Alcohol Relapse Prevention Through Electrodermal Activity and Heart Rate Analysis

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Introduction

- The amount of alcohol being consumed in the world has been on a steady increase and this trend is expected to continue. [1]
- Those that wish to relinquish their drinking habits are more likely to relapse when they are either not treated correctly or not treated at all. [2]
- The ability to monitor a person's psychophysiological responses in real time through a wearable device such as the Empatica E4 allows for more consistent and natural data collection.
- **Objective:** Design an alerting system that uses real time data to alarm the user when their physiological responses signify increasing levels of stress.
- **Hypothesis:** By using a wearable device that monitors a person's psychophysiological responses, more specifically electrodermal activity (EDA) and heart rate (HR), the possibility of relapse can be prevented because the person will be notified when their responses increase over a stress threshold.

Methods and Materials

- Participants:
  - 2 current participants
  - More than 10 participants are expected to contribute
- Device:
  - E4 wristband from Empatica [3]

Figure 1. Image of E4 wristband

- Procedure:
  - 2 weeks of data collection from the E4 wristband
  - Daily Likert Phone Survey (4x per day)
  - Create a TAG when feeling stressed or cravings
- Phone Survey:
  - Consisted of questions regarding emotion and alcohol cravings
- Software:
  - EDA Explorer [4]
  - Ledalab through MATLAB [5]
  - EDA/HR Analysis Scripts [6]

