Human Behavior Analytics
Homework 4

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HUMAN ENGAGEMENT

Part 1: Designing the Data Collection:

Part 1 (a)

A pair of individuals in a dyad can be linked via romantic interest, family relation, interests, work, partners in crime, and so on. The relation can be based on equality, but may be based on an asymmetrical or hierarchical relationship. From a developmental perspective, dyadic interactions with social partners and dyadic interactions with objects underpin social cognition in humans. Rather than being considered too complex, diversity of socio-emotional experiences during development can be embraced, with the goal to specify how they influence social cognition outcomes in humans. After evaluation of previous work in dyadic relationships, we have discovered a commonality in the methodology and results of how engagement is perceived.

In these papers, the authors wanted to understand the interactions between human-avatar, among children and also linking adult group types. One research investigated the merits of using an established system for rating behavioral cues of involvement in human dyadic interactions (i.e., face-to-face conversation) to measure involvement in human-avatar interactions. Another, presented the interactions between

homosexual, heterosexual relationships and the way they measured their interactions through vocal, skin conductance, and heart rate monitoring. Also, a paper wanted to understand engagement levels among children along with their environment and used vocal, facial, prosodic cues and word assessment to understand engagement.

Part 1 (b)

We plan to design a data collection experiment wherein humans are subjected to two different scenarios; low engagement and high engagement. The experiments are carried out in participants' rooms itself without modifying any external factors(change in environment, etc.). The physiological signals were collected using E4 devices. The signals that we plan to use are EDA, Blood Volume Pulse, Heart Rate and Inter Beat Interval to classify the tasks to be high or low engagement. The candidates would be participating in the experiment performed in a indoor and silent environment. The two tasks to be conducted would be reading a passage and watching a Virtual Reality film.This study would be very interesting as it would encompass the engagement levels of candidates between the age of 21-26. Also, they have similar demographics.

Our hypothesis is that we will find high correlation between EDA, Blood Volume Pulse, Heart Rate and Inter Beat Interval and the two classes as we have seen from the previous literature in this topic. It is expected that the highly engaged individuals will exhibit more synchronized physiological patterns. We expect to observe higher Heart Beat rate, Blood Volume pulse for high engagement activities.

Part 2: Performing the Data Collection

The experiment was conducted with 4 candidates using the E4 devices. The study environment was indoors and the candidates were seated in chairs.
We designed two experiments for each of the scenarios:

(i) Low Engagement: People are asked to read a english language passage (~1-2 paragraphs, 100 words). The passage given was not related to the domain the participant is comfortable in and was difficult to read & understand in terms of vocabulary used in the paragraph, complexity of sentence structure.

(ii) High Engagement: People are asked to watch Virtual Reality based thrilling videos, such as Roller Coaster rides or scene from Horror Movies.

