جامعة بيرزيت
BIRZEIT UNIVERSITY

**Faculty of Engineering & Technology**
**Electrical & Computer Engineering Department**

## Digital Signal Processing (DSP)

## ENCS4310

# Gender Recognition of a speaker
# Project Report

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# Abstract:

Gender Recognition of a speaker has various potential applications such as speaker identification for securing access to confidential information or virtual spaces.
As a human it is easy to differentiate between male and female voices, but in this project, we need to use an identification technique to recognize males and females voices according to their speech analysis.

Several voices of males and females were considered in the project as a test dataset files.wav, and check them if accepted or not.

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# Procedure & Results and Analysis

First, the voice was read, then the sampled frequency (fs) was found, and compared with the threshold frequencies of both male and female voices. For males (85-155 Hz), and for Females (165 to 255 Hz). The comparison is shown below in figure 1.

```
%decision making
if(fo<160)
    disp('THE VOICE IS OF A MALE');
else
    disp('THE VOICE IS OF A FEMALE');
end
```

*Figure 1: Compare the frequency of the signal with the threshold frequencies.*

After running the code shown in appendix, both time and frequency signals were plotted as shown below in figure 2, 3.

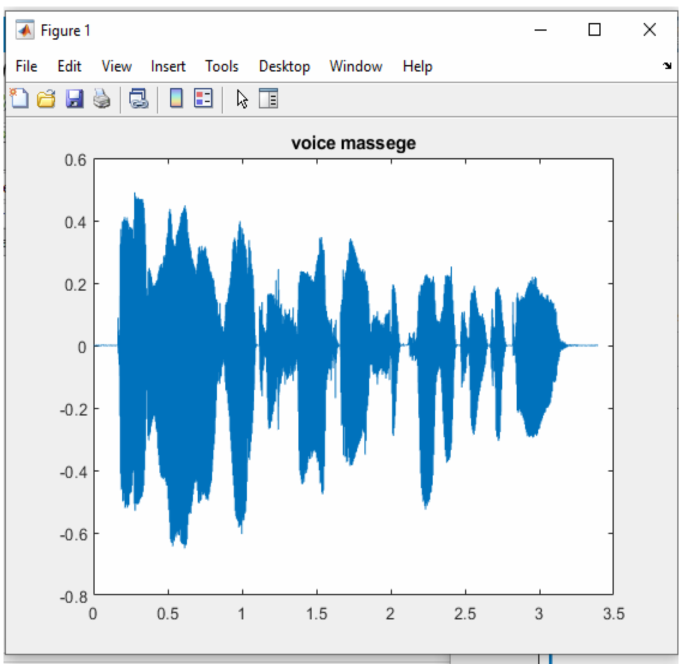


*Figure 2: time domain signal.*

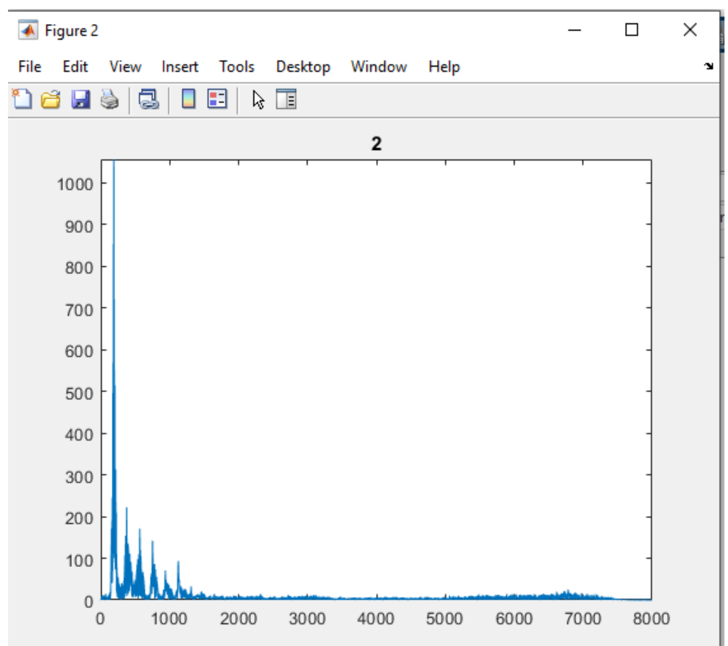


*Figure 3: frequency domain signal.*

Where the both previous plots are for female voice.

