

Octagon Competition

The goal of this study is to create a “digital biomarker”. A digital biomarker uses health and wellness data, collected from various types of technology, to predict a health outcome. In this case, we want to see what combination of biometric data (blood glucose, breathing rate, heart rate, presence or absence of exercise etc) can predict cognitive performance on memory tasks (see attached visual overview in the folder for this study). The predictive model is subject specific. All the data for this competition is for a single subject. The challenge of this study is to create a digital biomarker that will predict cognitive performance. To do this, you need to create some kind of statistical model, that can make this prediction, based on the data released in this study. The study looked at lifestyle choices that can impact cognitive performance such as junk food consumption (sugar), exercise and watch television.

Challenge: What statistical model, based on the data collected, best predicts cognitive performance? How well does it perform?

The study collected 30 sessions of data. One session took place over the span of 48 hours over 3 calendar days. Data for each session is collected from a few measurements; a blood pressure test for both systolic and diastolic pressure, a blood glucose test and a Braincheck cognitive test measuring immediate recognition, delayed recognition and a Stroop colour and word test.

There are 3 permutations, with 10 sessions each. Each permutation consists of combinations of the stimuli performed by the test subject. All permutations are performed on Day 2. Activity 1 is performed before the 2nd measurement at 9AM, Activity 2 is performed before measurement 3 at 3PM and Activity 3 is performed before the 11PM. These activities are done within 30 – 60 minutes of this time.

Each of the measurements are taken a total of 5 times over the three days:

1. Day 1: 11PM
2. Day 2: 9AM
3. Day 2: 3PM (6 hours after the morning session)
4. Day 2: 11PM (14 hours after the morning session)
5. Day 3: 11PM

Each permutation consists combinations of the three stimuli:

- Watching a TV show or reading for 30 - 60 minutes
- Jogging for approximately 20 minutes
- Intaking a high amount of sugar

Table 1. Descriptions of each permutation

	Permutation 1	Permutation 2	Permutation 3
9 AM	TV	Reading	TV
3 PM	Aerobic Exercise	Aerobic Exercise	No Exercise
11 PM	Sugar	Sugar	No Sugar

*All measurements are taken in Eastern Standard Time

Folder description:

- Part 1: Day 1 at 11PM – Day 2 Waking up
- Part 2: Day 2 Waking up – Day 3 Waking up
- Part 3: Day 3 Waking up – Day 3 at 11PM

Legend

Hexoskin: Heart rate (beats per minute) (BPM)

Heart rate is calculated as the average BPM over the last 16 beats. One beat is measured as the difference in time between the two QRS peaks. Upon an invalid detection, the previous valid heart rate is carried forward. A valid range between 30 – 220 BPM is accepted.

Hexoskin: Cadence (Strides per minute) (SPM)

Calculated as the average SPM of the last 8 steps, or last 7 strides. A valid range between 30 – 240 SPM is accepted. No other invalid detections.

Hexoskin: Breathing rate (respirations per minute) (RPM)

Calculated as the average of the last 7 respirations. Upon invalid detection, the last valid breathing rate is carried forward. A valid range between 2 – 60 RPM is accepted.

Cognitive Braincheck Score: Immediate Recognition (IR) and Delayed Recognition (DR)

It is important to know that each Braincheck testing session runs five different cognitive tests. The IR test is always the first test completed. The DR test is always the final test completed. The DR test is the same as the second part of the IR test. The user waits several minutes after the IR test to recognize as quickly and accurately as possible which words were originally seen.

Cognitive Braincheck Score: Stroop Colour and Word Test (Stroop)

The Stroop Test is a commonly used test in psychology testing reaction time for the recognition of specific stimuli. A brief description of it by Braincheck can be found in the following link:

<https://braincheck.com/articles/examples-of-neurocognitive-testing/>

Blood Pressure

Two measurements are taken, systolic (BPS) and diastolic (BPD). Units: (mmHg)

Blood Glucose (BG):

(mmol/L)