

Deriving stress from peripheral physiology

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Objectives

We set up an experiment to explore whether peripheral physiological parameters are capable of reflecting human (short term) stress.

Methods

For 30 participants, we measured peripheral physiology (SCR, ECG, RSP, TEMP, EMG) during several tasks (3 relaxing, 3 physically stressful, 3 mentally stressful). After each task, we measured their blood pressure, asked them to complete the Stress Arousal Checklist, and took a saliva swab to measure the cortisol concentration. For each participant and each task, we derived various peripheral physiological parameters (e.g. HR-mean, SCR-st.dev.) from the physiological signals.

Results

As expected, blood pressure, cortisol concentration and stress arousal scores did significantly vary over the 9 conditions ($p < 0.001$ for each). When the peripheral physiological parameters were regressed onto each of them, correlations of approximately 0.75 emerged.

When performing a binary (leave one subject out – cross validation) classification of the median splits of the cortisol data on the basis of the peripheral physiological parameters, classification performance was only 62%. For a similar classification of the stress arousal scores this performance increased to 72%, whereas for blood pressure it hardly exceeded random guessing.

A classification of the peripheral physiological data into the three types of tasks (relaxed, mental stress, physical stress) yielded a classification performance of 88%, using only SCR and ECG features.

Intriguingly, we also found a correlation of -0.72 between the median blood pressure of each participant and the variation in his/her SCR peaks.

Conclusions

It is possible to derive satisfactory predictions of (short term) stress from peripheral physiological data.