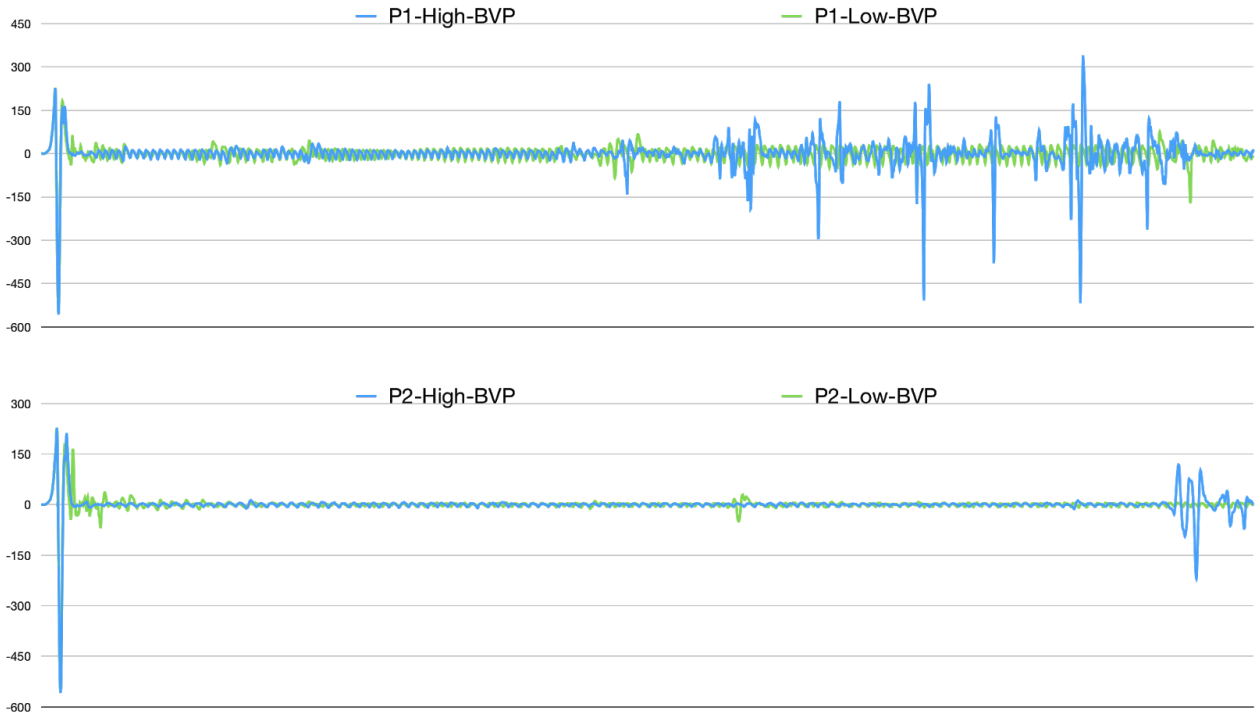
We chose this experiment as is it easy to perform and intuitively, the level of engagement between the two tasks varies a lot which makes it easy to distinguish between the signals collected.

