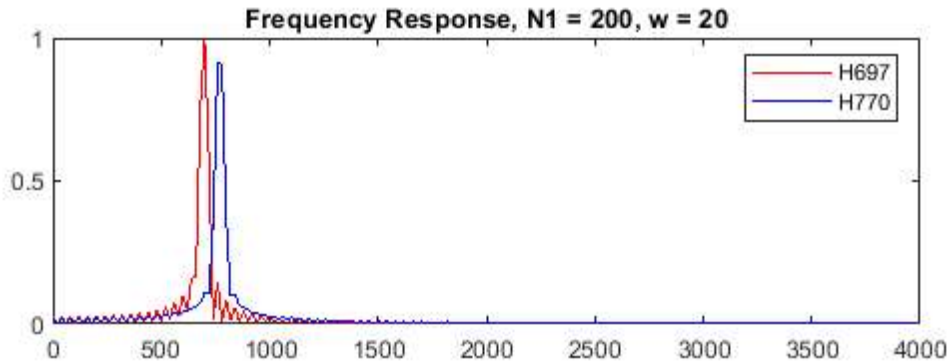

Impulse Response of b770 and b697 Signal
H770
H697
0.02
0.01
0
-0.01
-0.02
0
20
40
60
80
100
120


Frequency Response, N1 = 100, w = 40
H697
H770
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
4000









Step 6

Compare the results of Steps 4 and 5 with respect to the filter's ability to suppress one of the tones. What is the effect of reducing w? What is the effect of increasing N? Chose a set of values for N and w that you think would be the best to use in filters that would reliably distinguish the row 2 tone from the row 1 tone and j

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%Increasing 2 makes it much more stable while increase n increases the
%accuracy of perception as we take more samples. I think 150 and 2 would be
%great.
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