EE 4820, Won, Spring 2022
Speech Detection Project
Due date: Monday 05/16

1 Content knowledge and skills

The learning objectives of this assignment is to incorporate methods and techniques we have learned in EE4820 this semester to design and implement a speech to text algorithm that could assist individuals with hearing impairment.

The learning outcomes are to:

1. Understand a biomedical application of signal processing techniques.
2. Design an approach to a signal processing program which would meet real needs of real people.
3. Visualize data and results.
4. Conduct spectral analysis; spectrograms.
5. Measure performance.
6. Communicate the approach and results effectively.

2 Problem statement

You will write a program in MATLAB which reads in an audio file and prints the words on the screen so that someone who is deaf would still be able to know what was said in the audio file. You will be working in pairs (in groups of 2).

3 Tasks

1. Understand the broader need for the speech-to-text program and the more specific needs by interviewing someone with hearing impairment.
2. Design an approach that would be a solution to a problem the person you interviewed has due to their hearing impairment.
3. Implement the approach in MATLAB and debug the approach.
4. Measure your MATLAB program's performance.
5. Analyze your results and glean any insights you can gain from your results.

4 Format

Please submit your assignment as follows:

1. a .pdf document to explain your approach and present the results. Be sure to at least include this content:
   (a) Background - Explain the motivation for your project - what problem you are addressing, why does it matter.
   (b) Objective statement - Concisely state what you are trying to achieve with your project and how
   (c) Approach - Describe clearly and thoroughly how you designed your program to convert the speech signal into text to display for a person with hearing impairment.
   (d) Performance of your program - Demonstrate performance of your algorithm through appropriate figures, tables, and/or chargs. Embed a .png image file for each of your figures. Show not only the final output but the steps toward getting there. Analyze your results.
   (e) Insights and reflections - Can you say anything about why your algorithm performed as well as it did, or about why it did not perform as well as you expected? Any insights as to what helped your algorithm perform better, bugs you overcame, or what hindered the performance? How did you tailor your program based on what you learned from the interview? Any suggestions for future work? How much impact do you think your program could have on people with hearing impairment? On healthcare in general? On society in general?
2. the .m files (scripts)
3. your presentation file (e.g., .pptx)

5 Grading

This rubric shows what I will check for when I run your script.

EE 4820 Project Rubric					
Criteria	Ratings				Pts
Connected project to societal impact Created 3 or more interview questions to better understand the impact your work could have on people with hearing impairment.	Expectations met Completely 10 pts	Mostly 7 pts	Minimal 4 pts	None 0 pts	10 pts
Connected project to societal impact Interviewed someone who has hearing impairment and reflected on the potential impact your work could have on this person's life and on society	Expectations met Completely 10 pts	Mostly 7 pts	Minimal 4 pts	None 0 pts	10 pts
Project planning and reflection Through weekly reflections, demonstrated thoughtful planning, assessment, and re-assessment of project, and provided rationale which justified the approach	Expectations met Completely 15 pts	Mostly 10pts	Minimal 5 pts	None 0 pts	15 pts
Approach At least 3 signal processing tools or techniques learned this semester were incorporated into the project	Expectations met Completely 15 pts	Mostly 10pts	Minimal 5 pts	None 0 pts	15 pts
Implementation Implemented signal processing methods correctly; algorithm output detected speech phonemes, output detected text from speech. Demonstrated adequate and appropriate debugging efforts	Expectations met Completely 20 pts	Mostly 14 pts	Minimal 7 pts	None 0 pts	20 pts
Analysis of results Clearly analyzed the algorithm's performance using appropriate figures, tables, charts, text, etc. Demonstrated the accuracy of the signal processing algorithm performs accurately	Expectations met Completely 20 pts	Mostly 14 pts	Minimal 7 pts	None 0 pts	20 pts
Critical thinking Identified limitations of the algorithm and discussed potential improvements	Expectations met Completely 10 pts	Mostly 7 pts	Minimal 4 pts	None 0 pts	10 pts

6 Important dates and tasks

1. over spring break, by 4/4: read over project assignment, start planning, given the following due dates below.
2. Mon. 4/4: find group partner, decide on your phrase bank.
3. Wed. 4/6 (in class): class "interview" with Dr. Raymond Goldsworthy, Professor of Otolaryngology, USC.
4. Wed. 4/6: "2-minute paper" weekly reflections.
5. Mon. 4/11: Write up of your interview notes.
6. Wed. 4/13: upload speech files
7. Wed. 4/13: "2-minute paper" weekly reflections
8. Mon. 4/18: plan / approach to your speech detection program.
9. Wed. 4/20: "2-minute paper" weekly reflections
10. Mon. 4/25: 1st draft of your working code.
11. Wed. 4/27: "2-minute paper" weekly reflections
12. Mon. 5/2: debugged code.
13. Wed. 5/4: "2-minute paper" weekly reflections
14. Mon. 5/9: finalizing code; first draft of report.
15. Wed. 5/11: "2-minute paper" weekly reflections
16. Mon. 5/16, 2:30pm: written report due.
17. Mon. 5/16, 2:30-4:30pm oral presentation