CS3570 Introduction to Multimedia Technology

Homework #4

Due: 11:59pm, 2024/05/21

1. Bézier curve (40%)

You are given 1 raster image (bg.png) and 1 path object (Bézier curve, extracted as **N points**) and Q1.ipynb to draw the point and Bézier curve.

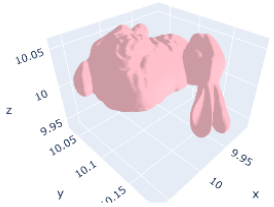
bg.png

a. Plot two sets of (N-1)/3 cubic Bézier curves along with N points on bg.png. Color the low-detail curve in blue and the high-detail curve in red. Save the resulting image as 1a.png.
   I. for low detail curve: t = {0, 0.25, 0.50, …, 1.0}; for high detail curve: t = {0, 0.0001, 0.0002, …, 1.0}.
   II. Discuss how you implement the Bézier curve and the differences between high and low-detail curves.

b. Scale up the image and the curves by 4, then plot and save it as 1b.png.
   I. bg.png is scaled using Nearest-neighbor interpolation.
   II. First scale the N points, then draw the curve (using the settings of the high-detail curve)

2. 3D Models (60%)

Launch the script (Q2.ipynb) to implement the translation and illumination of bunny.obj and a 3D surface respectively. Here, we use plotly, a python graphing library, to help us render 3D graphics.



a. Shift the center of the bunny to (0, 0, 0) and save the figure as **2a.png**. Center is defined as `[(max(x) + min(x)) / 2, (max(y) + min(y)) / 2, (max(z) + min(z)) / 2]` where x, y, z are the vertices of the object.
b. Based on (a), implement the rotation matrix to rotate the bunny to face the screen(like the following example). Discuss how you implement the rotation matrix and save the 3D figure as **2b.png**.
c. Based on (b), given a surface, try rendering the bunny in different ambient strength k_a, diffuse strength k_d, and specular strength k_s in the following settings. (Please do not modify the given lighting position in .ipynb):
   I. (k_a , k_d , k_s) = (0.1, 0.8, 0.05) and (k_a , k_d , k_s) = (0.9, 0.8, 0.05)
   II. (k_a , k_d , k_s) = (0.8, 0.1, 0.05) and (k_a , k_d , k_s) = (0.8, 0.9, 0.05)
   III. (k_a , k_d , k_s) = (0.8, 0.8, 0.2) and (k_a , k_d , k_s) = (0.8, 0.8, 2.0)
   Plot the result for each condition with **2 subplots** and discuss the difference between each pair of settings. Results are saved as **2c_1.png, 2c_2.png, 2c_3.png** respectively. You can refer to the following link for more information.
   plotly lighting
   reference:https://plotly.com/python/reference/#surface-lighting

Reminder

- Your ipynb would be better off keeping the results displayed correctly, and also making sure that the code inside can be run.
- Directly put your report and discuss at .ipynb using markdown.
- Please compress your code, input images, and result images in a zip file named HW4_{Student-ID}.zip and upload it to eeclass.
- If you encounter any problems, please post your problems/questions on eeclass.
- Please follow the file structure below: