Embodied Hand Prosthesis Learning Using VR

Project Management and Software Development
for Medical Applications

General Info

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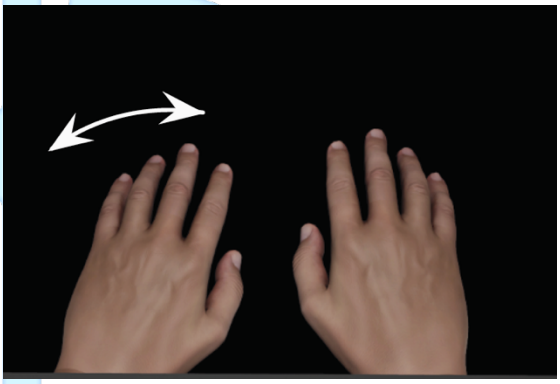
Project Abstract

Virtual Embodiment can be achieved by simultaneous multisensory stimulation to and resulting integration by human users.

In this project, we investigate how such virtual embodiment and potential mirror neuron stimulation could be of use for machine-learning based prosthesis model adaptation.



Background and Motivation

Hand prosthesis control is essentially similar to the control over a robot hand. However, the control has to be learned on the basis of training data acquired by the patient. While previous approaches already use different training approaches, the question arises whether user embodiment could lead to benefits in motion learning, data quality, and control.

Tasks Description

The task for this project is to develop a virtual hand embodiment simulation (can be desktop based due to COVID19 restrictions, but could also be VR based) that can be driven by camera or data-glove based input, or alternatively animated by predefined animations. Initial test data should be gathered in a preliminary data collection.

Technical Prerequisites

Knowledge of or strong interest in C# and Unity3D are required (potential C++ integrations are possible). Knowledge of VR or AR devices is of benefit. Interest in Kinematics and Computer Animation is of benefit.

References

[1] Botvinick, M., & Cohen, J. (1998). Rubber hands 'feel'touch that eyes see. Nature, 391(6669), 756-756.

[2] Yuan, Y., & Steed, A. (2010, March). Is the rubber hand illusion induced by immersive virtual reality?. In 2010 IEEE Virtual Reality Conference (VR) (pp. 95-102). IEEE.

[3] Roth, D., & Latoschik, M. E. (2020). Construction of the Virtual Embodiment Questionnaire (VEQ). IEEE Transactions on Visualization and Computer Graphics.

[4] Mattioli, F. E., Lamounier, E. A., Cardoso, A., Soares, A. B., & Andrade, A. O. (2011, August). Classification of EMG signals using artificial neural networks for virtual hand prosthesis control. In 2011 Annual International Conference of the IEEE Engineering in Medicine and Biology Society (pp. 7254-7257). IEEE.

Please send the completed proposal to javier.esteban@tum.de, ardit.ramadani@tum.de, mf.azampour@tum.de and zl.jiang@tum.de. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance