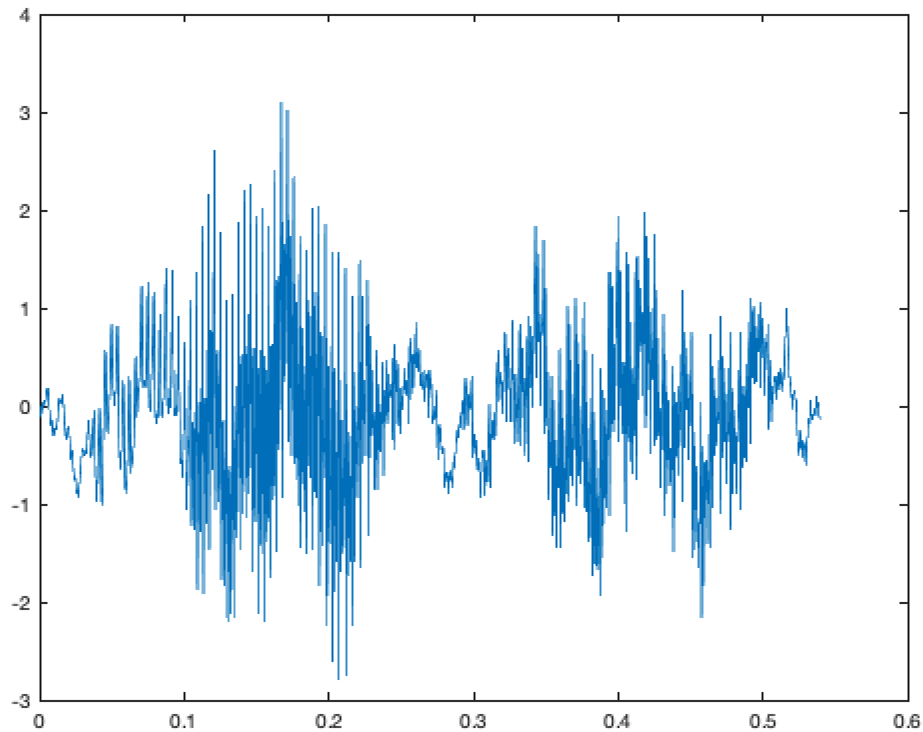
David Hou
bh1762

Table of Contents

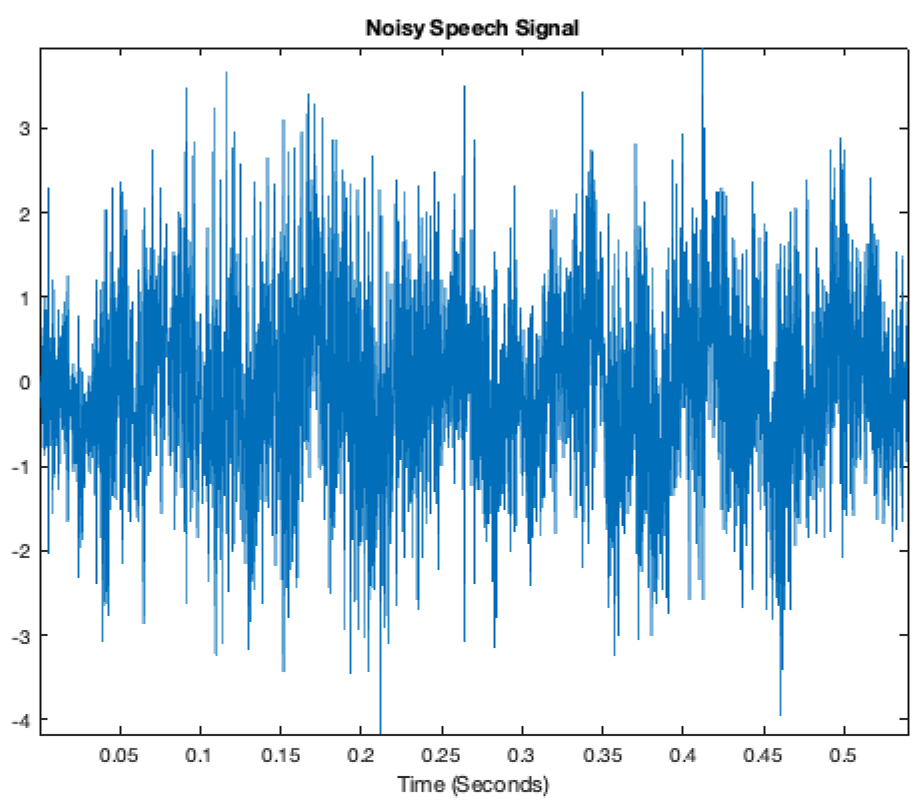
1. Noisey Speech Plots

```
load mtlb
who

L = length(mtlb);
figure %1
plot([1:L]/Fs,mtlb)
load NoisySpeech.txt
x = NoisySpeech;
figure %2
plot ([1:L]/Fs,x)
axis tight
xlabel('Time (Seconds)')
title('Noisy Speech Signal')
soundsc(x)
```

```
Your variables are:

Fs            N             Rs            a             mtlb
L             NoisySpeech   Wn            b             x
M             Rp            Y             f
```



