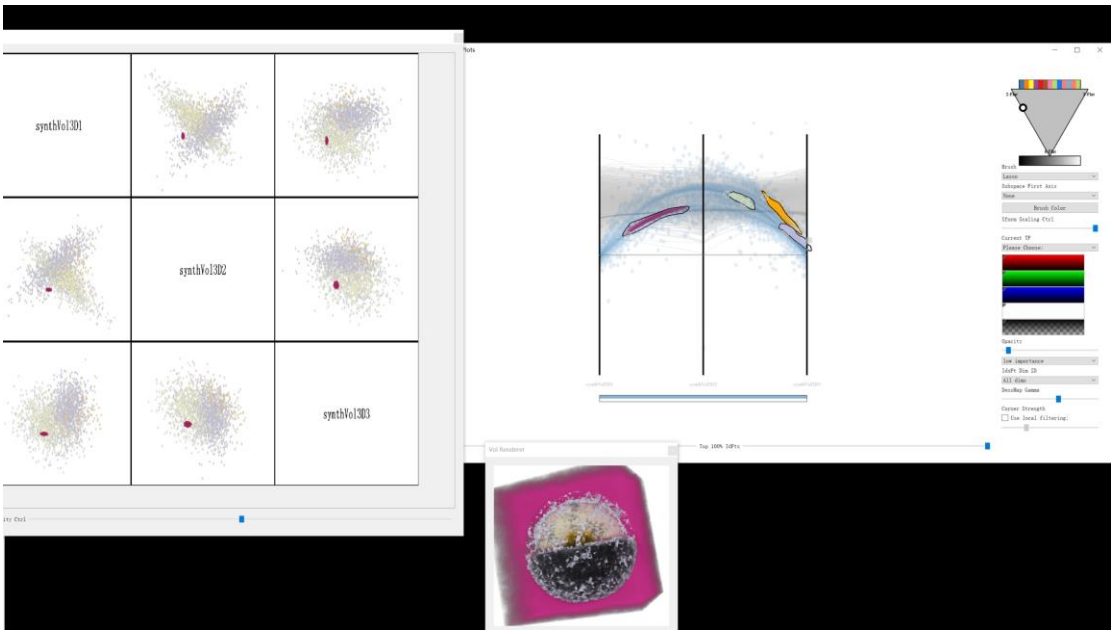
User Study of "Continuous Indexed Points Visualization for Multivariate Volumes"

Introduction

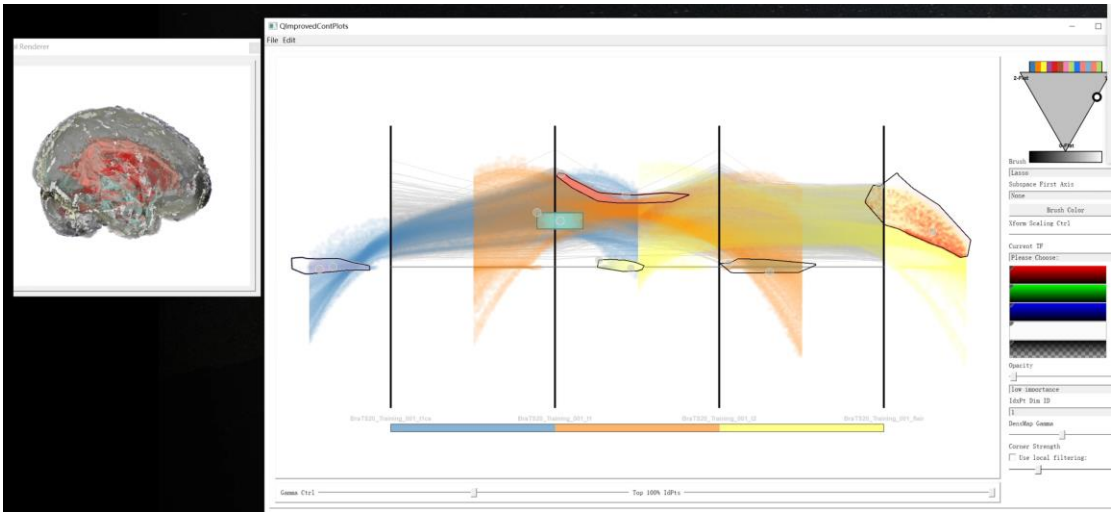
We introduce continuous indexed points for multivariate volume visualization. Indexed points represent linear structures in parallel coordinates and can be used to encode local correlation of multivariate volume data. With our new method, multivariate volume data can be classified using the eigenvector information from local spatial embeddings. We support the analysis of linear correlations of 2 volume variables with so called 1-flat indexed points, and the correlations of 3 volume variables with 2-flat indexed points. In this user study, you will be asked to explore two datasets with our interactive tool. The study will take 5-10 minutes and works only on Windows systems (tested on Win10). Thank you for your corporation!

Tasks

1. Exploring a synthetic dataset of 3 attributes with 2-flats and reproducing a similar result as shown below.



2. Exploring a brain MRI dataset (from the BraTs open database) of 4 scan modals (4 attributes) with 1-flats and reproducing a similar result as shown below.



**NOTE that these results are typically not possible with traditional volume rendering methods with the input multivariate volumes. **

Procedure

1. Watch the demo videos of the exploration of the two datasets.
   Task 1:
2. Open the “data/synthetic.ipcproj” file and change to all occurrences of “YourPath” to your actual absolute path of the folder.
3. Run the interactive tool: “bin/QImprovedContPlots.exe”.
4. Load the project file of the synthetic dataset: “data/synthetic.ipcproj”.
5. Explore the synthetic dataset.
6. Reproduce the classification of the synthetic data shown in the video.
7. Close the tool.
   Task 2:
8. Open the “data/BraTs_T1ceT1T2Flair.ipcproj” file and change to all occurrences of “YourPath” to your actual absolute path of the folder.
9. Run the interactive tool again.
10. Load the project file of the MRI dataset: “data/BraTs_T1ceT1T2Flair.ipcproj”.
11. Explore the MRI dataset.
12. Reproduce the classification of the synthetic data shown in the video.
13. Close the tool.
14. Fill out the questionnaire.

Hints of user interactions in the visualization tool

Some of the interactions cannot be fully shown in the demo video as keys or mouse buttons are not recorded.

1. **Hold “Ctrl”** and drag/draw with the **left mouse button** to create a rectangle/lasso brush.

2. **Left click** a brush to select it and drag it with the left mouse button.
3. For a rectangle brush, left click on its edge or corner to resize it.
4. **Right click** on a transparent circle within a brush to select the opacity gradient control point, and drag it with the right mouse button to fine-tune the size of the opacity gradient within the brush. Note that the opacity function follows a radial gradient, i.e., with the center at the highest opacity and falls to zero at the other control point.
5. When a brush is selected, press "Del" to delete it.
6. ** There is a known bug if you change the opacity to very low that the color becomes black, and you could move the brush very slightly to correct it. **
7. Use "Edit"→"Rendering Configs" to change the sampling rate and querying behaviors. If you feel the tool runs slowly, lower the sampling rate and uncheck the querying options.