

Homework 3

Keyframe animation

ADVANCED COMPUTER GRAPHICS 2020/21

1 Introduction

The goal of this homework is to get familiar with animation interpolation in 3D computer graphics. Your task is to develop an animation system that interpolates between character shapes over time. The homework also has some optional extensions. The homework must be turned in before May 28, 2021. You will have to defend the homework at the laboratory exercises. The homework is worth 10 % of the final grade. The defense of the homework after the deadline lowers the maximum worth: 1-week extension: 7 %, 2-week extension: 5 %.

2 Input

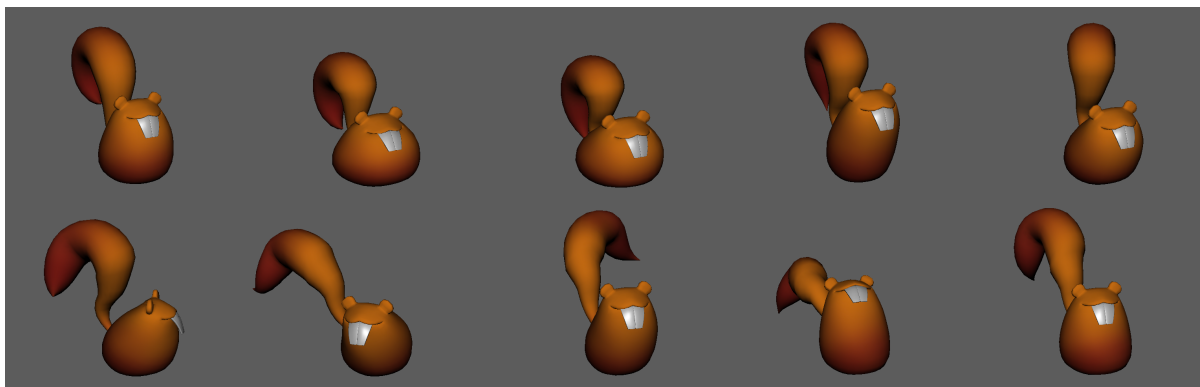
The input will be a set of polygonal objects, stored in OBJ files.¹ These objects will have the same number of vertices and in the same order for the interpolation to work as intended.

Additionally, you will be given an animation description file containing the keyframes as filename-timestamp pairs. The timestamps will be specified in milliseconds from the beginning of the animation. Note that the keyframes can be non-uniformly spaced, and that negative timestamps are valid.

An example animation description file:

```
frame_01.obj 0
frame_02.obj 500
frame_03.obj 1200
frame_01.obj 1500
```

An example character you will be working with:



3 Interpolation with Catmull-Rom splines

To animate the character, choose a frame rate (time between individual frames) and a time range, from which you will draw the timestamps. For each timestamp, you will have to generate new vertex positions by interpolating the vertex positions in the keyframes. To interpolate each individual vertex position, use a Catmull-Rom spline (all the necessary details were presented at the lectures).

Optional: Implement chordal and centripetal parametrizations of Catmull-Rom splines.

¹https://en.wikipedia.org/wiki/Wavefront_.obj_file

4 Optional: 3rd order Bezier spline interpolation

In addition to section 3, interpolate the keyframes with 3rd order Bezier splines with C^1 continuity. Also include a simple switch to select a different type of interpolation splines.

5 Visualization

You can store the results in individual OBJ files and visualize them with existing software (e.g. Blender, Maya), or you can use your own visualizer.

If you choose Blender, there is a useful add-on called “Stop-motion-OBJ”² that lets you import a sequence of mesh files and play them back in real time or render a video. A similar script is available for Maya.³

6 Outputs

The expected outputs of this homework are the interpolated frames and videos of the visualized outputs.

7 Grading

This assignment is worth 10 points:

- 6 points for interpolation with Catmull-Rom splines, and
- 4 points for visualization.

²<https://github.com/neverhood311/Stop-motion-OBJ>

³<https://forums.cgsociety.org/t/how-to-import-obj-sequence-into-maya/861836/2>