Semester project: Evaluation of Bimanual Interactions with Neural Networks Finger Tracking.

Background:
PhaseSpace system is an effective professional Mocap system. It’s an optical tracking system, meaning that it uses several cameras which get the signal emitted from LEDs. Thus, we can detect the position of these LEDs in the tracking space. This system is very flexible and allows us to track several objects as well as the entire body. However, this system, which is optical, has some occlusion issues. That’s why we need a certain number of LEDs and Cameras to reduce these risks but it’s not enough in some cases.

Project Idea:
In our case, we have used an advanced machine learning method to track the fingers in order to deal with many occlusions in a robust way. We wish now to evaluate our system with complex bimanual interactions (join hands together, manipulate object). First, only one hand dataset being available, we need to train our system for the other hand by mirroring the dataset. Then, a protocol has to be elaborated to evaluate our system in bimanual interactions. For this purpose, a list of key bimanual interactions needs to be established. This protocol will be used to compare our approach with other approaches using Leap motion or ManusVR in particular. Indeed, the list of key bimanual interactions established in the first phase of the project will have to be reproduced with different finger tracking in order to compare our system with these alternatives. This will also allow us to identify the weakness of our system. Finally, these issues will be addressed and a second iteration of the study will be conducted.

Goal:
- Conduct a study to compare different devices.
- Evaluate and Improve our finger tracking system.
- Design the protocol for the study.
- Produce a Unity plugin

Requirements:
- Unity (scripting in C#/DLL in C++)
- Machine Learning (basis)
- 3D geometry and quaternions (Vectors, cross products, rotations)
- Matlab/R (statistical tool).

**Information, materials and resource:**

*Unity3D game engine*: http://unity3d.com/learn

*Phasespace active tracking system*: www.phasespace.com/

*Machine learning*: C. Bishop: *Neural Networks for Pattern Recognition*

*The project with our finger tracking system (Unity project and Notice) will be given*

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