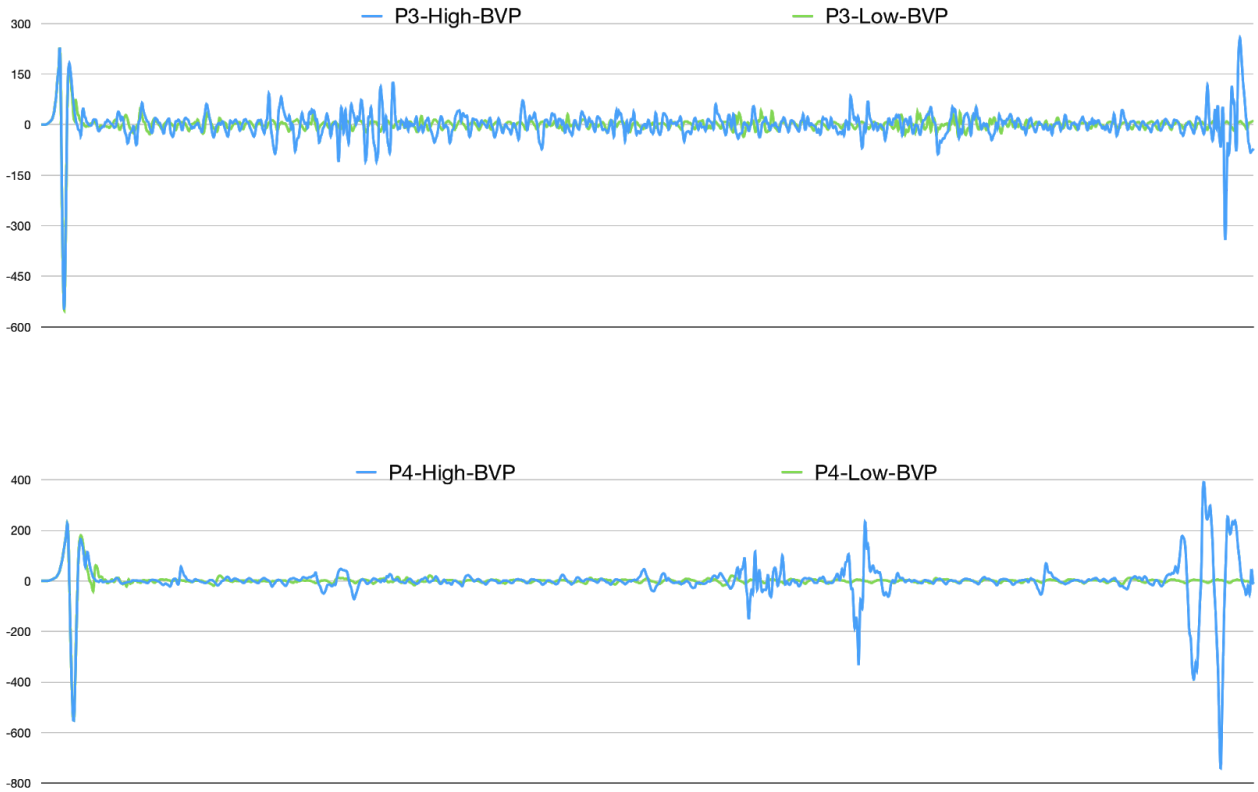
Part 3: Analyzing the Data

Instead of performing statistical analysis between multiple segments of each features, we are comparing the feature values for the entire session of data collection. This is with an intention to get a high-level picture of the data to verify if it supports the hypotheses.

Following are the graphs for each of the features for both engagement levels and for each of the four participants:

1) Blood Volume Pulse (BVP):

