Towards Anti-Stuttering: Understanding the Relation between Stress & Stuttering using different Physiological features

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Funded By: CCLS Mini Grant 2015

**Motivation**

Stutterers: 1% of the World’s Population

- Stuttering - a speech fluency disorder causes still not clear
- Role of Stress, Anxiety & Nervousness unknown.
- Autonomic Nervous System (ANS) controls stress & anxiety by activating & deactivating sympathetic & parasympathetic nervous system
- Limitation in current research: 1) Experiments only performed in controllable environments; 2) Existing data analysis methods are relatively simple

**Research Goals**

- Apply advanced machine learning & pattern analysis techniques to the stuttering research
- Understand the relations between stuttering, stress and physiological changes

**Methods**

**Processing**

- ECG Cardiac Activity
- RR Interval
- Beats per minute
- Mean RR
- SDNN
- RMSSD
- pNN50
- LF/HF
- Overlapping Windowing
- Human ANS
- GSR Electrodermal Activity
- Power Spectral Density
- Low Freq L.F
- High Freq H.F
- LF/HF
- meanGSR
- St.Dev GSR
- No. of Response

**SPECIFICATIONS:**

- ECG sampled at 500 Hz, HPF used.
- GSR sampled at 5Hz
- 60sec window used
- Overlap increment of 10sec.
- RR-Interval: distance between beats(msec)
- SDNN: Standard deviation of RR interval
- LF: Low frequency components (0.04 to 0.15Hz) of RR interval
- HF: High frequency Components (0.15-0.4Hz) of RR interval
- RMSSD
- pNN50

**Analysis**

- Types of Stutterer
- Block w
- Repetition x
- Filler y
- Break z
- Weightage 10.0
- 5.0
- 3.0
- 2.0

- Microphone Analysis:
  - Sampling Frequency = 8KHz
  - Window size = 60sec
- Window Stuttering = 10w + 5x + 3y + 2z

- Feature Analysis:
  - Feature Normalization
  - PCA Classification was used to find the co-relation between the features.

- Linear regression in order to determine the classification between stuttering & Non-stuttering using Stress.

**Future Work**

- The ECG & GSR patterns will be utilized in anti-stuttering assistive device design as the key signs to identify stuttering-related anxiety in real-time.

- Integrated with other audio/tactile feedback or biofeedback techniques, the ultimate goal of the assistive device is to eliminate patients’ negative emotional reactions, reduce severity of stuttering, and thus improve the quality of life of people who stutter

**Preliminary Results**

Comparison Between More Stuttered Reading Task & Less Stuttered Conversation Task

- Combined Features for stress Increment
- Combined Features for stress Decrement

**Research is still on-going and working to**

**References**

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**Stuttering and anxiety: The difference between stutterers and nonstutterers in verbal apprehension and physiologic arousal during the anticipation of speech and non-speech tasks.**

**Ant IS: Stuttering, emotions, and heart rate during anticipatory anxiety: a critical review.**