Psych-Talks

Department of Psychology & Salzburger Gesellschaft für Psychologie

Thursday, 12. May 2022

Start: 16:00 s.t. (till 17.30)

*in **HS 424** (FFP2)*

*& **Online Stream** https://uni-salzburg.webex.com/meet/manuel.schabus*

The talks will be presented in English

Current research from the FB Psychology … related to machine learning

A novel mobile App for tracking sleep and treating insomnia: First results and the AI behind

Prof. Dr. Manuel Schabus

&

Predicting daily health behaviours: machine learning applied to physical activity and food cravings

Prof. Dr. Jens Blechert

Abstract: *A novel mobile App for tracking sleep and treating insomnia: First results and the AI behind –* ***Schabus, M.***

Introduction: Insomnia disorder is the by far most common sleep disorder and affecting 6-20% of the adult population when defined in accordance with formal diagnostic criteria. Still many patients stay untreated and there is need for specialized and more easily accessible treatment

options that are well validated. Here, we do a first evaluation of the APP NUKKUAA that is reliably tracking sleep using an ECG chest band, and that offers small treatment “"nuggets" based on well-known techniques know from cognitive behavioral therapy (CBT-i). We also provide evidence that inter heartbeat interval (IBI) estimations from affordable consumer wearables in combination with deep learning algorithms can be used as a convenient tool to allow reliable 4-class sleep staging for end-users on a daily basis.

Materials and Methods: We are in the midst of evaluating a 6-week APP-guided intervention group that starts with a 2-week waitlist period. Every 7 to 10 days in the protocol one "level" in the program is completed. Thirty-nine volunteers (21 women; age= 51.03 [12.05], range= 30-73yrs) suffering from insomnia were included in the current analysis. The study protocol includes sleep questionnaires as well symptom inventories and quality of life scales. In addition, all participants undergo 3 ambulatory polysomnographies (PSG). During the program, participants are asked to use the APP daily, and evaluate subjectively their sleep in addition to wearing an ECG breast belt for monitoring sleep objectively.

For ECG-based sleep staging a Sequence-to-Sequence deep neural network architecture (based on Shridar et al., 2020) including a Multi-Head Attention Module (adapted from Edlere et al., 2021) was developed and trained to classify sleep into four stages (WAKE, LIGHT (N1+N2), DEEP, REM). Model training was performed on automatically extracted IBIs from an ECG channel on 8000+ PSG recordings that have been labelled by human experts based on standard AASM criteria.

Results: 74.4% of the sample reported a PSQI>5. The PSQI mean of the current sample was 8.87 (SD=2.86), with a median of 10. Preliminary analyses of people being at least 30d in the protocol (completing level 1-3) show improvements in subjective sleep quality (0-10) (Level 1: 5.74 to Level 3: 6.25; t39= -4.19, p<.01) and objective number of awakenings (Level-1: 18.4 to Level-3: 11.3; t32= 3.50, p<.01). Objective sleep onset latency did not (yet) change significantly (Level-1: 19.29min to Level-3: 15.00min; p = .15), as did subjective wake after sleep onset (36.92 to 31.28min; p=.12).

Overall epoch-by-epoch accuracy on a test split (25%) from the training dataset was 80% (κ = 0.702). Accuracy for the classification on our in-lab data based on the 1-channel ECG breast belt was 78.67% (κ = 0.672) which was practically identical to performance with gold-standard ECG (79.31%, κ = 0.68).

Conclusions: The findings give a first indication for a potential beneficial effect of a low-threshold digital intervention for improving sleep and complement subjective findings with objective measures from PSG as well as affordable consumer devices.

Importantly, IBIs derived from consumer wearables can be used to reliably score sleep into four classes. The achieved accuracy is even in the range of a 5-class sleep scoring performed by human experts based on full PSG.

Abstract: Predicting daily health behaviours: machine learning applied to physical activity and food cravings – ***Blechert, J.***

'What will I have for lunch today?' 'When will I exercise this week?' Health behaviors such as healthy eating or physical activity are highly relevant for many medical and mental outcomes. Yet, they are difficult to change. Being highly context dependent, research is trying to intervene on such behavior close to the actual 'decision points' in everyday life, that is, at the time points when the above questions arise. Such real time interventions require a solid, individualized data basis that current research – being mostly based on 1-time, trait-level assessments cannot provide. Thus, we adopted an 'n of one', within-participant approach in repeatedly assessing key determinant for these health behaviors, based on smartphone-based self-reports. Several such inputs per day on 'intention to exercise' and 'food craving' were acquired for several days. Machine learning was then used to individually predict the next self-report of food craving or actual exercise. Prediction accuracies were good in case of exercising and above chance for food craving. Such predictions could server as triggers for just-in-time interventions in future, adaptive health apps. More research on food cravings is required and passive sensor/usage predictors need to be integrated.
