Assignment 2: Motion Capture Interpolation

CSCI 520: Computer Animation & Simulation

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Description:

In this assignment, we implement 3 methods of interpolation; Bezier interpolation for Euler angles, SLERP interpolation for quaternions, and Bezier SLERP interpolation for quaternions. Then, we compare the methods to determine their effectiveness and their drawbacks.

Folders:

I have placed the graph images in the 'graphs' folder and the 'screenshots' folder in the "csci520-assignment2-startercode" folder. The screenshots folder contains 3 sub-folders for each of the outputs requested.

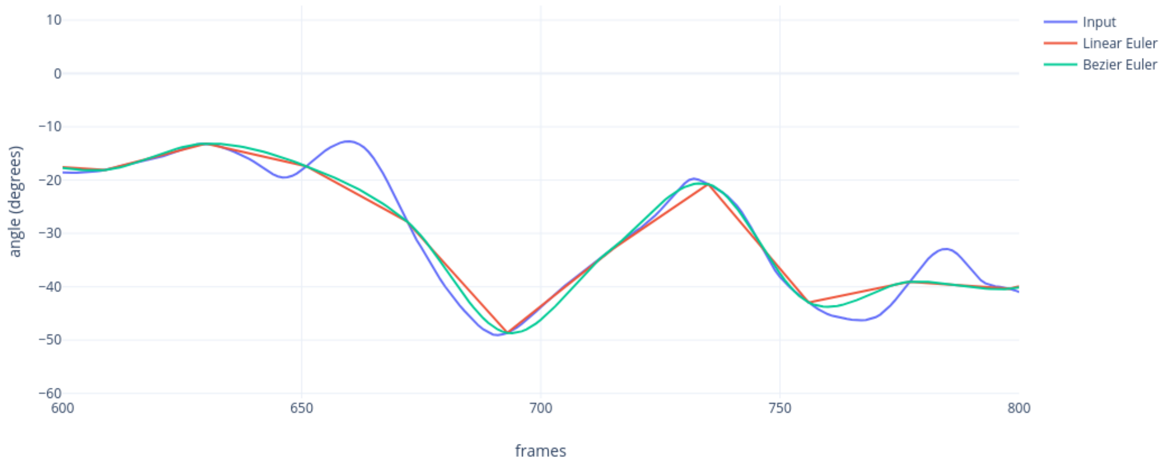
- Input motion and Bezier Euler. *
- Input motion and SLERP quaternion. *
- Input motion and Bezier SLERP quaternion. *

*(superimposed on top of each other)

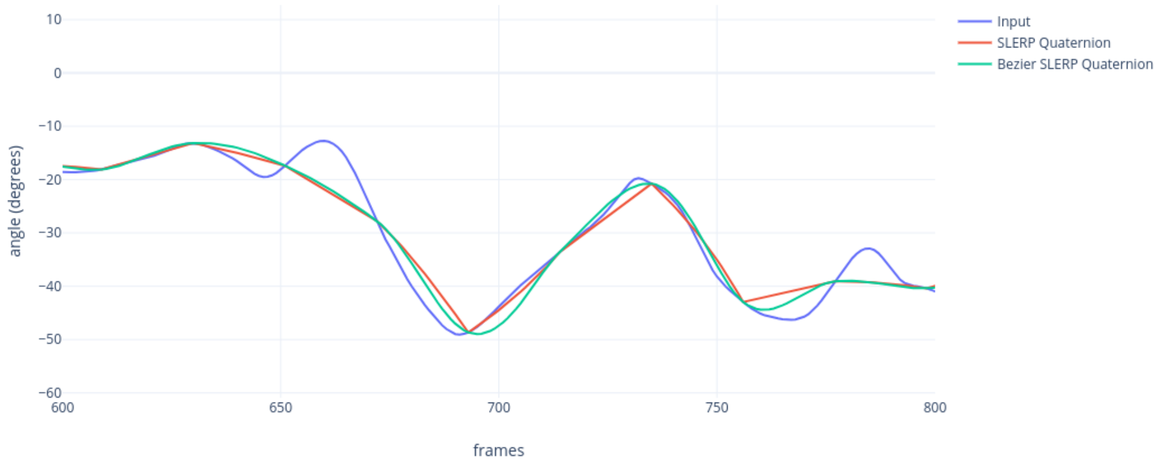
They have been converted from ppm to jpg format. Their respective *amc* files exist within 'csci520-assignment2-startercode/IDE-starter/VS2017', as well as the amc files needed for the graphs that are shown below.

