



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

Digital Signal Processing DSP-ENCS4310

Assignment#1

Simple Gender Recognition and Classification of speech signal

Instructor:

Dr. Ashraf Alremawi

Prepared By:

Abd Khuffash-1200970

Section:

1

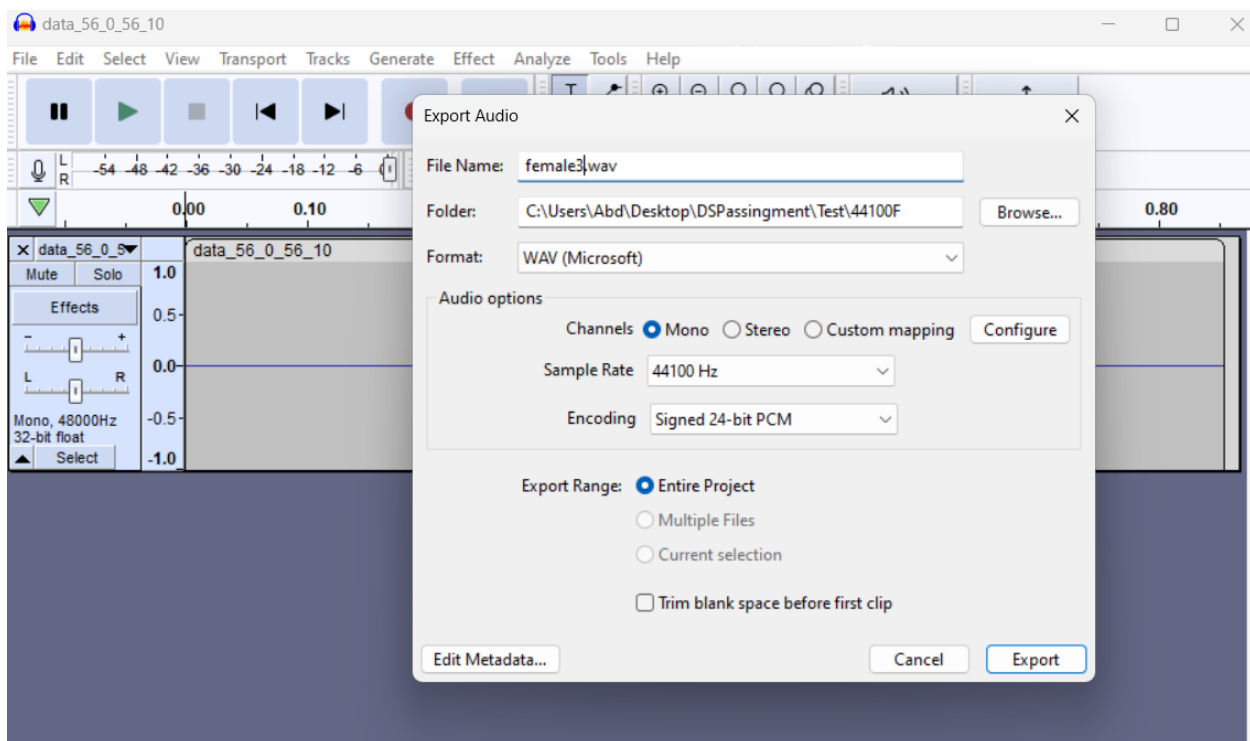
Date:

18-1-2023

In this assignment, the data utilized were sourced from the following link: https://github.com/soerenab/AudioMNIST/blob/master/data/audioMNIST_meta.txt.

This dataset comprises multiple records involving male and female participants articulating the word "zero" across various age groups and in different environmental settings. Initially, the audio recordings were verified to have a sample rate of 44,100 Hz, utilizing the Audacity software. Subsequently, these recordings were categorized into training and testing datasets. The training set comprises 20 recordings of males pronouncing the word "zero," alongside 20 recordings of females articulating the same word. Additionally, a set of 10 recordings was designated for testing purposes.

Audacity tool:



During the training process, a dataset consisting of 20 audio recordings containing utterances of the word "zero" was utilized to train the model. These recordings encompassed both male and female speakers. For the purpose of analysis, the mean energy of these recordings was computed separately for each gender.

In addition, the zero crossing count (ZCR) analysis was conducted on the audio signals. To ensure a comprehensive assessment, each audio signal was divided into three segments, and the ZCR was computed for each of these segments. This approach was adopted due to the observation that there is minimal discernible variation in ZCR between male and female speakers.

