SUBJECT CODE: CS 6630
SUBJECT: SCIENTIFIC VISUALIZATION

LEENA KORA
EMAIL:leenak@cs.utah.edu
CADE_ACCOUNT: kora

PART A

Isocontouring With Opacities

FILES USED

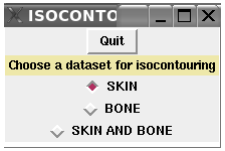
CODE FILE: opacity.tcl
DATA FILES PROVIDED: head.60.vtk head.120.vtk

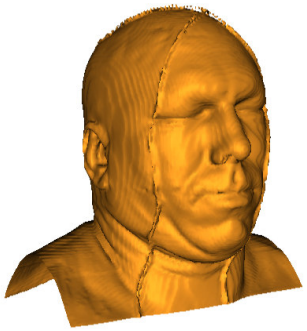
VTK PIPELINE:

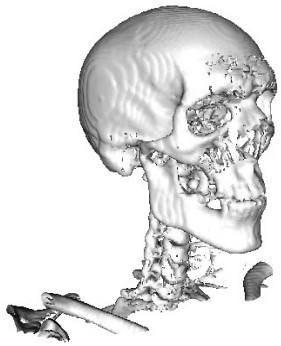
head.120.vtk-->STRUCTUREDPOINTSREADER-->CONTOURFILTER-->POLYDATANORMALS-->STRIPPER--> POLYDATAMAPPER--> ACTOR

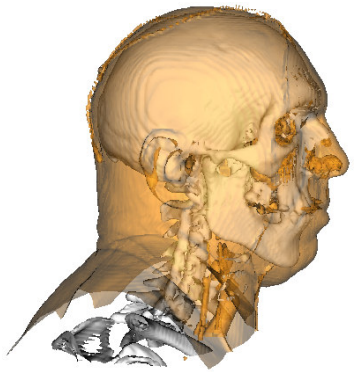
The file provided for visualizing using isosurfaces was head.120.vtk. It was a binary file of a CT scan of a human head, from the Visible Man dataset. Actually, the datasets have been resampled from the original scan, in order to lower the resolution (making it faster to visualize). This file is fed to the vtkStructuredPointsReader filter to read the data. It is then fed to contour filter which extracts the isocontour with specified value. The output is then attached to the vtkPolyDataNormals filter which creates normals for polygonal mesh. Then the pipeline includes vtkStripper which then creates triangle trips from input polygons. The vtkPolyDataMapper is attached to the pipeline which connects to the vtkactor.

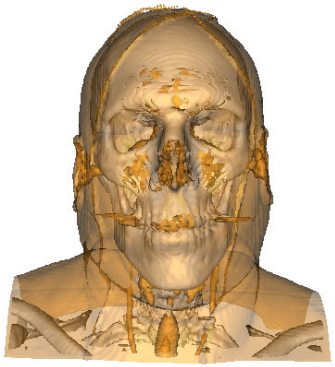
I have provided a gui to switch between skin, bone and transparent skin with opaque bone.











QUESTIONS:

1] Which isosurfaces look the most interesting, and how did you find them?

Ans] I have set isovalue to 50 to extract skin and 77 to bone. I got the skin as the isosurface when I used any value within 40 t0 55. But I found isovalue 50 for skin as the appropriate value as I experimented using different values. I checked many value from 70 to 100 but I found 77 as the best value for bone which was highlighting the inner structure of the head. I have used opacity of 0.5 to skin and 1 to bone. To show both skin and opaque bone i have added two actors to the rendered. I have set the skin color as (0.9300 0.5700 0.1300) using SetColor property of the actor. I have used natural color(white color) for bone. I have used specular color to highlight specular lighting. Following are the snapshots of the my rendered output.

