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| https://lh4.googleusercontent.com/jbT7I7EvjrWej7Q-CGx5MCL8s8CmRyoqxazwOk8CTbafMZP-wKp8P9IzKJ8hntZyxrai25shXAdUHhqlUAhK0YjAzCl9Bg5KzO0XvP81J8Or2H161JKD117K98jIfUGAuHZxAkw  **AN UNDERGRADUATE PROJECT PROPOSAL**  **BY**  **AYENI TRUST OLAMILEKAN**  **(SCI/17/18/0358)** |  |

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| **Project Title** | **Bias Mitigation in Voice Recognition Systems for an enhanced productivity in V.R. Technology in Africa.** |
| **Supervisor** | **Dr Hammed. F.A** |
| **Main Subject Area/s** | * **Artificial Intelligence:**   **NLP (Natural Language Processing)**   * **Machine Learning** * **Cloud APIs for African English Language** * **Adobe X.D. (UI/UX Design) for Prototype Application** |

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| **Project Description**  **Why is this a crucial problem to solve? Make a case for building this product in terms of its impact on recurring revenue, market share, customer happiness, and/or other drivers of business success.** | * **Voice A.I. is becoming ubiquitous and powerful. Forecasts suggest that voice commerce will be an $80 billion business by 2023.**   **Recently, the Algorithmic Justice League’s voice erasure project found that speech recognition systems from Apple, Amazon, Google, IBM, and Microsoft collectively achieve word error rates of 35% for African American voices versus 19% for White voices.**    **In African countries, as a case study, various companies, including tech companies, are considering tapping into the power of A.I. to make life easier by making purchases online, front desk automation, voice-based digital assistants, and more.**  **Many Africans prefer lower-budget technologies/ IoT devices, not that they don’t have the money for the purchase, but the mentality that “I can’t buy what cannot understand what I’m saying” makes Africans ignore those techs.**   * **In this project, I will use A.I. to train this large corpus of data, fine-tune this multi-class classification model on the voices collected from different continents (countries), and then deploy the model into the cloud and mobile devices through a conversational app. This product will also support online inferences for 3rd party integrated tools through REST-APIs.**   **In a nutshell, this project aims to bridge the gap between human and computer interaction with NLP and increase customer satisfaction or purchasing decisions on V.R. Technology.** |

**Data**

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| **Data Acquisition**  **Where will I source my data? What is the cost to acquire these data? Are there any personally identifying information (PII) or data sensitivity issues I will need to overcome? Will data become available on an ongoing basis, or will I acquire a large batch of data that will need to be refreshed?** | **Data sources**   * **Questionnaires: Survey monkey, Google forms.** * **Forming partnerships with various institutions and companies who will be the customers for the product.** * **Internet**   **Getting these data would require lots of money, time, and energy. I would also travel to different countries to collect my data (primary data).**  **PII (personally identifying information)**   * **I will not be using any sensitive or personally identifying data but voice data related to a particular model class.**   **My product would use a large amount of data that will be refreshed every two months.** |
| **Data Source**  **Considering the size and source of data, what biases are built in the data, and how can it be improved?** | **Biases**  **Bias such as race and gender bias can still occur if the product becomes widely acceptable. Many users in countries/continents whose voice data have not also been collected, users with different intonation, pitch, language can be at a more significant loss.**  **All of this points to the fact that our data, to a certain degree, might not be inclusive and diverse enough to represent remote people, thus skewing the model’s learning and inference to favour a particular class over another.**   * **Measurement bias:**   **Differences in the data collected for training would differ from the data collected during production.**   * **Algorithm bias:**   **is caused by the development of the model, how the model was trained that results in unfair outcomes.**   * **Exclusion bias:**   **I might add/remove features that I think are relevant or not without bringing in a domain knowledge expert to conduct feature engineering.**  **Improvement**  **The data can be improved through:**   * **Data profiling: this is used to examine the data defects analyzing the correctness and usefulness of data.** * **Data normalization: My model contains data from different sources and includes a variety of spelling options. Normalization is the process of reorganizing data so that it can be easily accessed.** * **Quality control on the data being collected.** * **A/B Testing on a few ML models to check for biases.** |

**Minimum Viable Product (MVP)**

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| **Methodology**  **What does my minimum viable product look like?** | **In this project, I will make use of an MVP (Minimum Viable Product).**  **The MVP will be a cross-platform speech recognition app and a REST-API. The app would first display a conversational user interface that collects voice data from the user and their country, adding it to the model’s corpus of knowledge (pre-trained model).**  **The app is then able to recognize spoken words from anyone in any country.**  **Furthermore, the REST API allows third-party applications to use the hosted online model for inference.** |
| **Use Cases**  **What persona am I designing for? Can you describe the significant epic-level use cases your product addresses? How will users’ access this**  **product?** | **The main personas:**   * **Students** * **Tech Companies planning to use the product in their services** * **Individuals** * **Military**   **Use cases:**   * **In the educational sector, students who are blind or have impaired vision can benefit from using this technology to convey words and then hear the computer recite them and use a computer by commanding it with their voice, instead of looking at it the screen or keyboard.** * **Tech companies: (automobiles) simple voice commands can be used to initiate phone calls, select radio stations, play music from a compatible smartphone, MP3 player, or flash drive.**   **Voice recognition capabilities vary between car make and model. Some of the most recent models offer Natural Language speech recognition in place of a fixed set of commands, allowing the driver to use complete sentences and common phrases without memorizing a set of fixed command words.**   * **Military: In fighter aircraft, Speech recognition is used for a wide range of cockpit functions.**   **Voice commands are confirmed by visual and aural feedback. The system reduces the pilot workload and even allows the pilot to assign targets to his aircraft with simple voice commands.**   * **Medical sectors: The model can be implemented in the front-end or back-end of the medical documentation process. A large part of the clinician’s interaction with the EHR (Electronic Health Record) involves navigation through the user interface using menus and tab/button clicks, which heavily depend on the keyboard and mouse. Thus, voice-based navigation provides only modest ergonomic benefits.**   **Finally, users can access the product through cloud APIs or on IoT devices.** |

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| **Resources Required** | * **A.I. Computer (3.70GHz and above processor speed)** * **8Gb RAM** * **Inbuilt Microphone** |
| **Recommended Knowledge** | **A.I. Fundamentals, Python, Adobe X.D.** |
| **Project Form** | **The prototype model will involve testing with students/individuals.** |