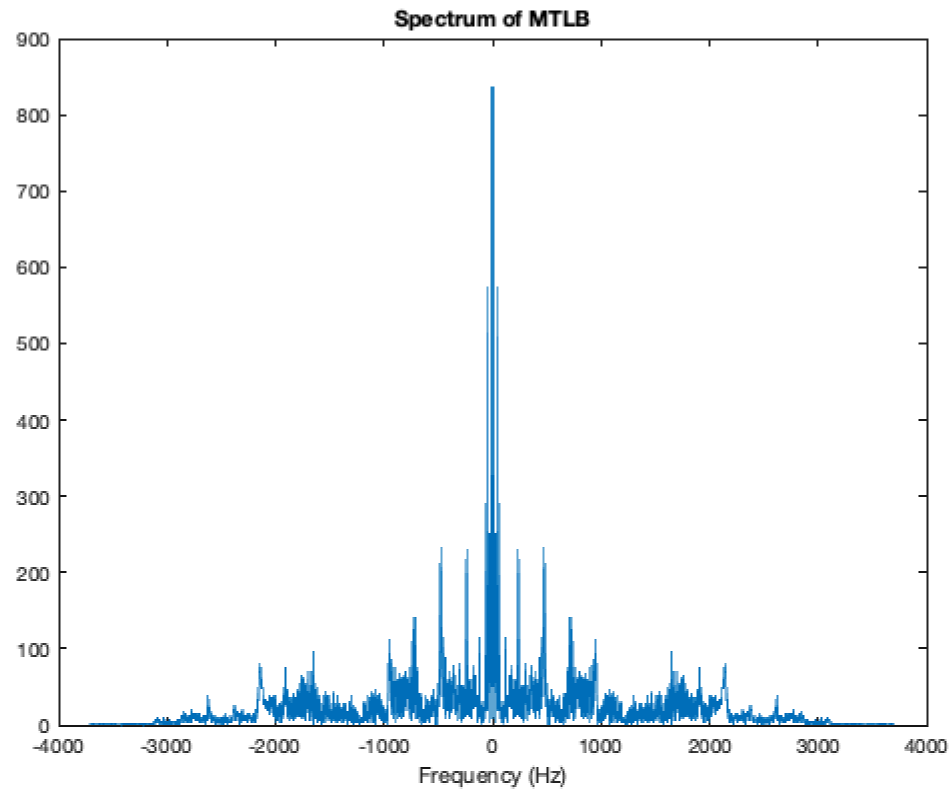
4
3
2
1
0
-1
-2
-3
0
0.1
0.2
0.3
0.4
0.5
0.6



Noisy Speech Signal
3
2
1
0
-1
-2
-3
-4
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Time (Seconds)