PART B

Isocontouring With Univariate Colormaps And Curvature Volumes

FILES USED

CODE FILE: univariate.tcl
DATA FILES PROVIDED: head.60.vtk head.120.vtk norm.60.vtk norm.120.vtk angle.60.vtk angle.120.vtk

VTK PIPELINE:

head.120.vtk-->STRUCTUREDPOINTSREADER-->CONTOURFILTER-->POLYDATANORMALS-->STRIPPER-->OUTPUT1

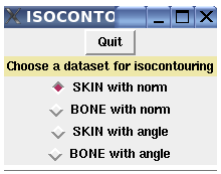
STRUCTUREDPOINTS READER -->OUTPUT2

OUTPUT1+OUTPUT2-->PROBE FILTER--> POLYDATAMAPPER-->ACTOR

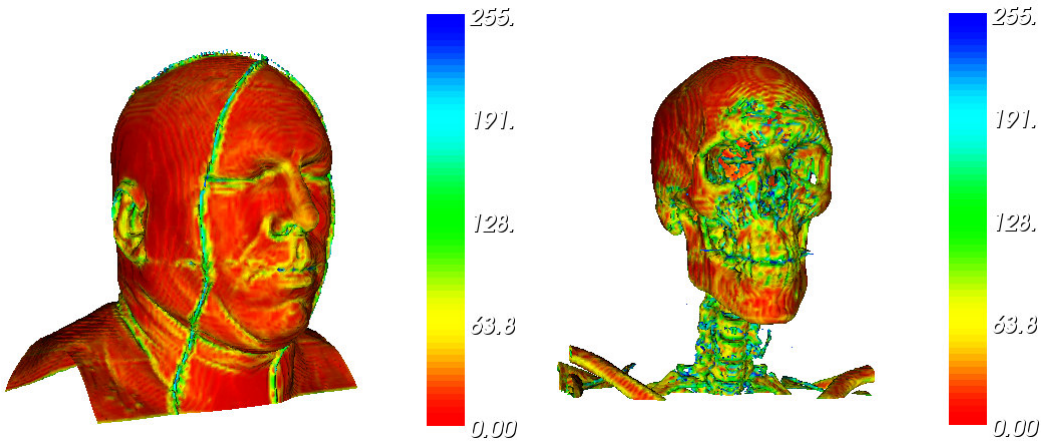
The head.120.vtk is read by the vtkStructuredPointsReader. It is then passed to the vtkContour filter to extract the required surface. Then the output is fed to the vtkPolyDataNormals to create normals which is then connected to the vtkStripper filter which generates output1. The curvature volume(angle/norm) is read by the Structured reader which generates output2. Both output1 and output2 will be fed to the probe filter to probe the input using the source. The probe output is fed to the polydatamapper to map the it using vtkactor.

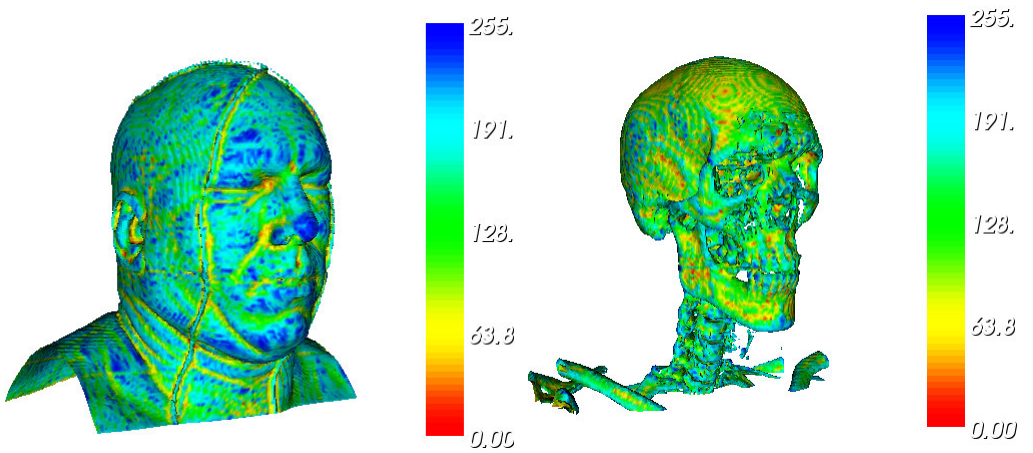
Here I have used HSV colormap and set hue to 0.0-0.667 to get the rainbow colormap. I did set the my colormap to mapper and scalarbar actor to map color to the data.

Following are the snapshot of the output.



The two above images are generated using norm volume and below images are generated using angle volume.





QUESTIONS:

2] Describe how the two values relate to the shape of the isosurface.

Ans] The isosurfaces rendered with norm curvature volume enhances the curved nature of the surface rendered by changing the color. The surface has red or yellow color where there is very slow change of curvature.So the areas like shoulder, head, forehead and on the check have red or yellow. And the surface has green or blue where there is rapid change of curvature which is because of the rapid change of normals over that area. So the areas near neck, nose, eyes and on the thread have green or blue.

