Week 4: Surface and volume rendering

Materials

MDSC 689.03 - W2017 Students > Image_Datasets

- Hip.zip → MRI image of the hip. DICOM format.
- Thorax.tar.gz → CT image of the thorax. DICOM format.
- head.nii.tar.gz → MRI image of the head. NIfTI format.

*tar.gz files can be uncompressed in linux using ***tar -xvzf *.tar.gz***
*The WinRAR program can also help to uncompress images in Windows and MacOS.

Assignment

- Choose one or more images available online.
- Segment a relevant tissue (bone and skin are easier to segment).
- Display the **surface** of the segmented result in 3D in your viewer.
- Apply **volume rendering** to the image.
- Display the resulting 3D volume in your viewer.
- **Due on: Next monday at noon. Python files and screen captures must be uploaded to your Dropbox directory.**

Important considerations

- All vtk classes are allowed.
- Remember to check the python vtk examples online (http://www.vtk.org/Wiki/VTK/Examples/Python).
- It is a really good idea to apply a Gaussian filter before obtaining the segmentations for surface rendering, in order to remove some noise. Results can be impressive!
- The vtkImageMarchingCubes class offers an implementation of the Marching Cubes algorithm for surface rendering.
- The vtkDecimatePro class can help you to reduce the number of triangles used in your 3D representation, for faster rendering.
- The vtkVolumeRayCastMapper class offers an implementation of the Ray Casting algorithm for volume rendering.

Bonus

- You can display more than one surface, overlaid, by controlling its transparency.
- Remember that there other algorithms besides Marching Cubes and Ray Casting. Try to find others.
- The Osirix database (http://www.osirix-viewer.com/resources/dicom-image-library/) has many images available online with amazing volume renderings.

Some results

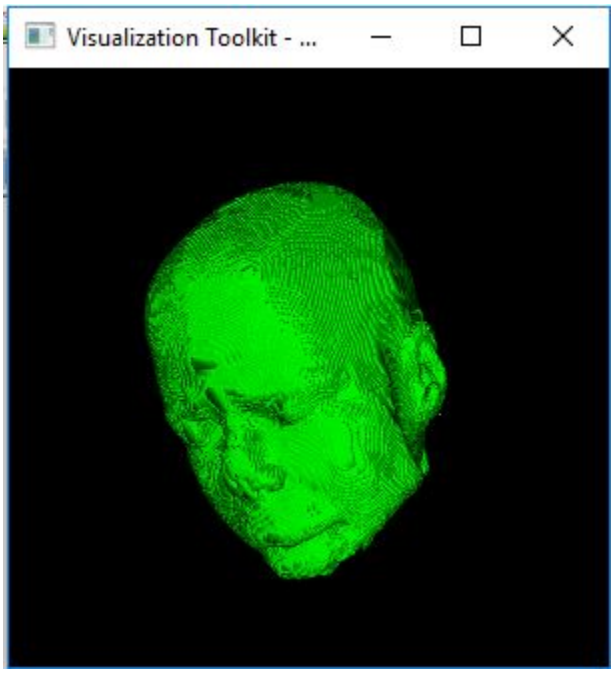

Figure 1. 3D surface rendering of the head.nii binary segmentation, after applying Gaussian smoothing. Lower threshold: 70, upper threshold: 1000.

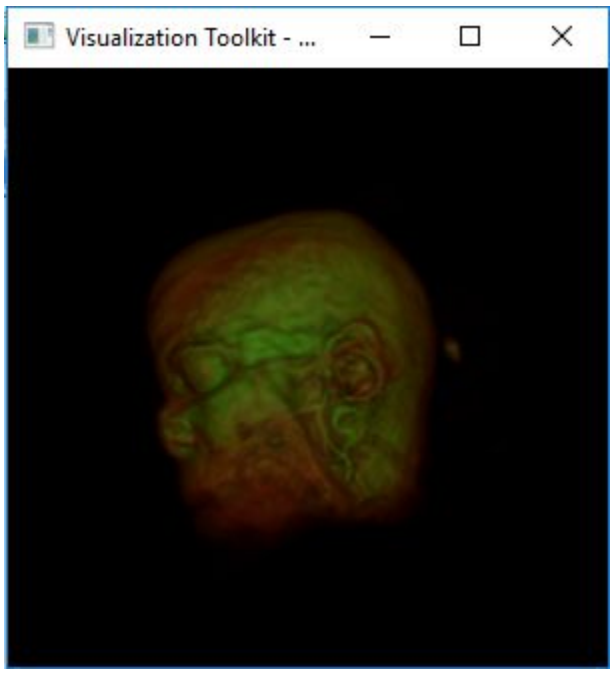

Figure 2. Volume rendering of the head.nii dataset, after applying Gaussian smoothing. Note how skin is red, and internal organs are green. Can you make your volume rendering look like the Osirix visualizations?