Perceptual features for the evaluation of human and meta-human facial expressions

University : Nantes Université

Research unit : LS2N – UMR 6004

Laboratory / Team : LS2N / IPI – Image, Perception, Interaction

Supervisor : Patrick Le Callet (50%)

Co-supervisor : Alexandre Bruckert (50%)

Contact : alexandre.bruckert@univ-nantes.fr, patrick.lecallet@univ-nantes.fr

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Context:

Virtual facial expressions play an essential role in digital interactions within games, virtual reality (VR), and social platforms. As these virtual environments become more prevalent, the demand for authentic emotional communication through avatars intensifies. Consequently, users expect avatars to convey emotions realistically, particularly through the use of realistic facial expressions.

In order to evaluate the authenticity and quality of facial expressions displayed by an avatar, it is important to understand how we perceive and recognize these signals. For this purpose, numerous behavioral data can be collected (subjective evaluations, eye-tracking data, interaction with the avatar, etc.) and then used to qualify a user's experience when confronted with an avatar displaying various facial expressions.

Objectives

The aim of the thesis is therefore to identify perceptual characteristics that allow for the evaluation of the quality of representation of virtual facial expressions and micro-expressions, and to develop appropriate tools for the analysis and representation of this data. We will also explore the transfer of these characteristics between real interaction situations (with human faces, in the form of videos or in situ interactions) and virtual ones (through the use of avatars). Additionally, we will focus on modeling these characteristics using learning methods to finely model user/avatar interactions. Such methods have already been developed by the IPI team, particularly for eye-tracking trajectories, in more general contexts. Several approaches can thus be considered for these models, although we would like to explore the potential of graph neural networks.

On a fundamental level, this thesis aims to better understand the impact of facial characteristics, animation quality, and rendering techniques on the perception of virtual

facial expressions, while exploring the role of micro-expressions and subtle cues in the effective transmission of nuanced emotions through avatars. This knowledge can be used to develop and evaluate generative models of avatar facial animation, which can be enriched by the use of these perceptual data.

This project develops themes related to the Marie Skłodowska-Curie Mobility Program "ACMOD". The aim of this project is to build 4D macro- and micro-facial expressions in accordance with emotional states, and to study differences in facial expressions under different conditions. To this end, the project consortium includes researchers from multiple disciplines and regions, paving the way for scientific exchanges and participation in interdisciplinary research for the candidate.

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ACMOD Project Staff Exchange https://sites.google.com/view/acmod-main/MSCA_ACMod