Furthermore, Power Spectral Density (PSD) and correlation coefficients were computed for each of the audio recordings from both male and female speakers. These additional analyses aimed to capture and quantify relevant acoustic features for the subsequent stages of model development.

Classifications:

```
>> assignmentdsp
The avarege  energy of male saying zero is
    0.5696

ZCR of Male Saying Zero is
    0.0839    0.0162    0.0105

The energy of Female saying zero is
    0.8611

ZCR of female Saying Zero is
    0.1144    0.0246    0.0170
```

5 testing records of males, 5 testing records of females:

Evaluation According to Energy:

```
-----Evaluating According to Energy-----
Test file [Zero Male] #1 classified as Male saying Zero ,E=5.088263e-01
Test file [Zero Male] #2 classified as Male saying Zero ,E=4.679532e-01
Test file [Zero Male] #3 classified as Male saying Zero ,E=3.976500e-01
Test file [Zero Male] #4 classified as Female Saying Zero E=1.017789e+00
Test file [Zero Male] #5 classified as Female Saying Zero E=1.036590e+00
Test file [Zero Female] #1 classified as Female Saying Zero ,E=4.036858e-01
Test file [Zero Female] #2 classified as Female Saying Zero ,E=3.142083e-01
Test file [Zero Female] #3 classified as Female Saying Zero ,E=2.035930e-01
Test file [Zero Female] #4 classified as Female Saying Zero ,E=1.120046e-01
Test file [Zero Female] #5 classified as Male Saying Zero ,E=1.067375e+00
Accuracy for male classification using Energy: 0.600000
Accuracy for female classification using Energy: 0.800000
```

Evaluation According to Zero crossing Rate:

```
-----Evaluating According to ZCR-----  
Test file [Zero Male] #1 classified as Female Saying Zero  
Test file [Zero Male] #2 classified as Female Saying Zero  
Test file [Zero Male] #3 classified as Male saying Zero  
Test file [Zero Male] #4 classified as Female Saying Zero  
Test file [Zero Male] #5 classified as Female Saying Zero  
Test file [Zero female] #1 classified as female saying Zero  
Test file [Zero female] #2 classified as male Saying Zero  
Test file [Zero female] #3 classified as female saying Zero  
Test file [Zero female] #4 classified as male Saying Zero  
Test file [Zero female] #5 classified as female saying Zero  
Accuracy for male classification using ZCR: 0.200000  
Accuracy for female classification using ZCR: 0.600000
```

Evaluation According to Correlation:

```
-----Evaluating According to Correlation-----  
Test file [Zero Male] #1 classified as Female Saying Zero, Correlation=-0.002088  
Test file [Zero Male] #2 classified as Male saying Zero, Correlation=-0.016447  
Test file [Zero Male] #3 classified as Female Saying Zero, Correlation=-0.008437  
Test file [Zero Male] #4 classified as Female Saying Zero, Correlation=0.102029  
Test file [Zero Male] #5 classified as Male saying Zero, Correlation=0.059089  
Test file [Zero Male] #1 classified as Male saying Zero, Correlation=0.006794  
Test file [Zero Male] #2 classified as Female Saying Zero, Correlation=0.001566  
Test file [Zero Male] #3 classified as Male saying Zero, Correlation=-0.003977  
Test file [Zero Male] #4 classified as Male saying Zero, Correlation=0.038671  
Test file [Zero Male] #5 classified as Female Saying Zero, Correlation=0.004953  
Accuracy for male classification using Correlation: 0.400000  
Accuracy for female classification using Correlation: 0.600000
```

