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Adaptive Training Strategies for BCI

David Sharma[1]*, Daniel Tanneberg[1], Moritz Grosse-Wentrup[2], Jan Peters[1,2], Elmar Rueckert[1]

[1] Technische Universität Darmstadt, 64289 Darmstadt, Germany
[2] Max Planck Institute for Intelligent Systems, 72076 Tübingen, Germany

*E-Mail: david.sharma@stud.tu-darmstadt.de

Abstract

Research of Brain Computer Interface (BCI) system consists of preprocessing the signals, artifact reduction, dimensionality reduction, applying filters and to learn classifiers to generate actions that can be send to actuators of exoskeletons or computer programs [1]. A problem with current BCI systems is that performance can decrease rapidly over time, since training can be tiring and the signals are non-stationary [2]. Furthermore, the motivation of the subject can drop quickly if no success in controlling the BCI system is experienced. Like in everyday life, if we want to learn a skill, we need feedback to be able to judge our current performance. Furthermore, the skill should be learned step by step, starting with an easy task and successively increasing the difficulty. A potential solution to the aforementioned problem is to develop adaptive training strategies, where we use one classifier to classify the data provided by the BCI system and an optimal agent which should assist the subject to modulate and improve her/his signals through continuous visual feedback to increase the classifiers accuracy. With increasing training time, control is given to the subject, reducing the effect of the optimal agent. With this attempt, we want to increase the convergence rate of the subject's performance at controlling a BCI system. To verify this, we will develop a simple computer game, closely related to the Cybathlon BCI challenge. In this game, the subject has to control a game figure to avoid obstacles by using different commands. The agents policy to assist the subject will be trained through reinforcement learning (RL). Finally, we are interested in the generalization abilities of the subject to previously unseen situations. Therefore, we will implement different difficulty levels with higher or faster obstacles.

References

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Short Biography

David Sharma acquired his Bachelor of Science in Computer Science in 2012 at Technischer Universität Darmstadt. Currently he is writing his master thesis on the adaptive training strategies for BCI. He is interested in exploring neural data with machine learning techniques to find out more about how the human brain works and how diseases affect the brain. In the Cybathlon competition, he is responsible for implementing and evaluating classifiers for the data.

* Presenting author Attending author(s)