Results

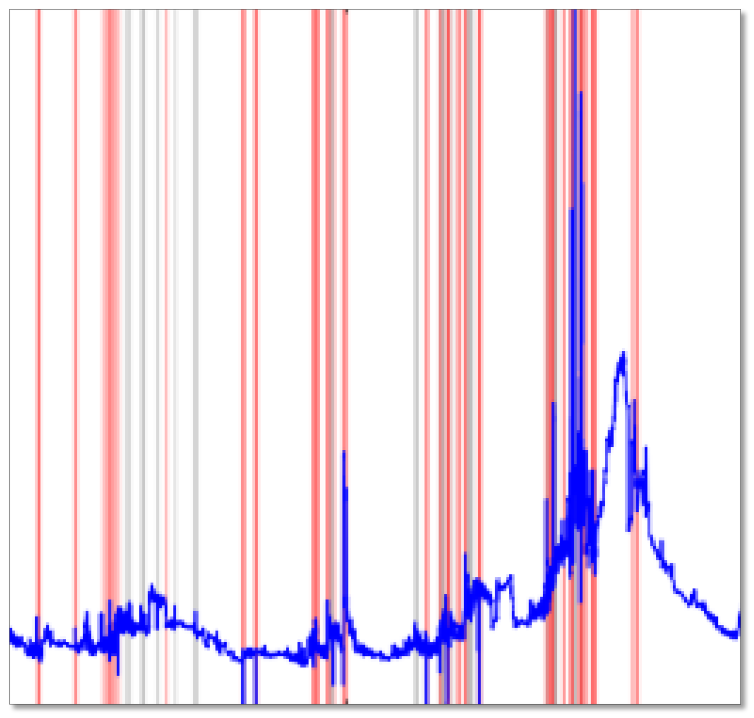


Figure 2. Example graph of the EDA noise analysis

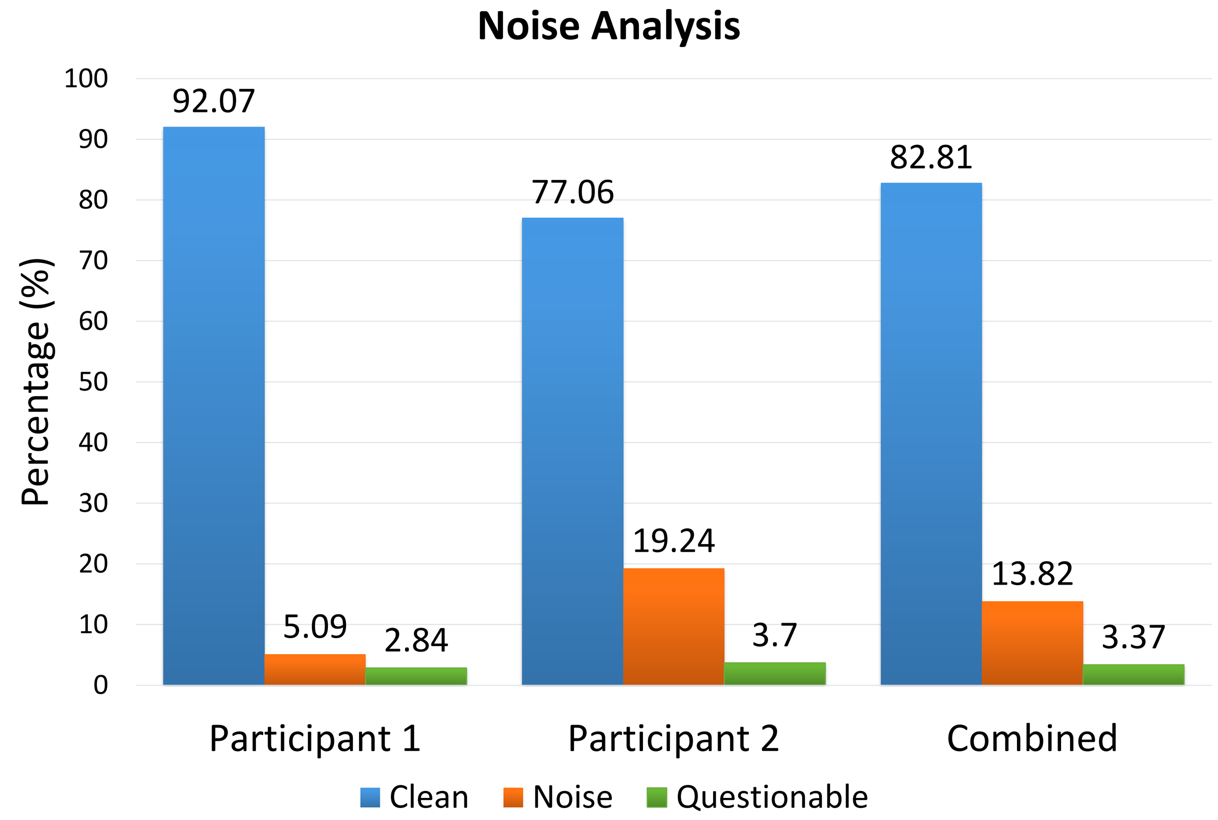


Chart 1. EDA Quality Analysis results

	Participant 1	Participant 2
EDA (µS)	2.415	2.546
Rise-Time (s)	16.536	14.253
Max-Derivative (µS/s)	0.203	0.361
Amplitude (µS)	0.149	0.279
Decay-Time (s)	2.124	1.717
SCR-width (s)	3.244	2.728
Area Under Curve	0.491	0.870

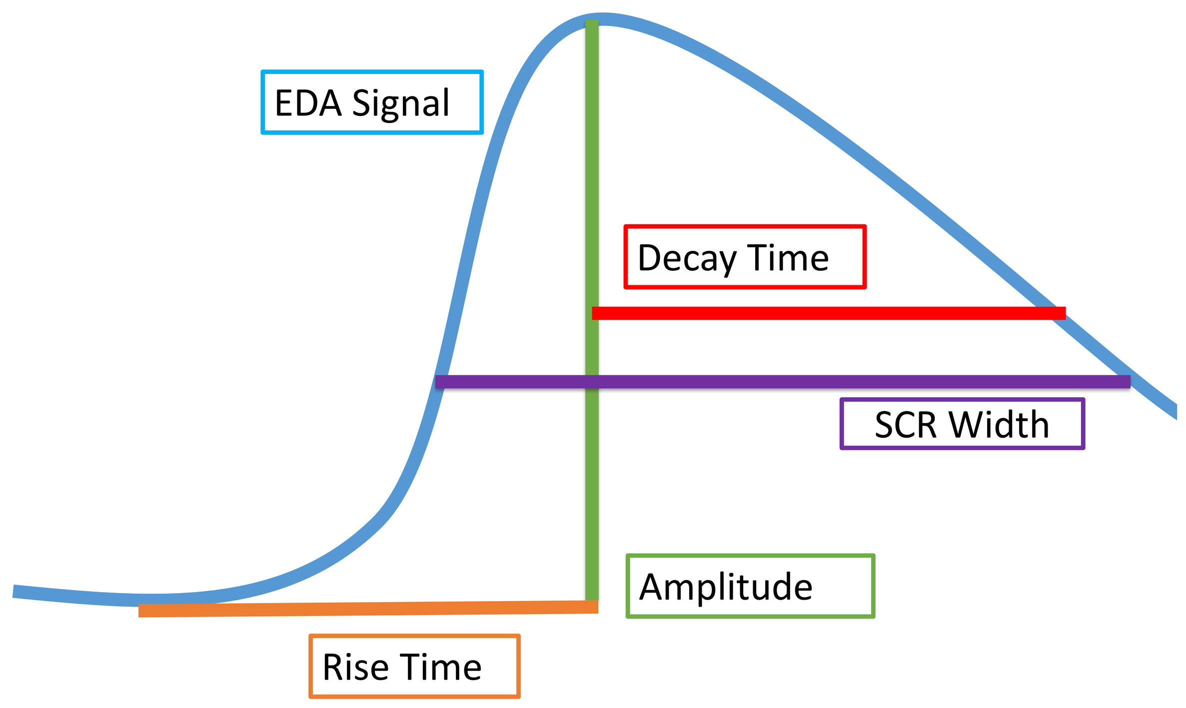
Table 1. Average results from EDA peak analysis

	Participant 1 (%)	Participant 2 (%)
40 to 49 (BPM)	0	0.01
50 to 59 (BPM)	0.9	1.29
60 to 100 (BPM)	72.18	84.41
101 to 120 (BPM)	24.95	10.96
121 to 150 (BPM)	1.95	2.92
151 to 200 (BPM)	0.01	0.40

Table 2. Distribution of Heart Rate throughout data collection

Discussion

- Each participant's data was collected into one excel file based on chronological order at the end of their participation to ensure accuracy and proper execution of the analyses.
- Figure 2 is a display of the typical electrodermal activity noise analysis where the red marks display noise, the gray displays questionable data, and the rest being clean data.
  - Noise refers to data that may be corrupted or distorted during the process of data collection
- Chart 1 shows the results of a noise analysis that was executed to determine the quality of the EDA data.
- Table 1 is the average results gathered from a peak analysis done through EDA Explorer. An example of what was analyzed is provided in the figure below [4]:



- Table 2 is the distribution of the heart rate per participant where a normal heart rate ranges between 60 to 100 bpm.
- Although most of the heart rate data is contained within the normal range, our focus is on the data outside of it which can be correlated to increases in electrodermal activity.

Conclusions and Future Work

- The preliminary results acquired from the analyses have resulted in success in terms of quality and reliability.
- Future work consists of the following:
  - Continue acquiring psychophysiological data from more participants.
  - Integrate the responses from the phone surveys to the collected data to find stress/craving correlations.
  - Design machine learning algorithms that will be able to detect any indicators of potential relapse based on the data acquired.

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