Machine Learning Algorithm Using Physiological Data to Detect Anxiety

Allison Hunter¹,², Dante Mancini¹,², Nana Anokye¹,³, Kumar Darsh¹,⁴, Roger Lacson¹,⁴

¹Department of Biomedical Engineering, ²Department of Chemical Engineering, ³Department of Mechanical Engineering, ⁴Department of Electrical & Computer Engineering

Introduction

Background:
- ~7 million struggle from General Anxiety Disorder[1]

Problem:
- No affordable device to provide live tracking and classifying of stress levels

Need Statement:
- An accessible and affordable device to provide insight and support to adults and young adults struggling with physiological symptoms of anxiety

Proposed Solution

- Use a decision tree algorithm to classify anxiety based on heart rate (HR) and galvanic skin response (GSR)

Data Collected from Sensors
- Heart Rate: EKG
- Skin Resistance: GSR

Machine Learning Algorithm
- Monitor Anxiety
- Decision Tree

Prototype Testing & Results

Sensor Set-Up

Trier Stress Test[2]
- Baseline
- Verbal Stress
- Math Stress
- Visual Stress

Physiological Sensor Data vs. Time

Stress Level % Change in HR % Change in GSR
1 10.7% 3.0%
2 10.2% 1.6%
3 15.8% 5.6%

Machine Learning Testing & Results

- Classify: Stressed vs Unstressed
- Decision Tree (DT) Model:
  ○ Pre-Pruned Tree Depth
  ○ 80 / 10 / 10 Split
  ○ 5-Fold Cross Validation

DT Validation Accuracy
- DT with WESAD Data 100.0%
- DT with Testing Data 81.0%
- DT 5-fold CV with Combined Data 62.9%

Conclusion

- EKG and GSR are useful to predict anxiety
- Machine learning algorithm & sensor wearable device instantaneously classification of anxiety

Acknowledgments

We would like to thank Dr. Zapanta and Jarrett Byod for the guidance and support during this project. We are grateful for the previous mental health team for their past resources and knowledge. We would also like to thank Dr. Sang and Dr. Chaplin for their mentorship during this project. A special thanks to OURSD for fundraising.

References