Intelligent and automatic action region based controllers for facial animation

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1 Introduction

Posing a face model is really time consuming if you’re positioning each vertex manually. In computer graphics, this problem is usually made simpler by defining a simpler set of handles (defined in a subspace) and defining a smooth and meaningful relationship between the subspace and the motion of vertices in the original model. Meyer and Anderson [1] proposed an automatic method which finds the best subspace handles for face posing automatically by using a statistical technique called Principal Component Analysis (PCA) from a large set of example faces already posed by the animator. However, this approach ignores the regions of the face should move independently in a local region around the handle.

More recently, Tena et al. [3] proposed a technique for posing the face based on the Facial Action Coding System (FACS), which is a simple region partitioning used in numerous disciplines to roughly partition the face based on the types of muscle activations that are possible. Manipulating handles in each region region results in a smooth and nearly local deformation. However, the region encoding is less useful for encoding actions, as motion from examples do not generally conform with these perfect partitions.

In earlier work we [2] developed a clustering method for identifying which large regions of vertices move together as individual action groups. This approach can be exploited to identify a set of actions regions which corresponds more directly with the data set by storing individual actions in a spatio–temporal representation and using a statistical model to decide which of these actions is being triggered by user interaction (see Figure 2).

2 Desired Outcomes

There are two main project outcomes:

- A method (with implementation, preferably in C++) to automatically partition a sequence of compatible face models into spatio-temporal action groups.
- A method (also implemented) to synthesize facial animation states based on handle deformation and predefined action groups.

A Maya plugin which incorporates some user interaction to manipulate handles and synthesize new face states based on these techniques would be smashing. I suspect that this project could be divided into two on these lines.
3 Prerequisite Skills

• You’ll need to know something about maths and statistics.

• Machine learning will be needed for deducing face states from handle positions.

• Experience with a language for rapidly prototyping your ideas (like MATLAB) would be very helpful.

• C++ development needed for Maya plugin, and you’ll need to use some existing math libraries, e.g. CHOLMOD, CGAL, GSL or another matrix analysis library.

• A hardcore CUDA l33t h4x0r may add some benefit (lots of matrix manipulations in parallel).

• Splendid writing and presentation skills for when this work gets published at SIGGRAPH (good luck with that!).

References