Then, the frequency where the maximum occurs was calculated by the code segment in figure 4.

```
%finding freq where the maximun occurs
[val,ind]=max(FFTy(1:N/2));
disp(ind);
fo=ind*Fs/N;
```

Figure 4: finding frequency where the maximum occurs

The rest of the code is about translating the voice into signals and data into a frequency level and take points of it as an array to find the maximum point where we should calculate f0.

```
   646

maximum occured at freq=
  190.2798

THE VOICE IS OF A FEMALE
>>
```

Figure 5: f0 and the final decision.

In this previous example picture, we tested a female voice and f0 = 190.3 which is higher than 160, so our calculations are true.

On the other hand, a male voice was also tested and both time and frequency signals are shown below in figure 6, 7.

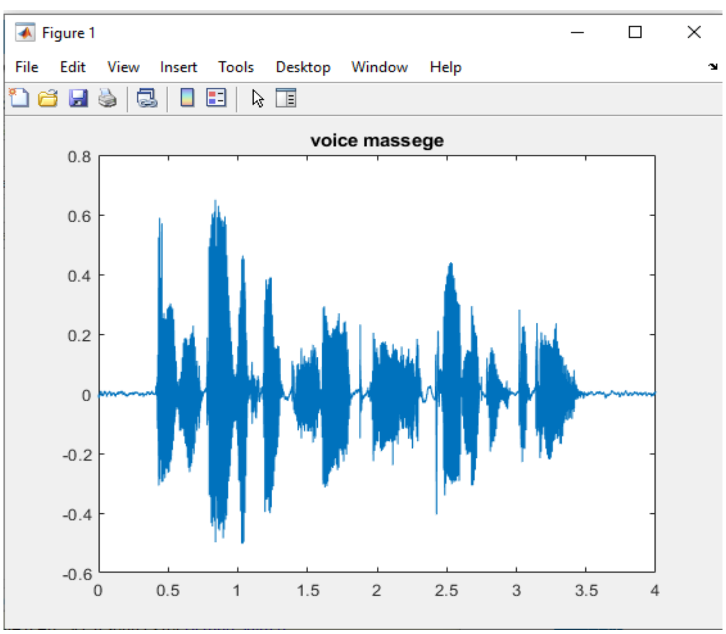


Figure 6: time domain signal for a male.

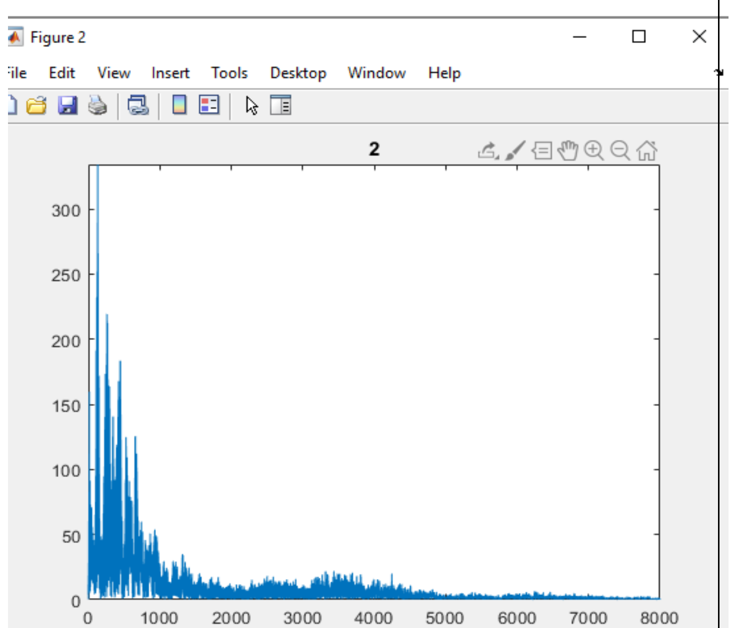


Figure 7: frequency domain signal for a male.

After applying the band pass filter, we can see the difference between male and female, as shown in figure 8.