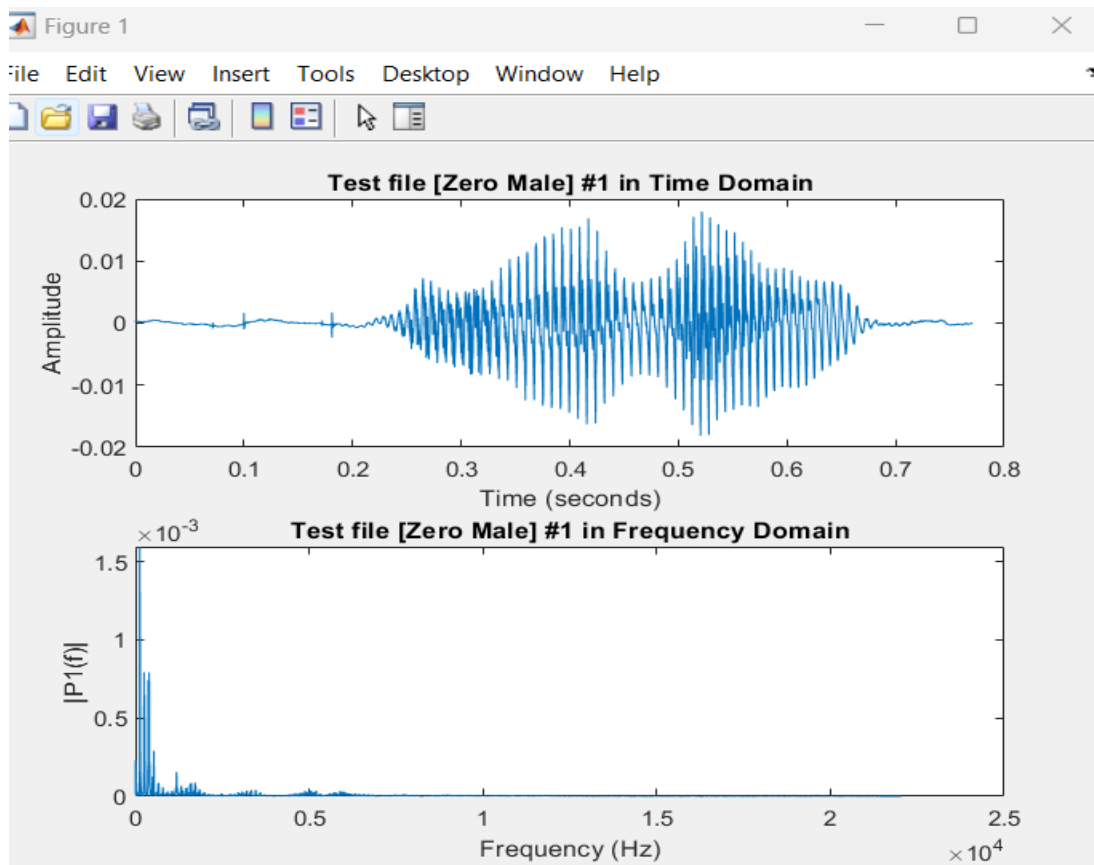
Evaluation According to Power Spectral Density:

