Face Animation Framework for Facial Expression Synthesis

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Abstract

A face animation framework is presented for synthesizing facial expressions, which provides a method for cloning real face expressions to generate new facial animation sequence. Firstly, the sample frames are re-sequenced to form a new animation sequence, and then the target face is animated using shape-blending method.

1. Introduction

Many researchers have tried a lot of efforts to drive a virtual face performing as human beings. We considered that automatic facial animation system could not only map the expression in each frame, but also learn the behaviors from sample expressions, when there is no direct sample sequence between two kinds of expressions, the system could search a new path for animation, we propose a novel framework for facial animation generation, which re-sequences the sample frames for new animations.

2. Expression Sequence

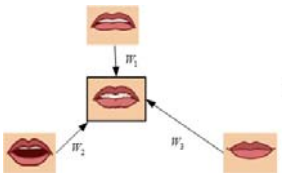
It is hard to perform all the expression sequences about how to change from one expression to the others for samples. Our purpose is to find a new expression sequence from the sample frames and generate a new expression animation sequence, when two frames are selected as the start and end expressions at random. Proposed solution is, firstly, reduce the dimensionality of the expression features, and then search a new expression path in the low-dimensional space.

The Isomap [1] can acquire the nonlinear degrees of freedom and discover the intrinsic global structure of a data set. We use the Isomap to embed the facial expression features into a low-dimensional space (Fig.2), the geodesic distance replaces the Euclidean distance to judge the similarity of the expressions. Similar-looking expressions have been located closely, which keeps the intrinsic relations among the expressions.

To form an expression sequence, the shortest cost path is searched in the low-dimensional space by Dijkstra algorithm. In-between expressions are the indexes along the path after re-sequence the sample frames.

3. Animation Based on Shape Blending

For each frame in the new expression path, the animated result is acquired by blending the three closest key frames together [2]. A set of extreme expressions of the target face is located in the low-dimensional space at the corresponding expression's positions, and blending weight vector is related with its position. Fig.1 shows a local mouth blending example, we judge the Euclidean distance between the point and key frame, when the distance is closer, and the weight must bigger, vice versa. The weight equals to 1 when the distance is zero.



$$\text{where,}\quad \begin{cases} \sum_{i=1}^{3} W_i = 1 \\ W_i \geq 0, \quad (i = 1,2,3) \end{cases}$$

Fig.1. Local mouth animation by shape-blending.

4. Experiments

Figure 2 shows our experimental results. The feature points are extracted from a real person's various expression images and embed into 2D space. A set of cartoon face's key expression images such as laughing, surprising, are located at the corresponding positions in advance (stars in Fig.2). Chosen any two points as the start and end expressions, the proposed framework can search a new animation path between them (line in Fig.2). Animation results by shape blending are shown along this new expression sequence.

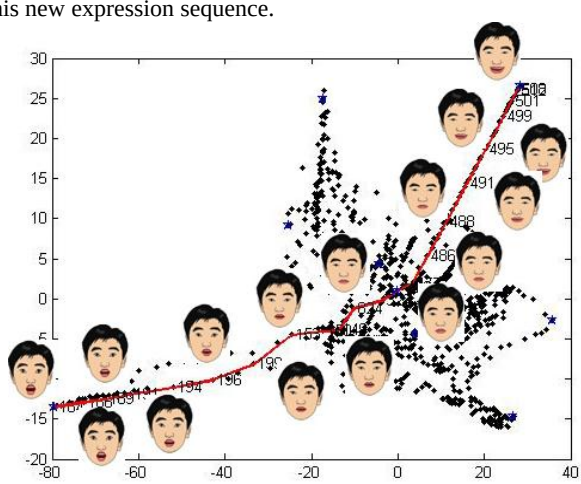


Fig.2. Experimental results.

5. Conclusions

A framework for facial animation sequence is presented, it is used to generate various cartoon face expression sequence. The experiments demonstrate that proposed method is efficient and desirable.

References

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