

# Psychological State Estimation During Robot Assisted Gait Training

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## Objective

**Idea:** Real-time estimate of the psychophysiological state from physiological measurements during robot assisted gait training in neurological patients and healthy subjects.

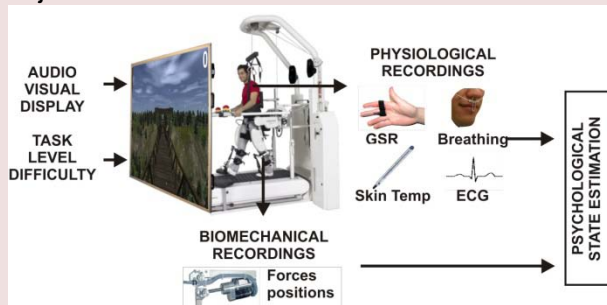


Fig. 1 Control chart for bio-cooperative state estimation in the Lokomat

## Classification Results

The four different psychological states are clearly distinguishable from recordings of breathing, ECG, skin temperature and galvanic skin response (GSR) alone.

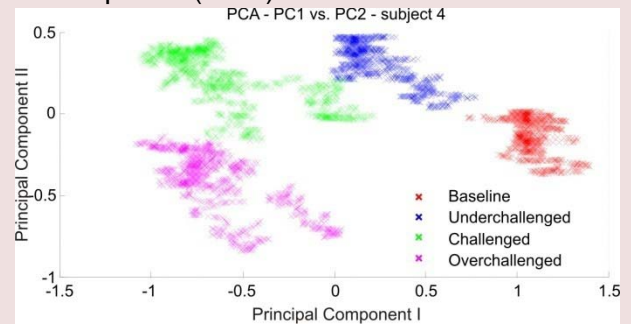


Fig. 2 Exemplary result of principal component analysis for one subject.

## Discussion

Real-time estimation of the psychological state of patients during Lokomat training was possible using physiological recordings as objective measures. In the future, we will strive for closed loop control of the psychological state to increase rehabilitation success.

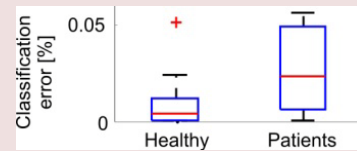


Fig. 3: Boxplot of the classification error of a neural network for all healthy subjects and all patients

## Background

**Rehabilitation:** the psychological state, i.e. the voluntary desire to active participation in the rehabilitation training, has crucial influence on success or failure of the rehabilitation.

**Psycho-physiology:** all social, behavioural and cognitive interactions cause changes in physiological signals. An objective quantification of the psychological state becomes possible.

## Acknowledgements

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## Methods

Physiological measurements of heart rate, heart rate variability, skin conductance, skin temperature and breathing frequency of 17 healthy subjects and 10 neurological patients.

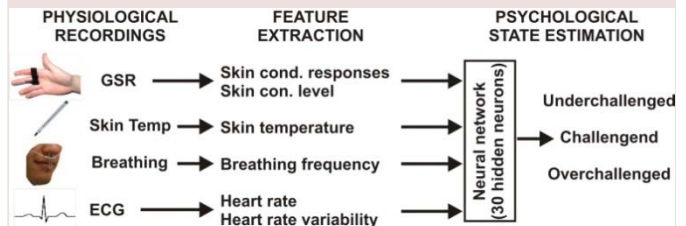


Fig. 4 Psychological state estimator

Virtual reality task with adjustable difficulty level to provoke different psychological states (Fig. 4) by making the task boring, unsolvable or challenging.

State classification using a neural network using 30 hidden neurons.