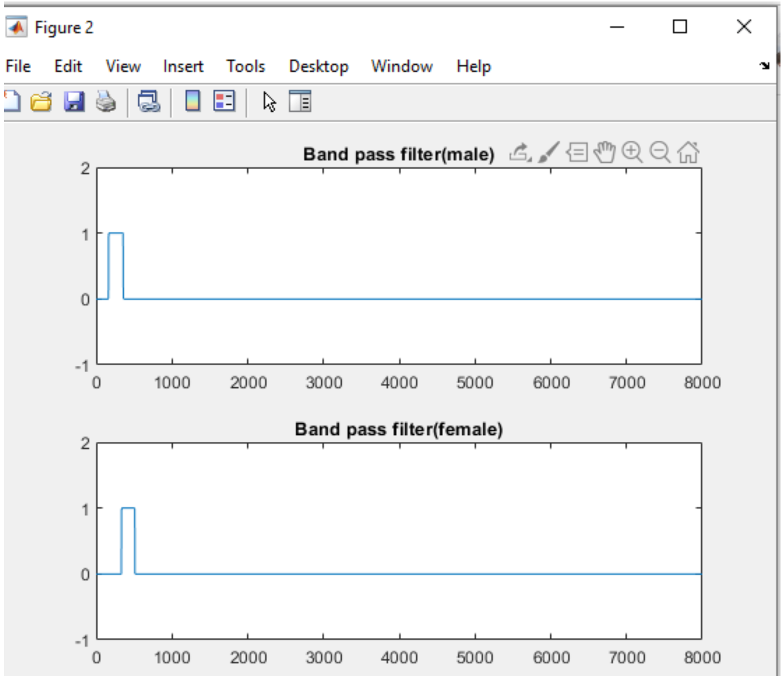


*Figure 8: bandpass filter for a male and female.*

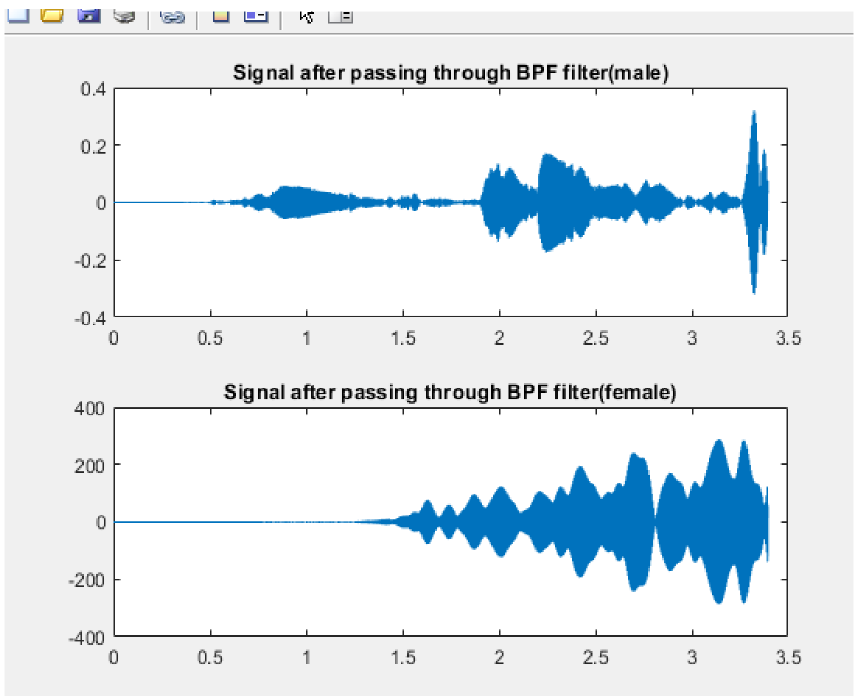


*Figure 9: the signal before and after the filtering.*

We can observe the difference between a male and a female signal after passing them into band pass filter.

Those 2 screenshots are in energy spectrum which shows that the female has a stronger pitch Than the male voices.

# Conclusion:

The project is very useful, we learned how to detect whether the voice is for a male or female, for an optimization to this idea, artificial intelligence will take place to give another method for detection.

As a development for the project, artificial intelligence may be added to the code to serve it better in recognition and separate from different ages and kinds like babies, kids, males, females, old and young people. Another development point is to specify better points to separate between different people's voices.

