**Project Team Members**

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1. ***Introduction***

***Background of the Problem***

Stuttering is “…a speech disorder in which the flow of speech is disrupted by involuntary repetitions and prolongations of sounds, syllables, words or phrases as well as involuntary silent pauses or blocks in which the person who stutters is unable to produce sounds”. (World Health Organization, 2010). The primary behaviours manifested by stuttering are repetition, prolongation of sounds, and blocking (Northern Arizona University, n.d.). A person who stutters may repeat words, syllables, or multiple syllables. Blocking occurs when the person experiences blocks of airflow; the speaker may pronounce broken words or incomplete phrases.

A speech language pathologist conducts speech therapy as well as diagnosis. Speech therapy is the process of correcting disfluency in speech. A speech diagnosis is needed before the actual speech therapy in order to accurately decide what treatment a patient should receive (Scott, 2008).

The speech pathologist conducts the diagnosis by first holding a casual conversation with the patient. Behaviors that are manifested physically by the patient are then documented by the speech pathologist. Afterwards, tests are conducted to measure the severity of stuttering by conducting speech focused tests that will test the patient’s fluency. The patient will be asked to read a passage where the percentage of the total number of words stuttered over the total number of words in the passage will be recorded. The patient will also be asked to hold a conversation with the speech pathologist with the patient discussing ideas about a certain topic, this time the patient’s voice will be recorded for use as reference. The percentage of the total number of words stuttered over the total number of words used by the patient will also be recorded. The speech pathologist also takes note of the different types of disfluency observed while conducting the speech tests.

The traditional method of diagnosing speech is generally time consuming. Another issue with it is that different speech pathologists may make their own different judgements when diagnosing (Kully and Boerg, 1988).

***Statement of the Problem***

* Diagnostic results tend to be dissimilar when compared between judges who reviewed the same patient sample.
* Speech assessments are time consuming to make.

***Objectives***

* Build a library of stuttered speech samples.
* Modify an audio analysis program to automatically identify stuttered speech.
* Configure a machine learning system that will be trained to recognized stuttered speech patterns.

***Significance***

The findings of this research will benefit the following agencies:

*To People who Stutter*

This project will benefit patients under speech therapy that will undergo speech diagnostics. The patient can be evaluated more objectively through the use of a computer and thus improve the process of the actual therapy.

*To Speech Pathologists*

Speech Pathologists will be able to use this project to produce more accurate and more objective results when conducting a speech diagnosis. Better diagnostic results will lead to more appropriate therapies among patients. This can also be used alongside the traditional method of diagnosis to lessen ambiguity.

***Scope and Limitations***

The study aims to automatically detect stuttered speech through modifying an audio analysis program to identify stuttered speech among audio samples and a machine learning system to recognize stuttered speech. Due to this, other disfluency behaviors that are not manifested through audio are beyond the scope of the study.

**II. *Related Literature***

***Behaviors of Stuttering***

Stuttering behaviors are mainly characterized into primary and secondary. The primary behaviors are:

* Repetitions of sounds, syllables and words
* Prolongation of single sounds
* Blocks of airflow when speaking

Secondary behaviors include:

* Hesitations
* Interjections of sounds, syllables of words (ahh, uhm)
* Word revision, word changes
* Unnecessary motor movements

(Northern Arizona University, n.d.)

***Related Researches***

*Automatic Detection of Syllable Repetition in Read Speech for Objective Assessment of Stuttered Disfluencies*

*(K. M. Ravikumar, Balakrishna Reddy, R. Rajagopal, and H. C. Nagaraj )*

This study proposed automatic detection of repeated syllables through the use of 4 major steps: segmentation, feature extraction, score matching, and decision logic. The collected audio samples are first segmented into syllables. After segmentation, the segmented speech syllables are subject to feature extraction. The audio features of the syllables are obtained by using the Mel frequency Cepstra coefficient algorithm. Score matching is then done using the Dynamic Time Warping Algorithm. Lastly, the decision logic uses the Perceptron machine learning algorithm to determine if the syllable is fluent or not.

*Development of a Two-Stage Procedure for the Automatic Recognition of Dysfluencies in the Speech of Children Who Stutter: II. ANN Recognition of Repetitions and Prolongations With Supplied Word Segment Markers*

*(P. Howell, S. Sackin, K. Glenn)*

This study used artificial neural networks to detect stuttered speech. The audio samples are first segmented into words. The samples are then classified whether the speech is fluent or disfluent as an output.

**III. *Appendices***

**7.1 Diagrams**