2. Discrete Time Fourier Transform

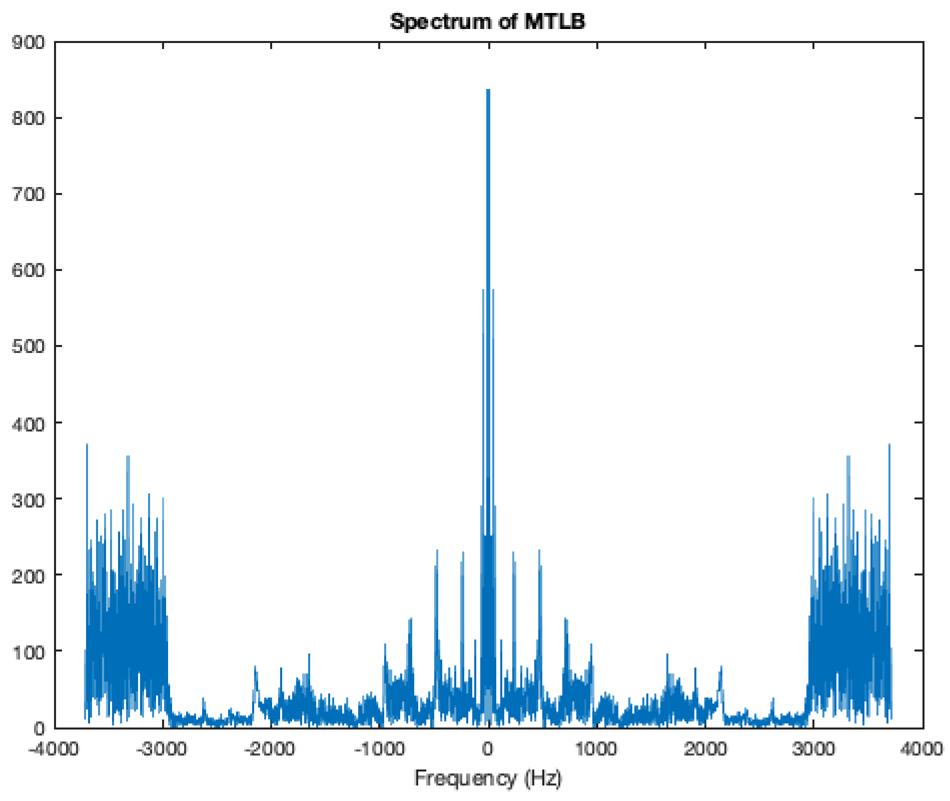
```
[M,f] = dtft(mtlb,1/Fs);
figure %3
plot(f,M)
xlabel('Frequency (Hz)')
title('Spectrum of MTLB')
soundsc(M)

% Fourier Transform plot can show the presence of specific frequencies
 in
% the signal. From figure 3 we can see that the largest spike is
 present at
% 0Hz. Various other spikes show the predominant frequencies in the
 signal.
```



3. dtft with Noisey Speech

```
[M,f] = dtft(x,1/Fs);
figure %4
plot(f,M)
xlabel('Frequency (Hz)')
title('Spectrum of MTLB')
soundsc(M)
```

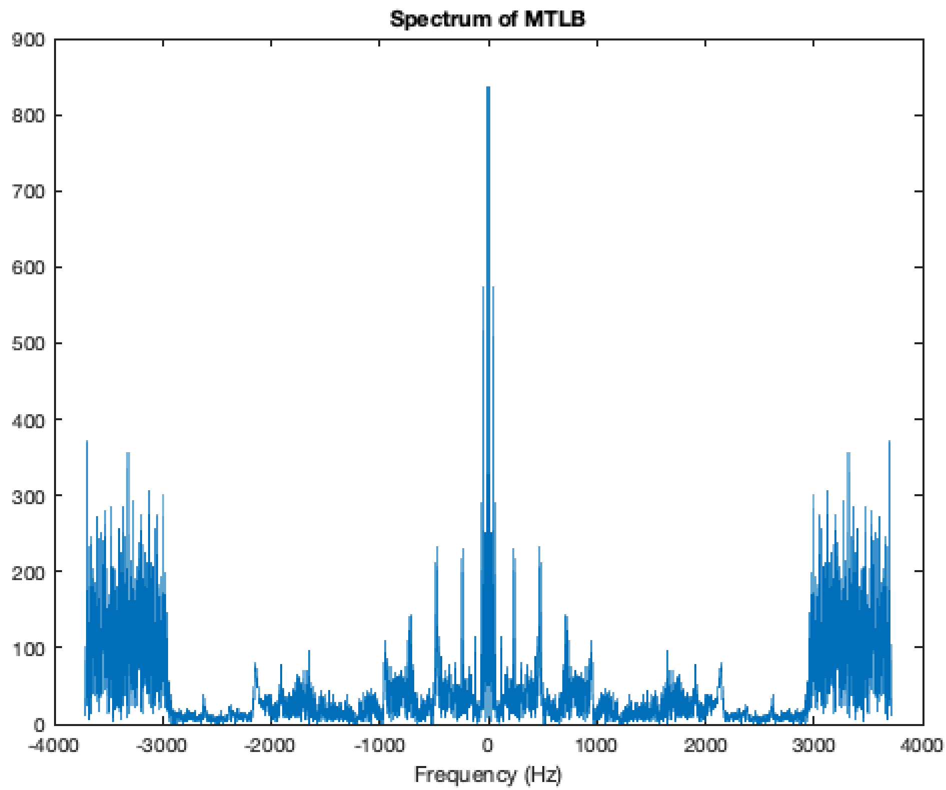
```
% We look again at the fourier transform plot, this time figure 4.
 Like
% part 2, the spikes in this plot represent the most prominent signal
% frequencies. However, at |?| > 3000Hz, we see signficant noise. To
 remove
% this noise, a high-cut/low-pass filter should be used. A high-
frequency
% cutoff of 3000Hz should be effective at removing the hihg-frequency
 noise
% from this signal.
```