# References:


WavSource: People: Men / Free Wav Files and Sound Clips

Finding several dataset voices.

https://www.youtube.com/watch?v=z7mZD0xQIX8

Reading the voice file in matlab and plot both time and frequency signals

7526a5d56b59c614ec8cf6233d2b5e2a.pdf (birzeit.edu)
Matlab based Gender Recognition using Voice Processing

Microsoft Word - Assim_AA_SPBOPEN_2019 (birzeit.edu)
Age and gender recognition from speech signals

# Appendix:

female_f.m | male_f.m | final_f_d.m | final_t_d.m

```matlab
function Hd = female_f

% All frequency values are in Hz.
Fs = 16000;  % Sampling Frequency

Fstop1 = 165;          % First Stopband Frequency
Fpass1 = 167;          % First Passband Frequency
Fpass2 = 255;          % Second Passband Frequency
Fstop2 = 257;          % Second Stopband Frequency
Astop1 = 60;           % First Stopband Attenuation (dB)
Apass  = 1;            % Passband Ripple (dB)
Astop2 = 80;           % Second Stopband Attenuation (dB)
match  = 'stopband';   % Band to match exactly

% Construct an FDESIGN object and call its BUTTER method.
h  = fdesign.bandpass(Fstop1, Fpass1, Fpass2, Fstop2, Astop1, Apass, ...
                      Astop2, Fs);
Hd = design(h, 'butter', 'MatchExactly', match);

```

female_f.m | male_f.m | final_f_d.m | final_t_d.m

```matlab
function Hd = male_f

Fs = 16000;  % Sampling Frequency

Fstop1 = 85;             % First Stopband Frequency
Fpass1 = 82;             % First Passband Frequency
Fpass2 = 178;            % Second Passband Frequency
Fstop2 = 155;            % Second Stopband Frequency
Astop1 = 60;             % First Stopband Attenuation (dB)
Apass  = 1;              % Passband Ripple (dB)
Astop2 = 80;             % Second Stopband Attenuation (dB)
match  = 'stopband';     % Band to match exactly

% Construct an FDESIGN object and call its BUTTER method.
h  = fdesign.bandpass(Fstop1, Fpass1, Fpass2, Fstop2, Astop1, Apass, ...
                      Astop2, Fs);
Hd = design(h, 'butter', 'MatchExactly', match);

```

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female_f.m | male_f.m | final_f_d.m | final_t_d.m

```matlab
clear;
clc;

filename= 'Male\arctic_a0007.wav';

[y,Fs]= audioread(filename);
N=length(y);

sound(y,Fs);

%plot the input signal
t = linspace(0,N/Fs,N);
figure(1);
plot(t,y);
title('voice massege');

%FFT of the voice signal
FFTy=fft(y,N);
w=Fs*linspace(0,1,N);
figure(2);
plot(w,abs(FFTy))
axis([0 8000 0 max(abs(FFTy))])
title('2');


%finding freq where the maximun occurs
[val,ind]=max(FFTy(1:N/2));
disp(ind);
fo=ind*Fs/N;

disp('maximum occured at freq=')
disp(fo)

%decision making
if(fo<160)
    disp('THE VOICE IS OF A MALE');
else
    disp('THE VOICE IS OF A FEMALE');
end

```

female_f.m | male_f.m | final_f_d.m | final_t_d.m

```
clear;
clc;

filename= 'Female\arctic_a0007.wav';

[y,Fs]= audioread(filename);
N=length(y);

sound(y,Fs);

%plot the input signal
t = linspace(0,N/Fs,N);
figure(1);
plot(t,y);
title('vioce signal');

%freq response of filters
fr_m=freqz(male_f);
fr_f=freqz(female_f);

w=Fs*linspace(0,1,length(fr_f));

figure(2)
subplot(2,1,1)
plot(w,abs(fr_m))
```

```
title('Band pass filter(male)')
axis([0 8000 -1 2])
subplot(2,1,2)
plot(w,abs(fr_f))
title('Band pass filter(female)')
axis([0 8000 -1 2])

%response after passing through band pass filters

ym=filter(male_f,y);

yf=filter(female_f,y);

%ploting time domine signals after passing through BPF filters

figure(3);
subplot(2,1,1)
plot(t,ym)
title('Signal after passing through BPF filter(male)')
subplot(2,1,2)
plot(t,yf)
title('Signal after passing through BPF filter(female)')
```

```

%calculation of energy
ym1=ym/max(ym);
yf1=yf/max(yf);

Em=sum(abs(ym1));
Ef=sum(abs(yf1));

%display the result
if (Em>Ef)
    disp('THE VOICE IS OF A MALE');
else
    disp('THE VOICE IS OF A FEMALE');
end

```