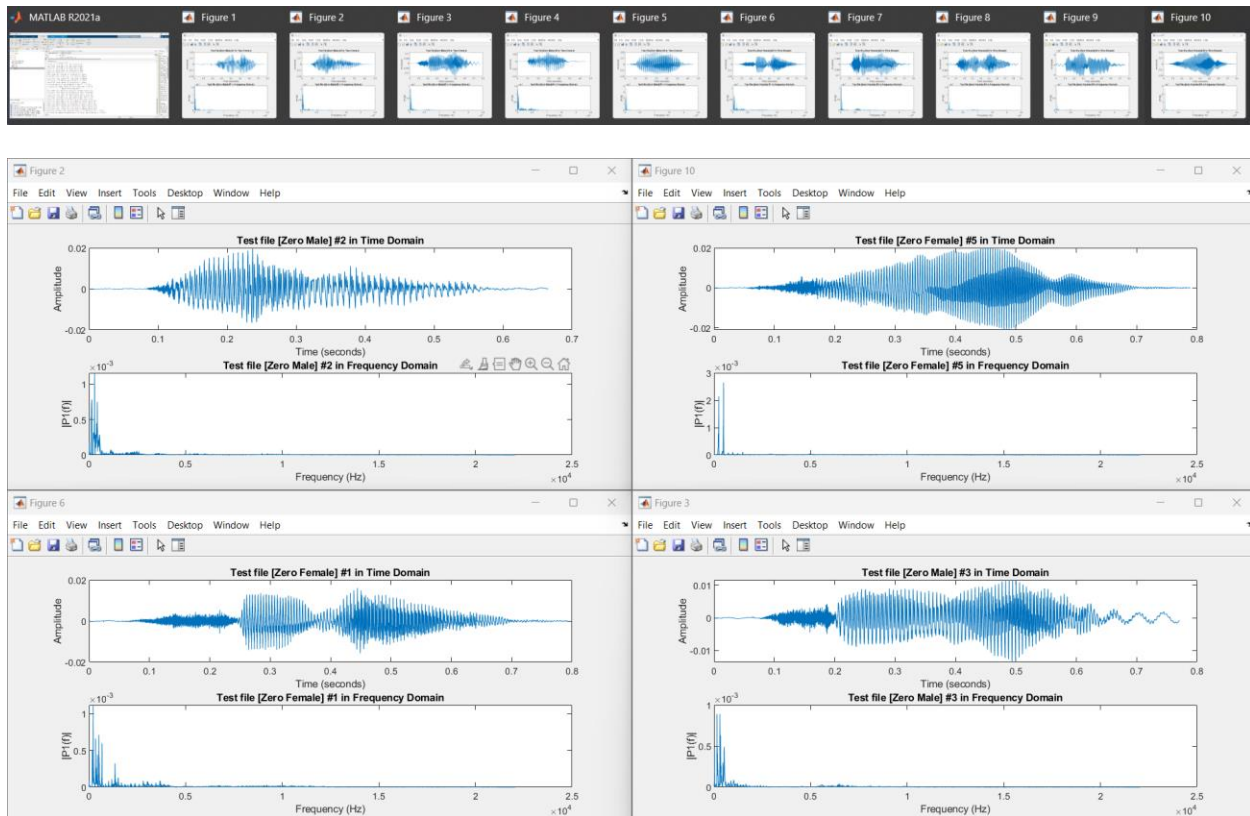
```
-----PSD Evaluating-----  
Test file [Zero Male] #1 classified as Male  
Test file [Zero Male] #2 classified as Male  
Test file [Zero Male] #3 classified as Male  
Test file [Zero Male] #4 classified as Male  
Test file [Zero Male] #5 classified as Male  
Test file [Zero Female] #1 classified as female  
Test file [Zero Female] #2 classified as female  
Test file [Zero Female] #3 classified as female  
Test file [Zero Female] #4 classified as female  
Test file [Zero Female] #5 classified as female  
Accuracy for male classification using PSD: 1.000000  
Accuracy for female classification using PSD: 1.000000
```

When using all CLASSIFICATIONS:

```
-----Merge Classifications-----  
Test file [Zero Male] #1 classified as Male saying Zero  
Test file [Zero Male] #2 classified as Male saying Zero  
Test file [Zero Male] #3 classified as Male saying Zero  
Test file [Zero Male] #4 classified as Male saying Zero  
Test file [Zero Male] #5 classified as Male saying Zero  
Test file [Zero female] #1 classified as female saying Zero  
Test file [Zero female] #2 classified as female saying Zero  
Test file [Zero female] #3 classified as female saying Zero  
Test file [Zero female] #4 classified as female saying Zero  
Test file [Zero female] #5 classified as female saying Zero  
Accuracy for male classification using all classifications: 1.000000  
Accuracy for female classification using all classifications: 1.000000
```

Each Record In Time Domain/ Frequency Domain:

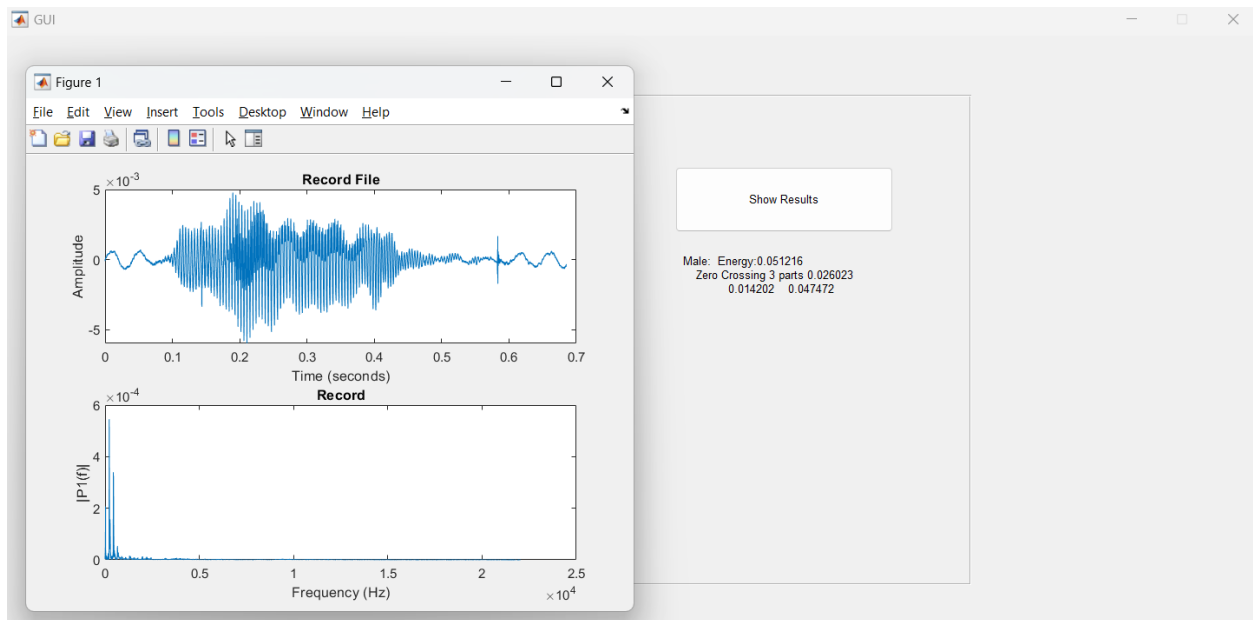
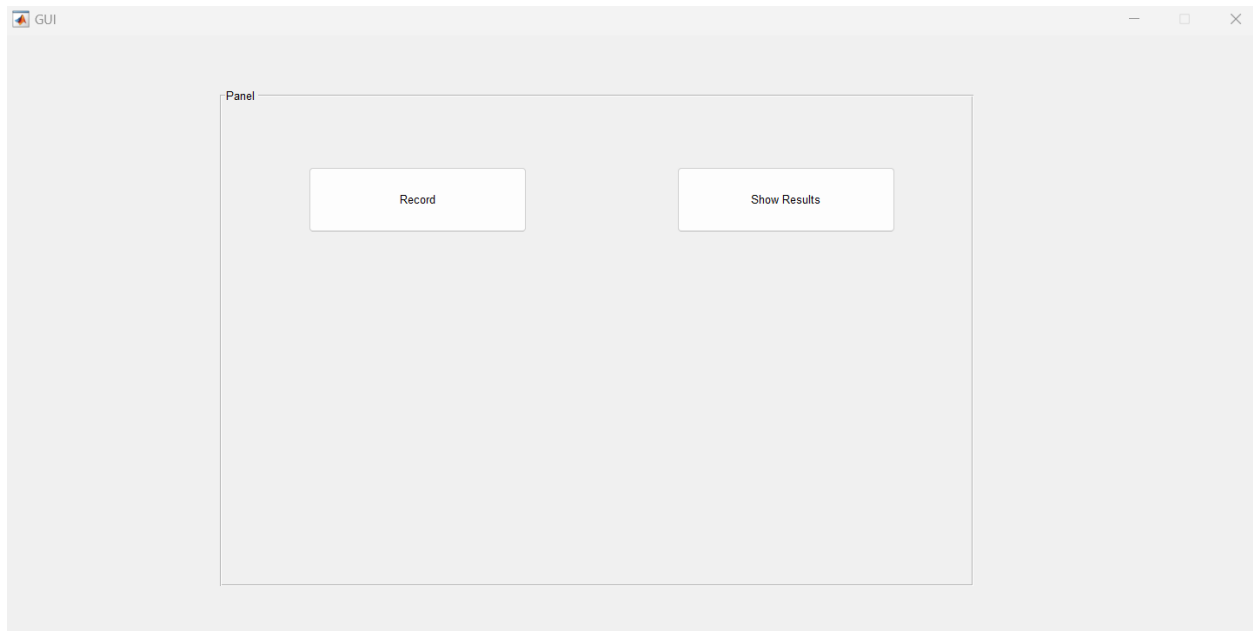




To enhance and broaden the capabilities of this speech recognition system, several strategies can be employed. These include expanding the training dataset with diverse speakers and environments, incorporating advanced machine learning models, augmenting data for variety, and utilizing techniques like dynamic time warping for temporal alignment. Additionally, language modeling, keyword spotting, and real-time processing should be considered to adapt the system for specific applications. Incorporating user feedback, a user-friendly interface, multilingual support, contextual analysis, and noise reduction will further improve its functionality and usability.

Graphic User Interface:

Main screen:



There is a short video testing the Model/GUI in the Attached Files.