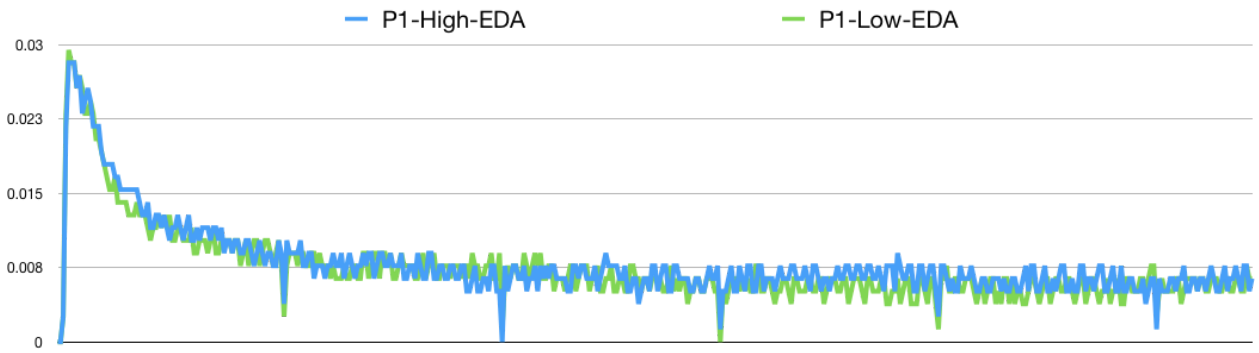


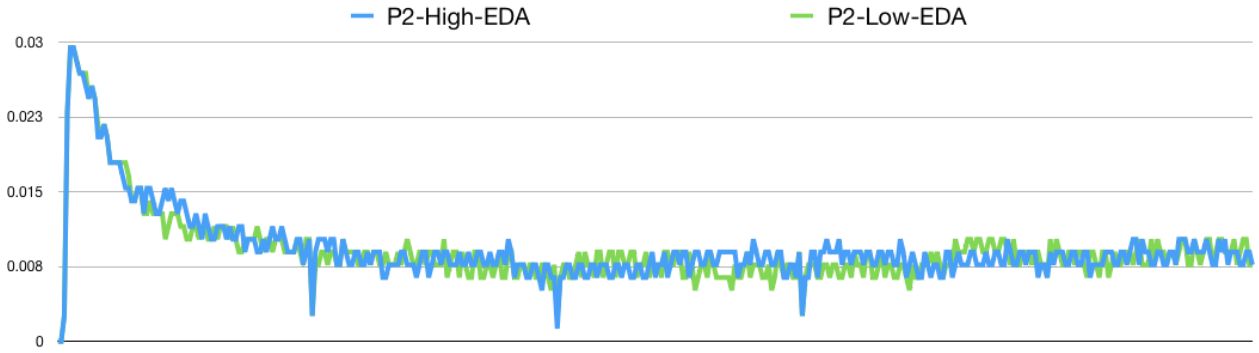


We can notice from the above four graphs for each of the four participants that Blood Volume Pulse (BVP) shows large variations for the high engagement task as compared to the low engagement task. This is expected as during the high engagement task, the blood volume can undergo rapid changes due to rapid cardiovascular contractions and expansions. For example, in our experiment, the blood flow for a participant can be really high while watching an intense horror scene.

2) Electrodermal Activity (EDA):

EDA or skin conductance, which is an indicator of arousal, was observed to have high values for the high engagement task compared to the low engagement task in general. This was also intuitively expected as high engagement task tends to arouse sympathetic responses more compared to the low engagement task.


P1-High-EDA
P1-Low-EDA
0.03
0.023
0.015
0.008
0


P2-High-EDA
P2-Low-EDA
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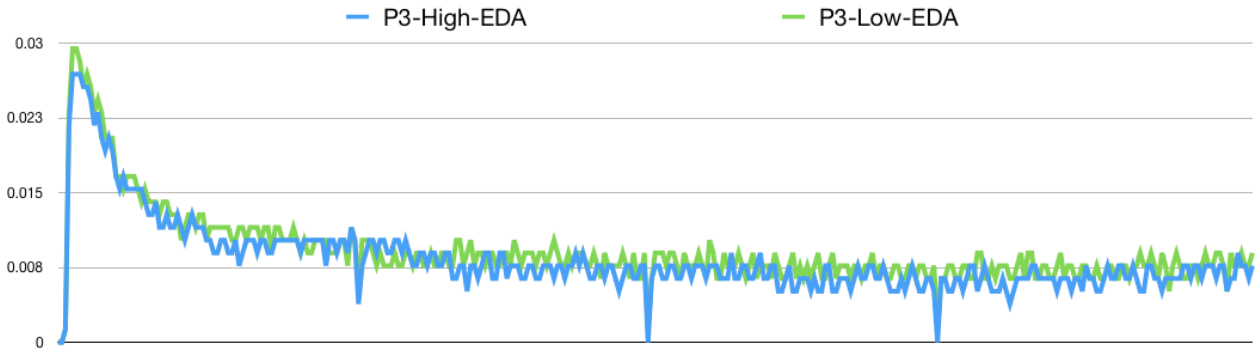
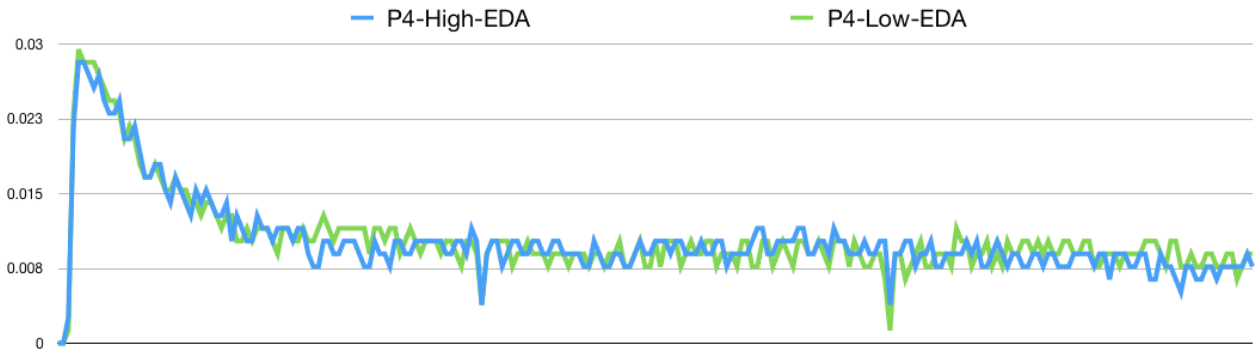
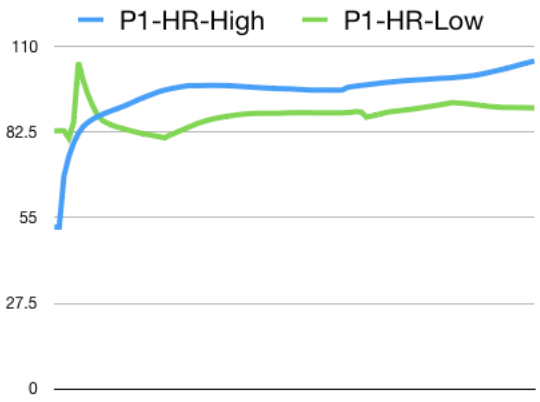
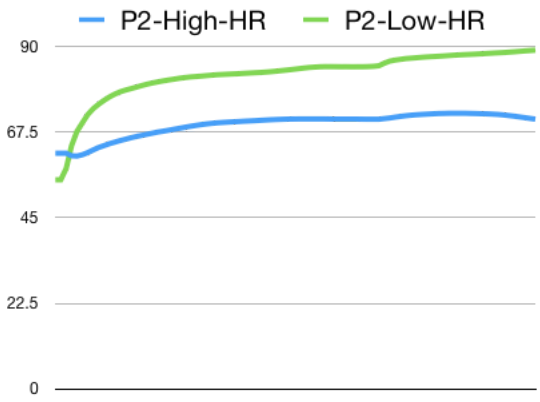
0.023
0.015
0.008
0