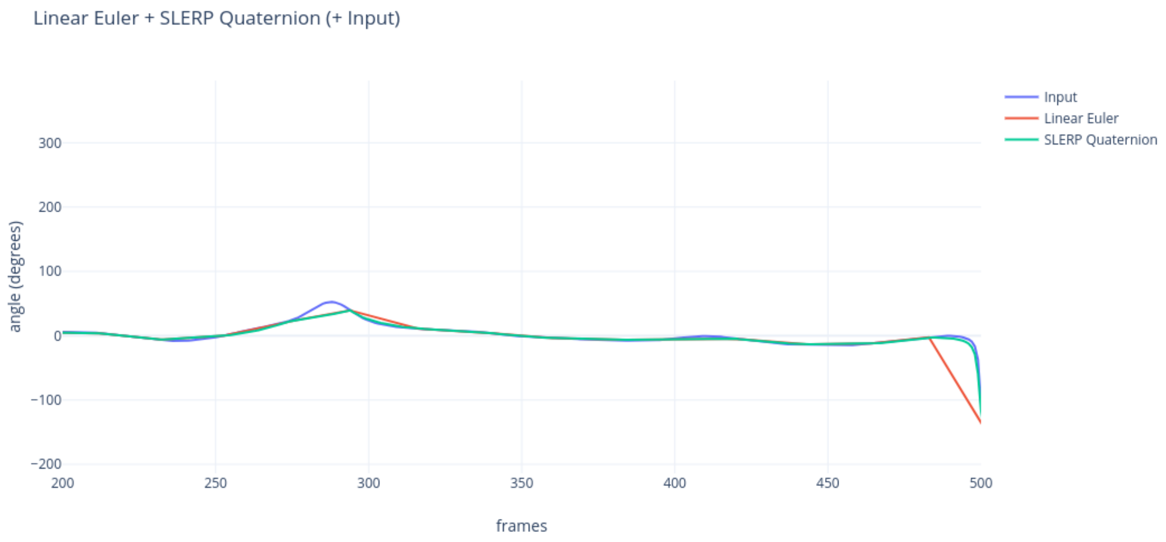
Plotted Graphs:

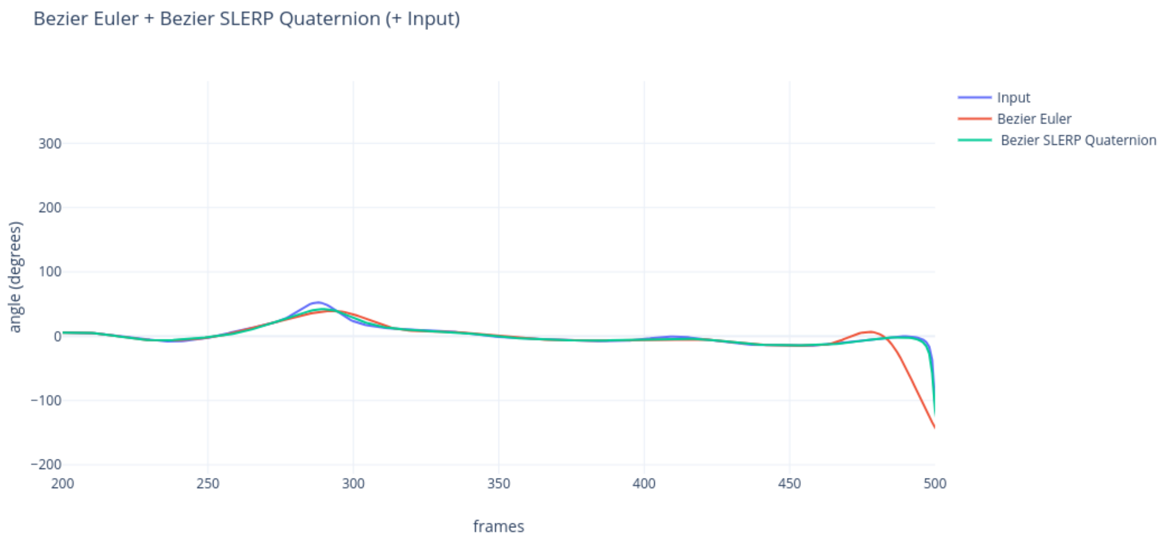
Linear Euler + Bezier Euler interpolation (+ Input)



SLERP Quaternion + Bezier SLERP Quaternion Interpolation (+ Input)







Efficiency Analysis + Observations:

On testing and comparing the methods, we find that Bezier Euler is better than Linear Euler. However, there is still a sharp motion that is quite undesirable. The Linear method has very sharp curves, indicating dramatic motion change in some frames. The Linear Quaternion method works quite well too, and is quite close to the input motion, however, sharp motion changes still exist. The Bezier quaternion method provides a much better result by avoiding this and although it is more computationally expensive, the smoothness of the motion, nearly identical to the input in most cases, makes it worth it. This is evident in the graphs above, as the curves are smoother.

(Extra Credit)

"Analyze the computation time of the different interpolation techniques."

I used the function clock() to determine how much computational time a method takes. I compared the time values of the 4 methods on the same skeleton and motion file. The computational time required by the methods is as follows in increasing order (where *N=10*), i.e.

Linear for Euler (0.065) < SLERP for quaternions (0.399) < Bezier for Euler (0.542) < Bezier SLERP for quaternions (1.198)

So Linear interpolation for Euler takes the least time, and Bezier SLERP interpolation for quaternions takes the most time, but has a much greater effectiveness.

Observations:

Linear interpolation may be quick, but the result is very sharp and undesirable. Bezier quaternion interpolation on the other hand delivers a better angular velocity that is smoother and preferred and is worth its computational cost. Therefore, it is understandable how quaternions have become a standard in most industries.