



Tender Bid for Project Number: 22P59

Project Title: Which Hand?

Group Number: 22G05

Project Overview:

In order to begin the design and implementation of the hand drawing analysis, sufficient research must be done to understand the effects of Parkinson's disease on a person's motor functions, and how this would affect their drawing ability. Research on image processing would also be important to understand the data provided for the project. The project will require image processing in order to convert the hand drawing data into a comprehensive database that can then be utilized for machine learning. The actual implementation of the project will involve the analysis of the data provided and the creation of an artificial intelligence program that is capable of interpreting the information and determining what stage of Parkinson's a specific subject is at. The final stage of the project will be testing the application against known values in order to ensure a product of high enough accuracy. Any necessary changes and improvements to the image processing and machine learning will need to be implemented. The resulting data will be used to efficiently analyze the effectiveness of Focused Ultrasound as a treatment for Parkinson's disease. The machine learning program can be used to compare the patient data before the start of the treatment to the data 2 years into the treatment. The program should effectively display the difference between the stages of Parkinson's displayed in each case.

Weekly Milestones:

Week 1: Perform thorough research into the Focused Ultrasound (FUS) treatment, Parkinson's disease and Essential Tremor to better understand the subject matter. Further research into the software requirements and solutions, as well as the computational and statistical analyses that will be used to provide quantitative analytics and results. Ensure all plans and deliverables are completely in-line with the standards, ethics and requirements of the professionals and data providers.

Week 2: Start designing image processing techniques (if necessary) and finalize what software will be used.

Week 3: Start applying the data preparation and image pre-processing to generate a comprehensive dataset so as to develop the dataset that will be further analyzed as well as data analysis techniques.

Week 4-6: Start developing the software: further image processing, data analysis, signal processing, output, etc. Ensure to develop tests and other checks that always ensure the utmost accuracy and quality output.

Week 7-8: Finalize the software and start performing final quality and accuracy tests.

Preliminary Budget & Resources:

In order to successfully implement this project, access to extensive data on the effects of Parkinson's disease on hand drawings, as well as images drawn by patients that can be used to produce a machine learning database will need to be provided by the university. The effectiveness of the program will need to be verified by comparing the results of patients in known stages of Parkinson's. It will therefore be necessary for the known stage of Parkinson's disease to be provided for the image data.

An image processing library will be required to analyze and manipulate the image data provided for the project. This library will need to convert the images into a data format so as the machine learning database can be developed. OpenCV is a commonly used image processing tool for machine learning, it is open source and therefore free to use.

A database will need to be developed with the hand drawing image data; this will require databasing software. Open-source software such as MySQL and Cassandra are available and free to use.

The development of the machine learning program will be done in Python as many machine learning related resources support this language and are readily available.

Risks and Mitigation:

This project is attempting to replace subjective, non-standard, labour-intensive task of an expert physician evaluating the effectiveness of the specific Parkinson's treatment. However, this means that the results of this project need to be reliable enough to be relied upon in a medical environment. Thus, the biggest and most important risk to consider regarding this project includes having an error margin that is too large, as this would result in unreliable results that could mislead physicians and patients. This risk can only be mitigated if the error margin of the final product is small enough, according to the professionals within this field, so that the results can be confidently and consistently relied upon. If this error margin cannot be achieved, then disclaimers and other ethical considerations must be discussed with all parties involved before using any of the results of the final product.

As mentioned, the use, analysis and result-distribution of the data provided offers ethical considerations that must be adhered to at all times. Ethics waivers and agreements must be drafted up and agreed to by all parties before the commencement of this investigation.