Surface Extractor: Polygonal Surface Extraction

Polygonal surface extraction is the process of converting an object in the voxel-based volume to a representation of the surface of the object, expressed as sets of vertices and polygons. This conversion must optimally extract a representative surface, with as much detail as possible, but do so with as few vertices and polygons as possible. This exercise will use the Adapt/Deform algorithm to perform such an optimal surface extraction. Often this surface extraction is a precursor to using the surface with other applications, such as CAD/CAM modeling, rapid prototyping (model building), and finite element analysis.

1. Load the **MRI_3D_Head.avw** data set from the **$:\BIR\images\TutorialData** directory.
2. Open the **Surface Extractor** module (**Segment > Surface Extractor**).
3. Choose **File > Load Object Map** and load the **MRI_3D_Head.obj** object map.
4. Open the **Extraction Parameters** window (**Generate > Extraction**).
5. Click **Objects** at the top of the Extraction Parameters window (figure 1). In the window returned, leave the **Brain** set to **On** and set all other objects to **Off** (figure 2). Click **Done** to dismiss the window.
6. Create a polygonal surface of the 'Brain' object using the Adapt/Deform algorithm with the default parameters. With the **AdaptDeform** tab selected click **Extract**.
7. A dialog box will be returned stating the number of polygons generated. Note the number of polygons (approximately 37,258), then click Done.
8. To create a rendering of the surface model, choose **Generate > Render**. A surface map will automatically be created for the 'Brain' surface, and the **Surfaces** window returned. The rendering will be displayed in the main Surface Extractor window (figure 3).
9. In the Extraction Parameters window change the **Cube Edge Size** to **5** and rebuild the surface by clicking **Extract**. Note, the number of polygons generated (approximately 12,261), then click **Done**.
10. Choose **Generate > Render** to view the extracted surface with the new parameters (figure 4). Increasing the 'Cube Edge Size' will smooth the surface, reducing the number of voxels considered when generating the initial surface estimate, which reduces the polygon count.

