Automated detection of bluffing in a game: revealing a complex covert user state with a passive BCI

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Abstract

Previous studies suggest that human-machine interaction could be enhanced by providing information about the actual user's state, thus allowing for automated adaption of the system. While some user states might be inferred from the user's behaviours, others like e.g. the perception of a self- or machine-induced error are hard to access externally. But such *covert user states* are reflected in physiological parameters like EEG and can be detected with a passive brain-computer interface (passive BCI). Aim of this study was to expand the complexity of covert user states, which can be detected by a passive BCI. An inherently covert and therefore complex state is the deliberate attempt to mislead an opponent in a game (e.g. in poker) – namely *bluffing*. We recorded high-density EEG from 6 pairs of subjects while they were playing a bluffing dice game against each other. The game included dedicated states in which the players had to bluff or to give up. When classifying whether a player would bluff or not, we achieved a cross-validated single-trial accuracy of 81.4% (± 6.5%) over all subjects. Based on that, further investigations of the detection of covert user states show promise to enhance the performance of human-machine systems.

Enhancement of HMS using knowledge about user states

With the proceeding development and increasing deployment of technical systems, the technical part of those systems becomes more and more complex and sophisticated. But every technical system has a user who has to cope with it. Although much research focuses on the technical part of such human-machine systems (HMS), rather little attention has been paid to ensure the user's capability to interact with the system.

User-friendly design of HMS has therefore become an important part of current research. New approaches evolve such as adaptive or interpretative HMS heading for optimal support of the user (Chen & Vertegaal, 2004; Rötting et al., 2009). One possible scenario is the adaptive reallocation of actions between operator and machine according to e.g. fatigue or attention. Or a computer could show the user the

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