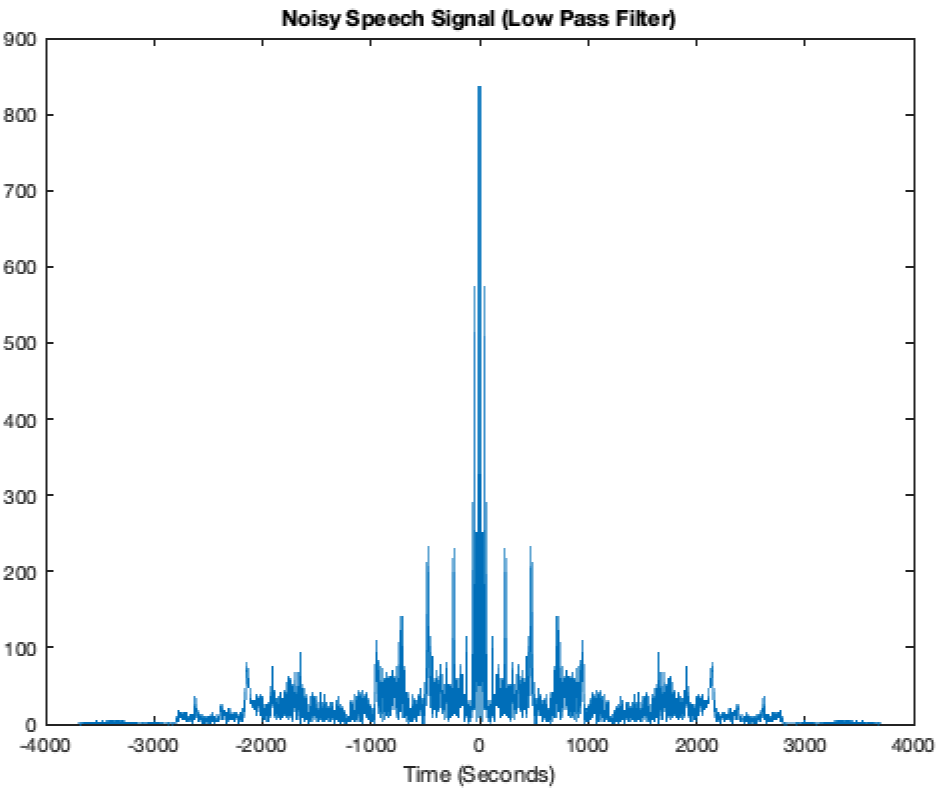


Part 4

```
Wn = 0.75;
N = 7;
Rp = 0.3;
Rs = 35;
[b,a] = ellip(N,Rp,Rs,Wn,'low');
Y = filter(b,a,x);
[M,f] = dtft(Y,1/Fs);
figure %8
plot(f,M)
xlabel('Time (Seconds)')
title('Noisy Speech Signal (Low Pass Filter)')
soundsc(M)
```

```
% Finding the proper Wn for the appropriate pass-band edge is the most
% important in reducing the noise in the signal. I find that Wn=0.65
 works
% very well for reducing noise without losing the original signal.
 Setting
% the filter to be too high-order also results in some strange
 results. I
% find that 7th order works well. Setting an appropriately high stop-
band
% attenuation Rs is also important. Too low and the noise will only be
% reduced in magnitude. 35dB attenuation is enough to mostly remove
 the
% noise in this case.

% After listening, these settings almost perfectly reproduce the
 original
% sound.
```





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