AN INTERDISCIPLINARY WORKSHOP TO IDENTIFY ALCOHOL CRAVING BASED ON PSYCHOPHYSIOLOGICAL SENSOR DATA

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Abstract: Patients suffering from alcohol addiction still have a high risk to suffer a relapse. Changes in psychophysiological parameters that are known to occur following such a relapse may also occur within the scope of alcohol craving prior to imminent alcohol relapse and hence may provide the potential to act as a predictor. The principal aim of this interdisciplinary workshop was to clarify, if abstinent alcohol patients can be distinguished from healthy volunteers merely due to domain knowledge based on psychophysiological sensor data recorded in a cue-related clinical study setting. Currently, the results did not fully support this hypothesis, yet. As expected, significant withdrawal symptoms could be identified. In addition, a suspicious 0.1 Hz component of the heart rate variability led predominantly to correct classification.

Keywords: alcoholism, addiction, craving, pattern detection, psychophysiological parameters

Introduction

Alcohol addiction is a common disease and can be considered as a chronic relapsing disorder [1]. Even after having an alcohol withdrawal therapy completed successfully craving is the leading cause and a solid predictor [2] for suffering a relapse. Following such a relapse various changes in psychophysiological parameters can be detected. However, it still remains unclear whether psychophysiological parameters also show measurable changes within the scope of alcohol craving prior to imminent alcohol relapse. Therefore, an interdisciplinary pattern detection workshop was organized to answer this scientific question based on controlled recorded sensor data. The objective of this workshop was to clarify if experts with domain knowledge can distinguish abstinent patients from healthy volunteers based solely on psychophysiological parameters in a cue-related study setting.

Methods

The aim of the underlying clinical study is to investigate whether, and if so to which extent psychophysiological parameters change in the scope of alcohol craving. Furthermore, which combinations of the parameters mentioned are key indicators of imminent alcohol relapse? Base is an open prospective nonrandomized data collection study without intervention followed by an explorative data analysis and hypotheses generating. 20 subjects - patients and volunteers - have participated in the study, so far. Inclusion criteria for the patients are primarily an alcohol addiction according to ICD-10 F10.20 with current abstinence for at least four weeks and minimum of three relapses of alcohol in the past. Further information concerning inclusion and exclusion criteria of both groups is listed in [3]. Along with grass root phenotyping, clinical signs assessment of alcohol addiction and laboratory-chemical examination, technical phenotyping was made and represented the basis of the workshop. Data recording took place while the subject was sitting in a single room at a desk watching validated alcohol-related pictures in a given order and schedule (Fig. 1). Meanwhile psychophysiological parameters were recorded with the aid of unobtrusive body sensors. The following parameters were measured: body temperature on the surface of the skin, heart rate and breath rate (RR intervals), galvanic skin response and surface electromyogram, and the three-dimensional acceleration at chest position.

Figure 1: study setting

Guided by a script the interdisciplinary pattern detection workshop was performed by two organizers and fourteen participants (8 computer scientists and 6 physicians - from staff member to director). The key points of this workshop were teamwork and discussion. At the beginning, the underlying study was introduced concerning study design and setup, parameters recorded as well as state of play in order to ensure that all participants had the same level of knowledge. Afterwards, the participants were divided into four teams, working independently of each other. This grouping was done by random selection.
without returning from two identical lot groups to ensure that knowledge from both subject areas occurs in every single group while random distributed. Each working party received the same 20 datasets in shifted order while equal timing. Those datasets were picked randomly out of 20 basic datasets - four to be dropped out again and four to be duplicated - and put into random order. Each dataset consists of the parameters mentioned above, visualised as curves or bar charts (Fig. 2). These datasets had to be analysed to identify patterns. Therefore, two cycles with differing dataset order were planned. One to clarify if changes in psycho physiological parameters and behaviour are recognisable by the data base of the participants, in any way. The second one to focus on typical pattern detection and symptoms with regard to alcohol addiction and craving. Those criteria which needed to be examined were listed in prepared protocols (one for each dataset) for commentating. The teams were asked to discuss and summarize their findings.

Figure 2: visualised data set of breath rate

Results

Besides the well-known fact of correlation between heart rate and breath rate, we found a correlation to the parameters galvanic skin response and the three-dimensional acceleration at chest position but we could not identify a comprehensive relation to alcohol addiction and craving, so far. The 0.1 Hz component of the heart rate variability could be identified as a strong indicator of psychological demand (as described in [4]) and led to correct classification of a patient when suspicious. In detail, 4 healthy volunteers and 3 patients could be identified correctly with a significant majority. One volunteer was suspected to be a patient.

Discussion

The workshop described gives an example of how cue-related psychophysiological sensor data may be analysed by means of expert domain knowledge. Finally, we have come to the conclusion that it is not that simple to detect alcohol craving on the basis of changes in psychophysiological parameters – in contrast to withdrawal symptoms.

With regard to the study setting it is still uncertain to what extent the artificial environment and varying excitement of the participants affects the outcome. Interviews with the patients led to the presumption that craving mainly occurred in the evening after study participation and less during data collection in the lab. Therefore, we now collect the psychophysiological data until the next morning as the sensor system enables ambulatory, unconstrained measurements outside a supervised lab inspection. Further research includes the use of machine-learning algorithms to gain a deeper insight in the parameter structure and larger randomized trials, while the small sample size could also limit our findings [5].

Bibliography