

# Project 1 Instructions

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**Due** Mar 27 by 11:59pm      **Points** 100      **Submitting** a file upload

**Available** Mar 1 at 4pm - Mar 27 at 11:59pm 26 days

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This assignment was locked Mar 27 at 11:59pm.



8 hrs



Teamwork

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## Objective

To determine if a time and a frequency domain representation of a signal can help to differentiate it from others. To compare different signals to determine frequency content, e.g., voice of different people saying the same text, with the objective to determine characteristics with clear differences that would help to form a base for voice recognition.

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## Instructions

- Carry out each of the experiments described in the following points and follow also check the different things you need to turned-in when submitting your report.
  - Write your report with a frontpage that contains all the information of each of the members of the team
  - **When submitting, each and everyone of the members of the team will submit the same document in PDF format to be graded.**
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- **Experiment 1.**
  - Define a sentence or phrase to be read by different people.
  - Read such text yourself and record your voice with [the MATLAB program in this link](#)
  - The program will show you a time and frequency content of your voice reading such text
  - In your report you will show a plot of your voice in time and frequency.
  - Conduct a statistical analysis of the amplitude of your voice in the time domain, i.e., histogram, mean, variance, standard deviation, skewness, kurtosis, dispersion (var/std), cdf, pdf. Show plots of cdf, pdf and histogram, as well as data on a table.

- Obtain the autocorrelation of your signal (find out how to do this in MATLAB), plot such autocorrelation.
  - Take the frequency domain representation of your voice signal (Fourier transform). Since this will be a complex signal, get the magnitude square (spectral density) of it and show this in a plot. Provide a description of your signal with respect to the frequency content or concentration.
  - Now take your autocorrelation and obtain its Fourier transform and plot it. See the similarities and differences with respect to the frequency domain representation you just obtained.
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- **Experiment 2.**
  - Repeat the recording of your (still the same person) voice several times (if possible around 50 or more). You can change the program to do this. Try to repeat the conditions of the experiment in order to have the least amount of changes in your voice. Store all your sample signals of your voice.
  - Now, create an average signal from all the samples that you have. Show plots of time and frequency domain of such average signal.
  - Conduct the same statistical analysis that you did for your first voice signal, but of your average signal. Show comparative plots and data tables of the time domain and discuss if there are significant differences.
  - Repeat the frequency domain with your average signal
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- **Experiment 3**
  - Now obtain samples from different people reading the same text and make a comparison. First by comparing the signals in the time domain, the frequency domain with your first signal and then with your average signal. Discuss similarities and differences in the plots and in the values of the tables.
  - Analyze if your voice could be detected as different from the others, explain your findings, and discuss how you would approach the task of detecting your voice from that of others.
  - Now, consider your voice being recorded but for example remotely, i.e., using phone or zoom (remote sample of your voice). Show a time and a frequency domain plots together with the statistical characterization.
  - Compare with your signal that was recorded at the beginning and discuss the frequency content and the differences



## Deliverables

- Your Matlab programs
- Your report containing all the plots, tables, description, and discussions.
- The report must contain a frontpage with all the names and IDs of the members of your team
- Each member of the team will submit the same files

**Format:** your PDF file of the report and your MATLAB programs

**Submission:** Submit your PDF file and m programs through the submission button in CANVAS. If you need, you can submit everything in one ZIP file.



## Evaluation and Feedback

- You will get feedback in the two weeks following the submission. The comments will be made through CANVAS