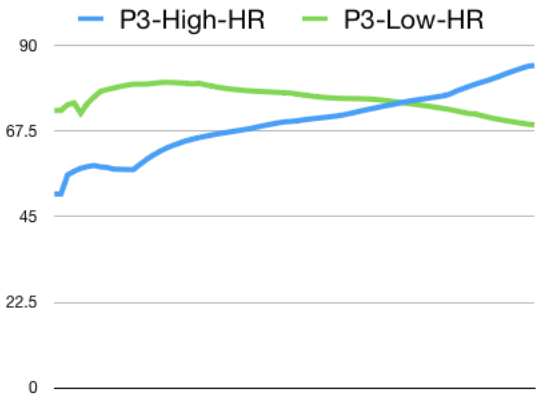

P3-High-EDA
P3-Low-EDA
0.03
0.023
0.015
0.008
0

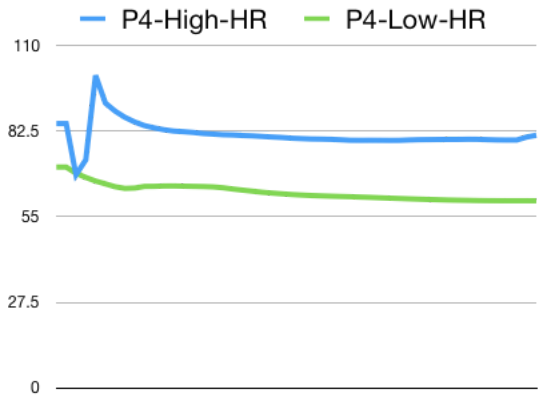

P4-High-EDA
P4-Low-EDA
0.03
0.023
0.015
0.008
0

3) HeartRate (HR):



