Hacking Stress
Using biometrics to identify and quantify mental stress
Introduction

What is stress?

A state of mental or emotional strain or tension resulting from adverse or very demanding circumstances.
Chronic Stress causes...

- Upper respiratory diseases
- Cardiovascular disease
- Immune system health
- Productivity loss at work
- Mental health issues

Macro Example: Job stress costs the US $300B/year

*Dusseldrop et al, 1999 Linden et al, 1996*
Bio-Signals and Emotions
Existing Tech to Measure Stress

- Blood Flow Sensors
  - fingers, (Garmin)

- Galvanic Skin Response Sensors
  - wrist or finger tips, (Empatica)

- EEG Sensing
  - forehead, (Muse)

- Heart Rate Variability
  - ear lobe, (HearthMath)
TECHNOLOGY

HEART RATE (ECG)  TEMPERATURE SENSING
MOTION  BREATHING MONITORING
HYDRATION  BLUETOOTH
HAPTIC  SWEAT MONITORING
Algorithm Development

Real-time data Collection

Clean Up + Feature Extraction

Calibration

Stress ML Classifier

Display

Stress from 0 to 1

Algorithm Development
Scenario - Gameplay
Scenario - Work vs Home
Scenario - Driving
Scenario - Eating
Our Self Report Tool

- **Daily Summary View**
- **Logging Stress**
- **Week Trend View**

Was a bit stressed this morning. Rushing to get stuff done for the meeting at 10:30.
○ What are some coping mechanisms that people find effective to manage stress?
○ How do you determine the difference between productive stress and disruptive stress?
For those that have looked at stress over a longer period of time, let’s say a full week. What was the model you used to figure out which days had more stress than others?
○ Do you think technology may be a hindrance to dealing with stress?
Have you tried any products to track your stress? Did you find them to be effective/ how was your experience?
Archived Slides
Has anyone explored connecting their stress data to any apps, devices or technologies that could help with activity reducing the stress?
Theory of Emotions

Russel’s Circumplex of Emotions:

Activation (intensity) vs. Valence (pleasantness)
Bio-Signals and Emotion

- Brain controls emotions and vital organs
- External Stimuli that cause emotions alter brain signals to vital organs
- Some emotions can be correlated with unique effects in bio-signals
- Machine Learning
Real-time data

Noisy data → Features within the data → Stress ML Classifier → Stress from 0 to 1

Clean Up + Feature Extraction

Update classifier

Calibration model

Display
Our Method

Data Collection

Clean Up + Feature Extraction

Calibration

Model Learning

Deploy Algorithms

Test in Real Time
Results
The Protocol

Transition

Anticipation

Relaxed/Calm

Stressed