BCI adaption for end user –The GRAZ-BCI approach

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Abstract

Non-invasive Brain-Computer interfaces (BCI) enable its users to interact with their environment only by thought. A possible BCI application may be to control a computer game solely by e.g. imagery of motor tasks. However, this requires several control commands and individual BCI training. So far, no gold standard procedure has been established on how to setup, train and individualize multi-class control for end users. In the following, we describe our four stage approach for individualizing and adapting BCI technology for an end user. Our approach is based on [1] and the findings of Friedrich et al. [2], and extended by personal experience and ideas.

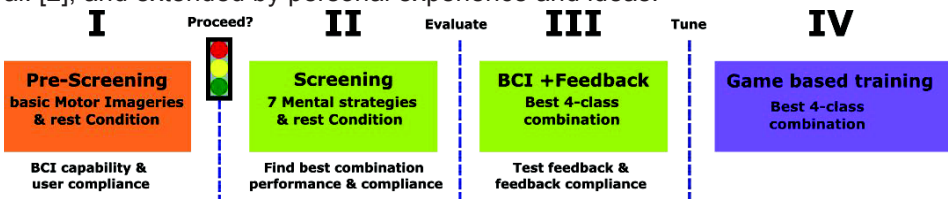

Figure 1: Stage Model

The procedure is divided into 4 different stages (Figure 1). In stage 1 we perform pre-screening to test whether the user is able to understand instructions, is comfortable with BCI technology and is able to produce distinct brain patterns. Results of this stage indicate whether continued training with the user is reasonable. Stage 2 incorporates a screening of several mental tasks as described in [2], including a non-control state. In an offline cross-validation setup of every possible combination, we determine the most effective (in terms of accuracy and user acceptance) combination of at least 4 different classes. BCI use commonly incorporates feedback, hence in stage 3, the previously identified class combination is used to test the user's compliance to feedback. In the beginning of stage 4, a BCI is closely tailored to the user based on the findings in the previous stages. Thereafter the user starts BCI training using the actual game. Our procedure provides a promising way to guide users from first contact with BCI technology to actually play a videogame by thought. We believe that an evidence based procedure, maybe similar to the one presented in this work, is a necessity to introduce BCI technology in the daily life of potential end users.

References

[1] G. Müller-Putz, R. Scherer, et al., "Temporal coding of brain patterns for direct limb control in humans," Frontiers in Neuroscience, vol. 4, no. 34, 2010.

[2] E. Friedrich, C. Neuper, and R. Scherer, "Whatever works: A systematic user-centered training protocol to optimize brain-computer interfacing individually," PLOS ONE, vol. 8, no. 9, 2013.

Short Biography

Andreas Schwarz received his M.Sc. degree in information and computer engineering in 2014 from the Graz University of Technology. Currently he is working towards his PhD at the Institute of Neural Engineering under supervision of Prof. Gernot R. Müller-Putz. His research focusses on the EEG-based decoding of upper-limb movements, especially grasping movements which eventually can be used for controlling a neuroprosthesis.