A Comparative Study of Algorithms for 3D Morphing

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Abstract. We present a comparative study between two 3D morphing algorithms for polyhedral objects. A 3D morphing algorithm establishes a smooth transition between the source object and the target object. The two algorithms compared are the one presented by Hong et al. [1] and the one presented by Kent et al. [2]. The main conclusion is that, in general, the latter algorithm delivers morphy sequences that look more natural.

1 Introduction

Morphing techniques allow the transformation of a source object into a target object. One of the main goals of morphing is to convince the eye that the source object is smoothly transformed into the target object. In this study we implemented and compared two algorithms ([1] and [2]). We selected these 2 algorithms since they are among the first solutions presented for the 3D morphing problem and still today they are at the core of many morphing solutions.

2 Algorithms

Both algorithms divide the problem into two steps. The first step deals with the correspondence between the points, or how to establish a mapping between each point of the target and source objects. Once this correspondence is established, the second step deals with the problem of interpolation. The algorithms differ on how to establish the mapping. Hong uses the criterion of the minimal dynamic distances whereas Kent combines the topologies of the source and target objects, creating a new object. For the interpolation step both solutions use a linear interpolation between each pair of correspondent vertices on a user-given number of frames.

<table>
<thead>
<tr>
<th>Morphing</th>
<th>Hong</th>
<th>Kent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realism</td>
<td>It does not seem very real depending on the complexity of objects</td>
<td>It does seem real (“natural”)</td>
</tr>
<tr>
<td>Intermediate forms</td>
<td>Distorted</td>
<td>Soft and continuous</td>
</tr>
<tr>
<td>Restrictions</td>
<td>Polyhedral objects</td>
<td>Star shaped polyhedral objects with genus 0.</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Do not maintain</td>
<td>Maintain</td>
</tr>
</tbody>
</table>

Table 1: Comparison between algorithms [1] and [2]

3 Conclusions

A summary of our findings is presented on Table 1 and a visual comparison between the 2 algorithms in shown in Figure 1. The technique presented by Kent et al. preserves the topology of intermediate objects, keeping the connectivity between the faces. This generates transformations with little distortions in the intermediate frames, that is, a soft and continuous morphing. The technique presented by Hong et al., on the other hand, ignores the topological information of the models, resulting in intermediate models where the faces seem “to fly separately” during the transformation. Therefore, in general, the solution proposed by Kent has better visual results.

Bibliografia
