E0 271: Graphics and Visualization Assignment #3

Weightage: 15%

Due: Nov 08, 2021

Data and the tasks

The data for problem 1 can be found in `https://klacansky.com/open-scivis-datasets/`. Each data set contains scalar fields in .raw format and can be read using the rawfileparser. For reading VTK files you can use meshio or any other VTK parser. Wherever applicable use **appropriate colormaps** as discussed in Assignment 1.**[N]** denotes the weightage of each task out of **100**.

1. **[50] Isosurface computation**

   Extend the marching tetrahedra implementation from assignment 2 using domain search technique. Compare the computation time for three different datasets of varying sizes, preferably large datasets. Compare the output quality with the isosurfaces generated using paraview. Submit the observation file.

2. **[50] Volume rendering and scalar field visualization**

   a. **[25]** For the given dataset compute all the critical points, design a transfer function that highlights the critical values and visualize corresponding features using paraview. Use this link to understand VTK file format. Submit the observation file.

   b. **[25]** For the given ocean dataset compute all local maxima of sea surface height(excluding the boundary points) and verify correctness of your computations using paraview. You can use appropriate color map to color all local maxima with red color. Submit the observation file. Click ***here*** to download VTK data.

Notes

General:

1. While user input and interactions won't be evaluated, it would help in the demo and also in debugging. So while not mandatory, virtual trackball can be explored to enhance user interaction. Sample code can be found on the internet which can be used[1].
2. Take the inputs like iso value from command line.
3. Use continuous rotation for demonstration.
4. Experiment with different data sizes for performance comparisons.

Scalar field visualization:

1. To compute scalar values at points which aren't grid vertices, use *trilinear interpolation*[2].

[1] `https://www.visgraf.impa.br/Projects/3dp/doc/html2/trackball_8cpp-source.html`
[2] `https://en.wikipedia.org/wiki/Trilinear_interpolation`

Submission

1. Format (zip following)
   (a) Directory with name <Student name>
      i. Directories with name <task no.>. For example 1a, 2a etc.
         A. code files
         B. make file
         C. readme file explaining how to execute/use your code
      ii. <data> folder
         A. corresponding data files. (If data files are too large to upload then just provide file names)
      iii. Common observation file explaining description of methods used, analysis, output comparisons, discussion of running times, any key learning/observation.
2. Strictly follow the submission format.
3. All files required to run the code should be submitted, including common util files.