Embedded Brain Reading

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Current autonomous robots and interfaces are far from exhibiting the adaptability of biological beings regarding changes in their environment or during interaction. They are not always able to provide humans the situation-specific and optimal support. Giving the robot or its interface insight into the human mind can open up new possibilities for the integration of human cognitive resources into robots and interfaces, i.e., into their intelligent control systems, and can particularly improve human-machine interaction. For this purpose, *embedded Brain Reading (eBR)* was developed. It empowers a human-machine interface (HMI), where the machine can be a robotic system, to *infer* the *human's intention* and hence her/his *upcoming interaction behavior* based on the context of the interaction and the human's brain state. Thus, eBR enables to implement *predictive* HMIs.

In my talk, I will present eBR and will discuss what is required to enable it. The applicability and reliability of the approach is supported by its formal model and experimental results. Presented experiments were conducted under controlled experimental setups, where subjects had to execute demanding simple and dual-task behaviours of different complexity as it is performed during human-machine interaction. By means of robotic applications for tele-manipulation and rehabilitation it is further shown that eBR can be applied to either adapt or to drive predictive HMIs in robotic applications. In case of adaptation, eBR can be implemented such that *malfunction* of the whole system can be *avoided,* as supported by the formal model and experimental results, while measurably *improving human-machine interaction*. In case that eBR is applied to actively drive an HMI, it is shown that an *individual adaptation* of the support with respect to the requirements of different users can be facilitated by utilizing multi-modal signal analysis in eBR.