The isosurfaces rendered with angle curvature volume enhances the type of the curved surfaces. It maps Different colors to Different shapes of curved surfaces. The concave areas near ear and nose are mapped with red and its adjacent color yellow. The convex areas near nose and eyes are colored with blue. The slightly planar areas are colored with green.

3] What do you think works best, or what are the benefits of the different approaches?

Ans] Both the approaches works well but it depends upon the feature of the dataset we are visualizing. If we are trying to visualize or enhance change in the curvature of the surface, then norm curvature volume would be best and if we are trying to stress the type of curved sufaces if has, then angle data would be the best thing to use.

PART C

Isocontouring With Bivariate Colormaps And Curvature Volumes

FILES USED

CODE FILE: bivariate.tcl
DATA FILES PROVIDED: head.60.vtk head.120.vtk anglenorm.60.6.vtk anglenorm.120.6.vtk anglenorm.60.8.vtk anglenorm.120.8.vtk

VTK PIPELINE:

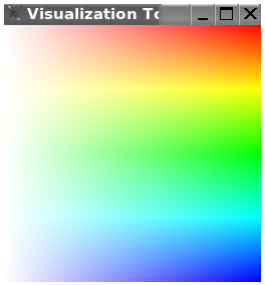
head.120.vtk-->STRUCTUREDPOINTSREADER-->CONTOURFILTER-->POLYDATANORMALS-->STRIPPER-->OUTPUT1

STRUCTUREDPOINTS READER -->IMAGEMAPTOCOLORS-->OUTPUT2

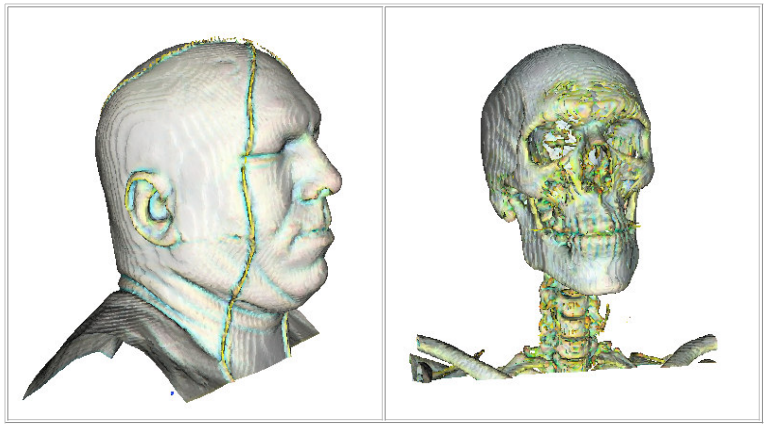
OUTPUT1+OUTPUT2--> POLYDATAMAPPER-->ACTOR

Part C is very similar to the part B. Here we have to use bivariate colormap.The head.120.vtk is sent as input to the vtkStructuredPointsReader filter. It is then passed to the vtkContour filter to extract the required surface. Then the output is connected to the vtkPolyDataNormals to create normals which is then connected to the vtkStripper filter which generates output1. The curvature volume(angle/norm) is read by the Structured reader which is then passed to the vtkImageMapToColors to map the data to colors using the provided bivariate colormap generating output2. Both output1 and output2 will be fed to the probe filter to probe the input using the source. The probe output is then connected to the mapper which then sends the output to the graphics pipeline to render the final output.

Here the bivariate map is set to mapper and ImageMapToColors filter to map colors to the data. The type of colormap i have used is RGB. I have converted the HSV lookup table to RGB using vtkColorTransferFunction filter. The snapshot of the bivariate map is as follows.



The below images are very well showing that the surface is colored white if the change in the curvature is very low. The area near ear, nose in the skin and eyes, nose in the bone are colored with green and blue to enhance curvature change and shape of the curve.



QUESTIONS:

4] What does the color map key say about the curvature at each point?

Ans] The colormap key shows how the point is oriented like whether it is on the curved or plane surface and on what type of curved surface it is on. The norm varies horizontally and angle varies vertically. The norm represents variation in

saturation and angle represents variation in hue. It is clear from the key that when the norm has zero value the angle is meaningless. This means that when the surface is flat then there is no question of what type the curved surface is.