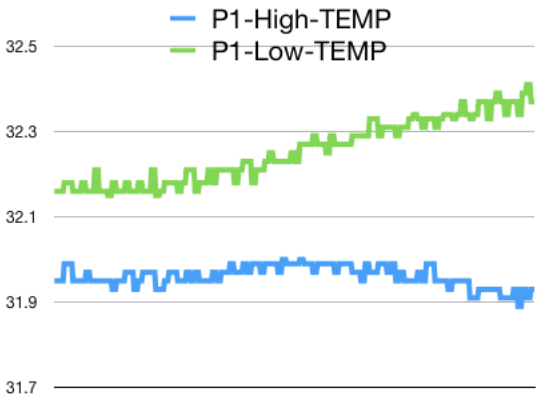


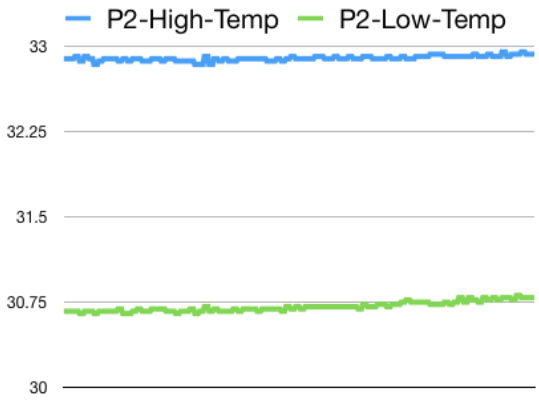


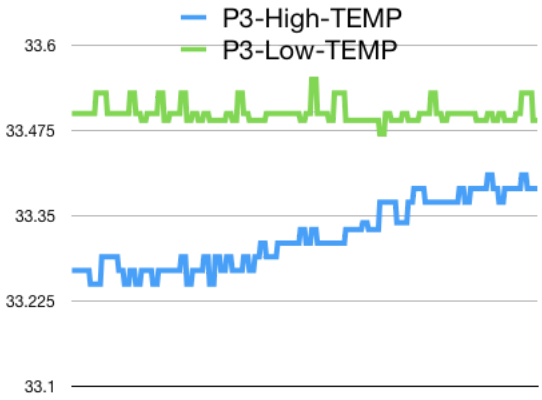


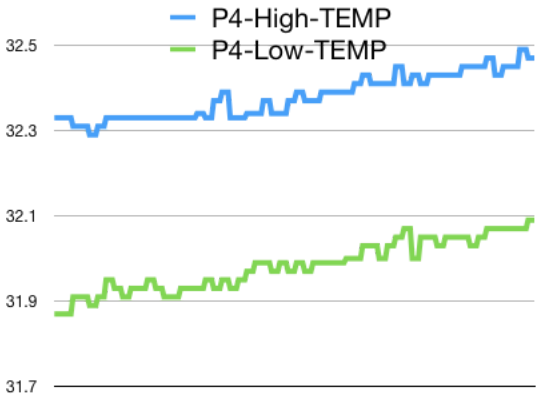
In terms of HR, it was expected that the HR values should be high for the high engagement activity as compared to the low engagement one, which is the case in general as suggested by above graphs, except for the participant P2. For P2, high engagement activity HR values are lower than that of the low engagement activity HR values. This was because the low engagement activity data was collected for P2 first , after which P2 had taken a shower. The high engagement activity data for the P2 was then collected after the shower. This anomaly in data can be attributed to warm shower that must have significantly lowered the HR for P2.

4) Temperature (TEMP):









As the data collected was just after coming home from the cold weather outside, temperature values have not shown any potential patterns to discriminate both the engagement levels.

Conclusion:

We successfully conducted the data collection experiment to explore human engagement. The collected data was analyzed to extract patterns in two different engagement levels. Most of the results of the experiment were consistent with the hypothesis. We conclude that, EDA, BVP, HR and IBI can be good indicators of different human engagement levels.