Probabilistic Model for the Online Synthesis of Stylized Reactive Movements in Virtual Reality

Nick Taubert[1], Junru Li[1], Dominik Endres[1], Andrea Christensen[1], Beatrice de Gelder[1] & Martin A. Giese[1]

[1]Section Computational Sensomotorics, Department of Cognitive Neurology, University Clinic Tübingen, Centre for Integrative Neuroscience, Germany

We present a system for the generation of reactive, complex body movements that exploits state-of-the-art Bayesian approaches in machine learning. We applied this approach in order to simulate a reactive avatar in a Virtual Reality (VR) that reacts on user input with gradually controlled emotional style. Reactive motions are generated by a dynamical extension of hierarchical Gaussian process latent variable model (GPLVM, [1, 2]). This probabilistic model includes latent variables that encode the emotional style of the executed actions, where these variable can be adjusted at run-time. We have verified by psychophysical experiments that this method generates human motion that is almost indistinguishable from real human trajectories. In addition, it also allows to control precisely and continuously the emotional style of the executed actions. This makes the developed method interesting for many applications, including experiments in neuroscience and psychology, computer graphics, and for the realization of human-machine interactions. Here, we applied the system to study the perception of emotions from body movements, where human participants were either involved in or just observed a social interaction. We found that emotional expressiveness of the stimuli was rated higher when the participants were involved in the action, as compared to pure observation ($F(1,17) = 8.70$ and $p < 0.01$, $N = 20$). Consistent with theories about embodied perception of emotion [3], the involvement in social motor tasks seems to increase perceived expressiveness of bodily emotions.

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