Context-Aware Motion-Based Interfaces for Virtual and Augmented Reality

Keywords

Natural User Interfaces, Sparse Representation, Machine Learning

Laboratory

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Context

The way we interact with computers is continuously evolving, and nowadays we are witnessing a major revolution in virtual reality (VR) and augmented reality (AR) that will reshape the way we interact with digital media. However, VR and AR systems break the *status quo* of current **human-computer interaction** (HCI) paradigms: well-known and widely accepted interaction paradigms such as the WIMP (windows, icon, mouse and pointer) fail to provide efficient interaction mechanisms. In this context, **motion-base interfaces**, by taking advantage of the expressiveness of the human body, could reduce the gap between the user and the virtual content enabling efficient and seamless interaction. This internship will focus on the main enabling component of such interfaces: **gesture recognizers**. Current gesture recognition algorithms take advantage of existing machine learning algorithms to build knowledge about user's gestures [L13]. However, current gesture recognition system still presents major limitations such as reliability and performance.

Objectives

The goal of this internship is to improve gesture-based interfaces systems by increasing the awareness between gesture recognition systems and users (in both ways). The perfect motion recognition system has to determine at any given moment the interactions the user wants to perform (intention inference) by analyzing the user's motion (temporal and multidimensional data) and the application context (arbitrary and application-dependent data). In order to accomplish this challenge two major research directions are envisioned.

- Current gesture recognizers are generic and mainly focus on user's motion, additional information can be used during the classification process such as contextual information (e.g. previous motions, the application state, etc [TSal15, WBal15]) . The main research challenge is to determine the most relevant (discriminant) context information and the best suited machine learning algorithms (e.g. multiple layers will be required).
- Real-time gesture segmentation. Current approaches (e.g. sparse representation [ADLG17]) require the user to explicitly determine the start and the end of the command. A second objective will be the extraction from a continuous motion stream the gesture candidates potentially representing meaningful gestures.

The technical development will be done using an existing framework for 3D gestures recognition developed in Matlab (Sparse Representation) and Unity (Immersive real-time interaction).

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