Engineering Project Detailed Research Plan

Please complete the information/questions begun/seen below in red ink. Save this document to your computer, and <u>add a printed hardcopy to your application</u>.

Date: November 17, 2020
Student Name: Eric Zhang, Nelson Gou
Project Title: Using Machine Learning to Recognize Accented Speech

Parts of the generic engineering project are listed below with descriptions to the students in the boxes. Students may provide a detailed research plan by describing their specific project in response to each box below.

> **Engineering Goal**: PROBLEM BEING ADDRESSED: All engineering projects solve a problem or fill a need. This goal should be a simple statement that describes the product being designed, the customer it is for and the problem or need it satisfies. Example" "The goal is to design a solar powered lawn mower for inexpensive automated lawn care for homeowners"

My Project Goal is: The goal is to design a program using Python that can recognize speech from people with different accents and read the intended speech out loud.

> **Design Criteria:** Design criteria define the product's required performance. Examples: " It will have a minimum speed of 10 KPH", The output will be within 15% of the mean of the experimental data". "It must withstand 15 repetitions of a 10N impact" The International System of units (SI) required.

My Project Design Criteria are the following: The reading must be correct 85-90% using everyday language.

> **Constraints:** Constraints are factors that limit the engineer's flexibility such as size, cost, and time limitations. Examples: "It must fit in a box no larger than 10x20x50 cm" "The maximum cost is $50" "The software must run in real-time on a Raspberry Pi"

My Project Constraints are the following: The budget is $100. The app size should be 200-300 MB on an Apple iPhone or a computer. The app should run smoothly without crashing. The project has to be finished by March 1, 2021.

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> **Provide your chosen design.** For hardware, provide a sketch. For software, provide a flowchart. Indicate the components you will develop, and the libraries you are using.

My Project Design is shown below: insert photos, diagrams, or illustrations below.

The app will be coded in Python. We will use machine learning to develop a program that works by inputting slurred speech and outputting the intended words by reading them aloud.

We will upload computer-generated voices (from voicegenerator.io) into the program.

Detailed Explanation: Train the program with a specific voice, and after several training sessions, the program should be able to identify what the voice is saying.

During training:

- If the translation is wrong, then associate the word with the way the user has pronounced the word.
- If the translation is correct, then the machine learning algorithm is correct and no association is necessary!
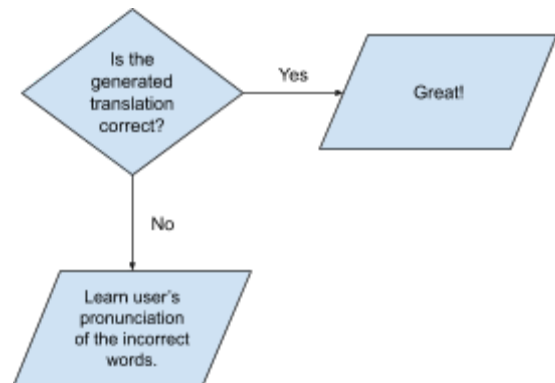
> **Test and evaluate your prototypes against the design criteria listed above to show how well the product meets the need/goal.** Provide a test plan describing how you will test the design criteria and constraints you listed above. How will you analyze the data?

I test and analyze my prototypes using the following methods:

Independent Variables: Voice

Dependent Variables: Accuracy

Control Variables:

- Passage/text: *I woke up early because I had a meeting at 7 a.m. It is a good thing I live close to my office, so I didn't have to leave too early. I stopped at Starbucks, which is near where I work. I am missed if I don't show up at a meeting, since the company is small. This meeting was about our latest project. We decided to collaborate on it to get a variety of ideas. The creativity of this company is the reason I took the job. It is a great job, but I haven't gotten a raise yet.* (page 136 of "Best Grammar Workbook Ever!")
- Pitch: 1
- Speed: 1

Materials:

1. Computer
2. WiFi connection
3. Phone

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Procedure:

1. Implement a machine learning algorithm using Python
2. Start training sessions several times (submit a voice recording and let the algorithm associate the words with the pronunciation)
3. After training sessions are done, test accuracy by submitting different recordings of the voice and having the algorithm decode it (should be at least 85% correct)
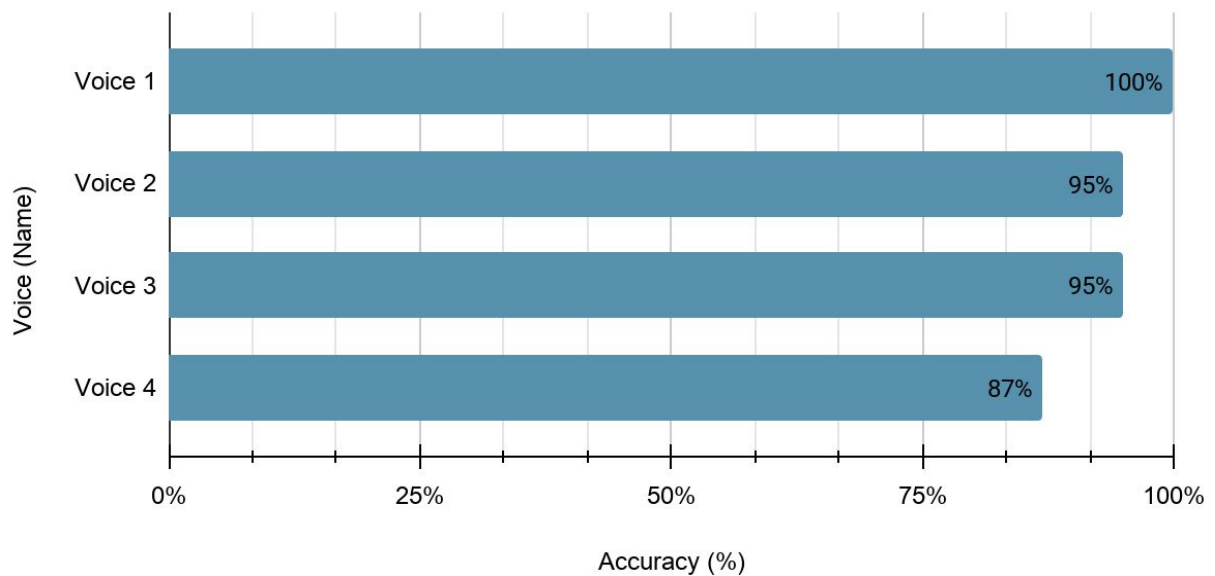
Data Table:

#	Voice	Accuracy (%)
1		
2		
3		
4		
5		
6		

In the end, use a bar graph (Accuracy vs. Voice).

Accuracy vs. Voice

Note: This is sample data.

Bibliography: List at least five (5) major references (e.g. science journal articles, books, internet sites & dates of review) from your literature review. If you plan to use vertebrate animals, one of these references must be an animal care reference.

1. Geitgey, Adam. "Machine Learning is Fun Part 6: How to do Speech Recognition with Deep Learning." *Adam Geitgey*, Medium, 23 Dec. 2016, medium.com/@ageitgey/machine-learning-is-fun-part-6-how-to-do-speech-recognition-with-deep-learning-28293c162f7a. Accessed 10 Nov. 2020.

2. "Machine Learning Basics | What Is Machine Learning? | Introduction To Machine Learning | Simplilearn." *YouTube*, uploaded by Simplilearn, 19 Sept. 2018, www.youtube.com/watch?v=ukzFI9rgwfU. Accessed 10 Nov. 2020.

3. Miller, Arlene. "Redundancy." *The Best Grammar Workbook Ever!*, Bigwords101, 2015, p. 136.

4. "Voice Generator." *VoiceGenerator.io*, voicegenerator.io/. Accessed 10 Nov. 2020.

5. "What Is Machine Learning? 3 things you need to know." *MathWorks*, The MathWorks, www.mathworks.com/discovery/machine-learning.html. Accessed 10 Nov. 2020.