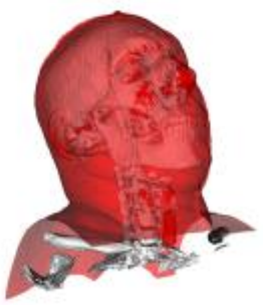
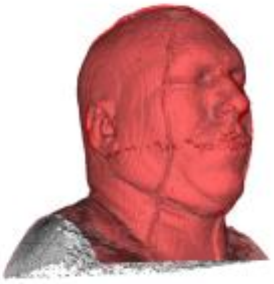
Project #4 Report
Xiangzhen Sun

(1) The original code was translated into python script.

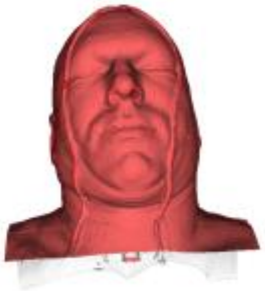
(2,3) In this project, there are two sets of filters, namely contour filters and probe filters. Each has employed SetValue() to set isovalues for bone and skin. In the first step, I modified the isovalues to observe the corresponding changes, as follows:



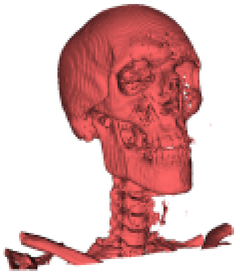
contour_bone.setValue(0,75)
contour_skin.setValue(0,25)



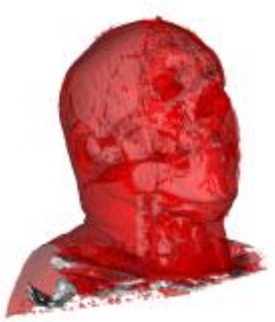
contour_bone.setValue(0,60)
contour_skin.setValue(0,25)



contour_bone.setValue(0,50)
contour_skin.setValue(0,25)

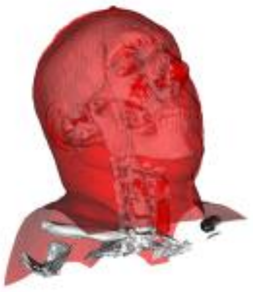


contour_bone.setValue(0,75)
contour_skin.setValue(0,75)

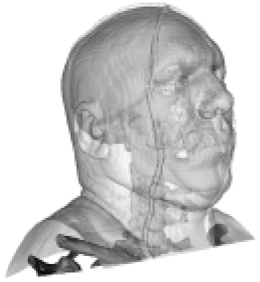


contour_bone.setValue(0,75)
contour_bone.setValue(0,60)

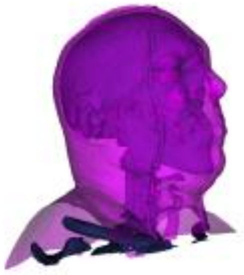
In the second step, it is easier to modifications to isosurfaces by changing color and opacity in the Look-up-Table. We do not change the number of colors and table range here, because it is unnecessary. The color is regulated by hue and saturation, so we change the color by modifying SetHueRange() and SetSaturationRange(), as follows:



original

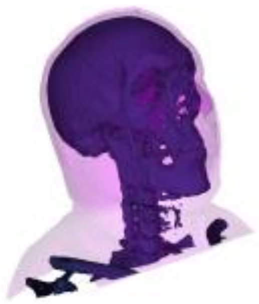


black-white

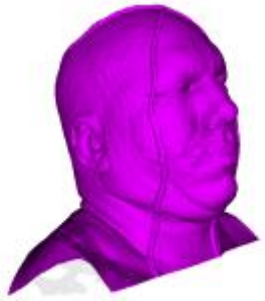


purple-blue

Meanwhile, having realized that the opacity is regulated by a single function SetAlphaRange(), we can test different opacity based on the last-modified visualization result (purple-blue), as follows:



opaque skin + concrete bone



solid skin + opaque bone

(4) In a research to coloring methods in VTK, I found two most common cylindrical-coordinate representations of points in an RGB color model. The first one is “Hue, Saturation, and Luminance” (HSL), and the second one is “Hue, Saturation, and Value” (HSV). Both of these two methods are based on RGB color model. RGB color model is an additive color model in which red, green and blue light are added together in various ways to reproduce a broad array of colors. This method is also used in visualization tool kit. In each cylinder, the angle around the central vertical axis corresponds to "hue", the distance from the axis corresponds to "saturation", and the distance along the axis corresponds to "lightness", "value" or "brightness". Because HSL and HSV are simple transformations of device-dependent RGB models, the physical colors they define depend on the colors of the red, green, and blue primaries of the device or of the particular RGB space, and on the gamma correction used to represent the amounts of those primaries. As a result, each unique RGB device has unique HSL and HSV absolute color spaces to accompany it (just as it has unique RGB absolute color space to accompany it), and the same numerical HSL or HSV values (just as numerical RGB values) may be displayed differently by different devices.

(5) There are basically two filters used in this visualization project. The first one is vtkContourFilter, and the other is vtkProbeFilter.

vtkContourFilter is a filter that takes as input any dataset and generates on output isosurfaces and/or isolines. The exact form of the output depends upon the dimensionality of the input data. Data consisting of 3D cells will generate isosurfaces, data consisting of 2D cells will generate isolines, and data with 1D or 0D cells will generate isopoints.

vtkProbeFilter is a filter that computes point attributes (e.g., scalars, vectors, etc.) at specified point positions. The filter has two inputs: the Input and Source. The Input geometric structure is passed through the filter. The point attributes are computed at the Input point positions by interpolating into the source data. The cell data of the source data is copied to the output based on in which source cell each input point is.

The purpose of our first filter, vtkContourFilter, is to make use of the provided data cell to generate the contour surface. The result was saved in contour_bone and contour_skin separately. All other data was interpolated during the contouring process.

The purpose of our second filter, vtkProbeFilter, is to resample data. The output of the first contour filter was probed, and then volume rendering techniques was used to visualize the results.