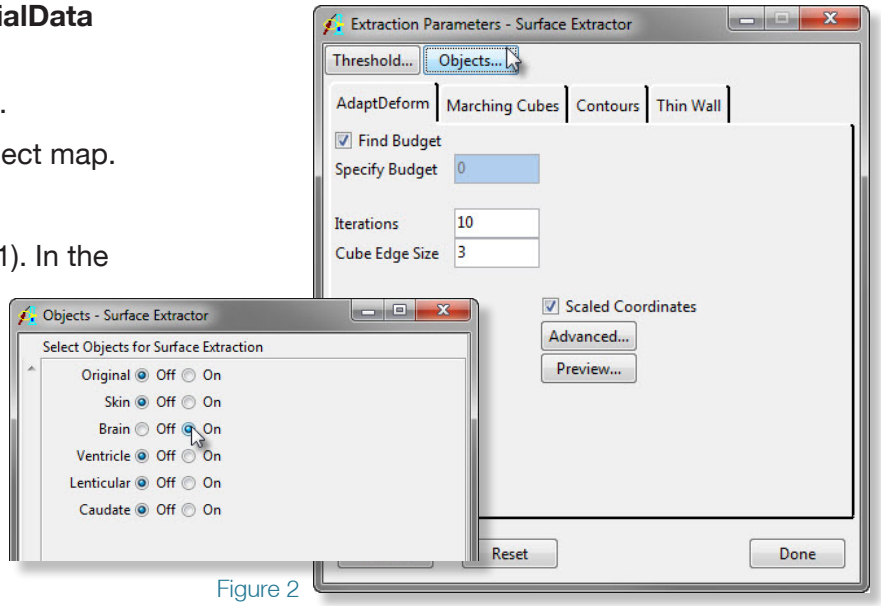

Figure 2

Figure 1

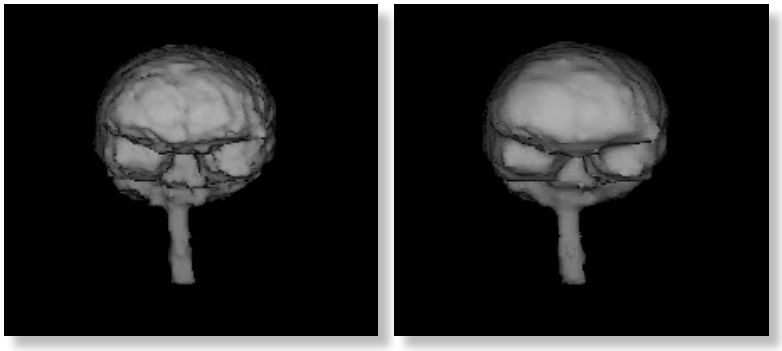

Figure 3

Figure 4

Surface Extractor: Polygonal Surface Extraction

11. Click **Reset** in the Extraction Parameters window to restore the default parameters (‘Cube Edge Size’ of 3).
12. Click **Advanced** and change the **Time Step** to **0.5**. Click **Done** to dismiss the window.
13. Rebuild the surface by clicking **Extract** in the Extraction Parameters window. Note the number of polygons generated (approximately 37,258), then click **Done**.
14. Choose **Generate > Render** to view the extracted surface with the new parameters. Increasing the ‘Time Step’ causes the surface extraction to reach equilibrium faster, producing a smoother surface without altering the polygon count. When the opposite changes are made, the surface will conform to the voxel surface better, resulting in a rougher, more “voxelated” surface.
15. **Decreasing** the **Surface Force** and increasing the **Spring Constant** (also ‘Advanced’ options) smooths the surface without altering the polygonal count by forcing the polygons to bridge small variations in the voxel surface (the polygons’ attraction to the surface is reduced and they become harder to bend).
16. Choose **File > Save Surface > To File** to save the extracted surface to disk.
17. In the Save Surface window returned (figure 6) you can select from the following surface description formats in the **Format** drop-down menu: Alias (.obj), Autocad (.dxf), Compressed Iges (.iges), Iges (.iges), Inventor (.iv), Patran (.out), Ply(.ply) Poly (.poly), 3D Systems (.stl), Binary 3D Systems (.stl), Vrml (.wrl).
18. Close the Surface Extractor module. To learn about extracting the surface of a binary data set, complete the following Additional Task.

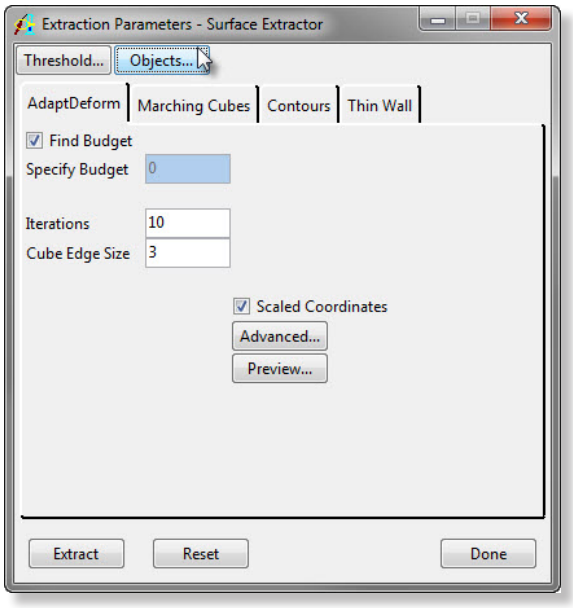

Figure 5

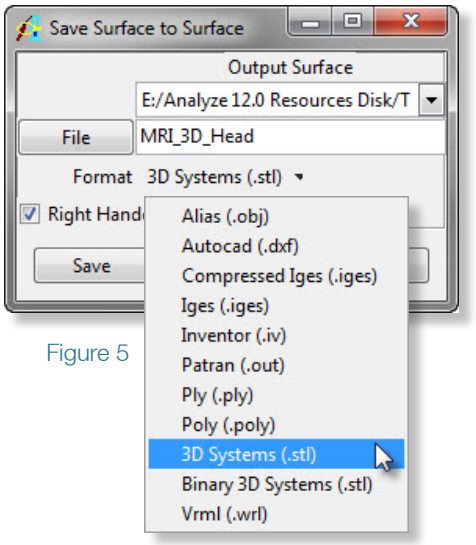

Figure 5

Surface Extractor: *Extracting a Binary Data Set*

1. Load the **MRI_3D_Brain_Bin.avw** data set from the **$:\BIR\images\TutorialData** directory.
2. Open the **Surface Extractor** module (**Segment > Surface Extractor**).
3. Open the **Extraction Parameters** window (**Generate > Extraction**).
4. With the **AdaptDeform** algorithm tab selected, click **Extract**.
5. Note the number of polygons generated (approximately 37,504) and choose **Generate > Render** to view the extracted surface (figure 1).
6. Close the Surface Extractor module before proceeding to the next exercise.

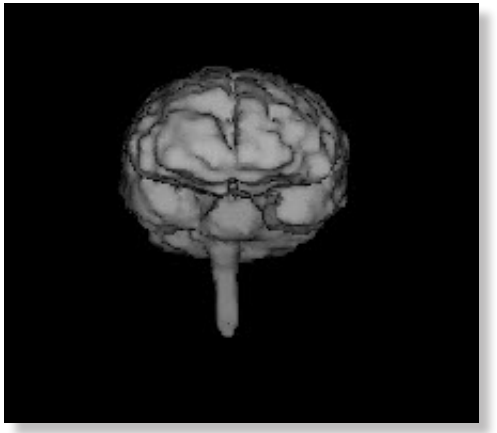

Figure 5

Supported Surface File Formats

Polygonal Formats

Alias Wavefront	(.obj) Read and Write
Autocad	(.dxf) Read and Write
IGES	(.iges) Write only
Compressed IGES	(.iges) Write only
Inventor	(.iv) Write only
Patran	(.out) Write only
Poly	(.poly) Read and Write
Binary 3D Systems	(.stl) Raad and Write
VRML	(.wrl) Write only

Contour Formats

HP 3D	(.hpgl) Write only
IGES	(.iges) Write only
Compressed IGES	(.iges) Write only
Pogo	(.slc) Read and Write
3D Systems Stereolithography	(.slc) Read and Write
ASCII Columns	(.txt) Read and Write