Research questions

- Is it possible to reliably capture and recognize the affective state of a person based on EMG sensors placed on their lower arms, while they interact with the virtual environment?
- Is EMG signal from one arm sufficient for detecting affect?

Motivations

- Facial affect analysis in Virtual Reality is challenging as the upper face is occluded by the headset.
- Currently in VR settings majority of the interaction takes place through the use of hand controllers. Therefore, we wanted to investigate if it is possible to capture affective state changes using arm muscle activations.

The Study

The study was conducted with 8 people (4 male and 4 female) wearing an Myo Armband on each arm. The participants played the following VR games:

- Eggs time -> positive and negative affect
- Google Earth -> neutral and negative affect
- Spell Fighter -> variety of negative affect
- Museum of Fine Arts -> low arousal, positive and negative emotions
- Fruit Ninja -> high arousal, positive and negative emotions.

Annotation

Participants were asked to provide self-reported arousal and valence annotations using the scheme adapted from Grekow and Ras [1].

EMG Feature Extraction

The listed features were extracted from the approximated signal (1-sec window) based on a discrete wavelet transform with a db2 wavelet. Detailed definitions of these are available in Phinyomark et al. [2].

- Mean absolute value
- Mean absolute value slope
- Original signal zero crossing
- Original signal zero crossing slope
- Original signal zero crossing slope sign changes
- Waveform length
- Variance
- Root Mean Square
- Waveform Length
- Standard deviation of the amplitude of the signal

Conclusion

- EMG measures from both (lower) arms provide sufficient information to analyse the affect experienced by a player of a VR game;
- Comparable accuracy is obtained by using the EMG signal from one arm only.

References


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