

Web-based Interactive Volume Rendering of the Visible Human Female
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A Web-based viewer, iVoxel, has been created for navigation through the Visible Human dataset. The viewer's intended usage is for Anatomy education and training. The iVoxel viewer is divided by function into three unique modules; the "Volume View" module (for volume rendered scenes), the "Model View" module (display of and interaction with anatomical models), and the "Slice View" module (2D slices through the dataset). Modules may be used individually or in combination as either stand-alone applications or embedded within Web pages. Modules support both mono (figs. 1, 2 & 4) and stereo viewing (fig. 3).

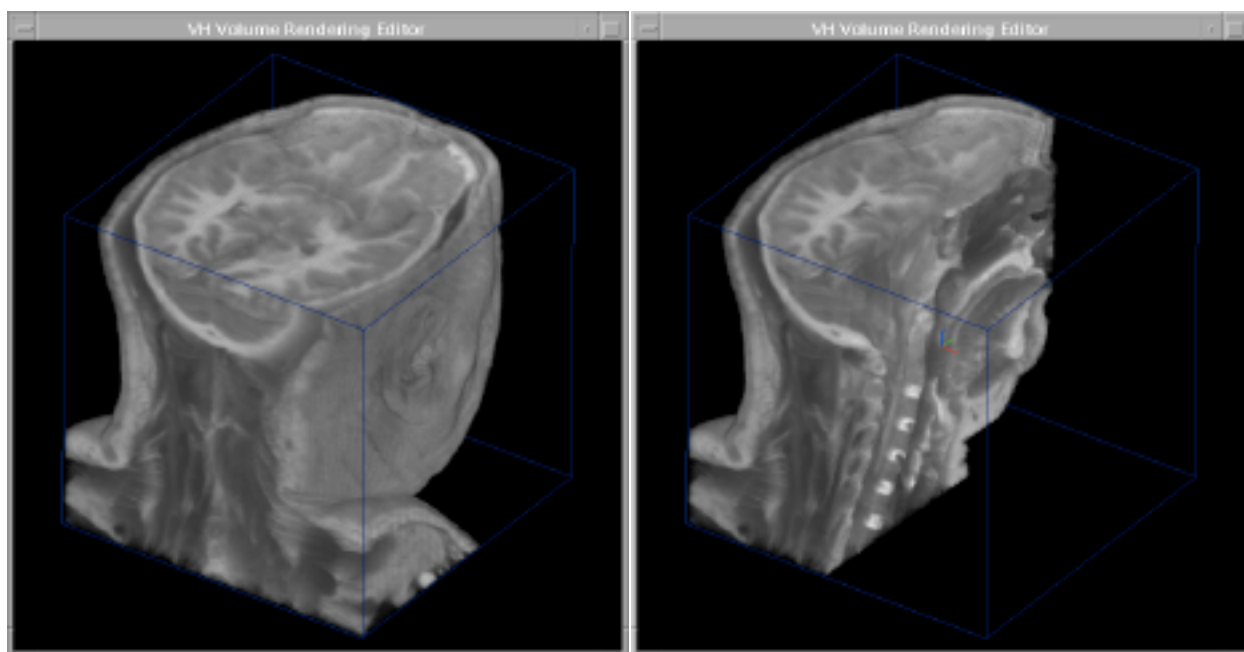
iVoxel's Volume View module is used to "volume render" the scene with or without the addition of arbitrary clip planes (figs. 1 & 2). Combinations of clip planes affords the user a volume rendered view of regions-of-interest within the dataset. Clip planes are interactive and under user control via the mouse for rotation and translation.

iVoxel's Model View module supports the asynchronous downloading, caching, and display of multi-resolution models. Using a set of models at different resolutions, iVoxel supports a "Level of Detail" display system that selects a model at an appropriate resolution for its distance from the viewer. With this system, the viewer always sees the highest fidelity data when close to the model. The "Level of Detail" system improves rendering performance by reducing the scene's total triangle count while always displaying the best view possible (fig. 4). The Model View module also allows for spline based animations through the scene. The viewer is animated along a predetermined flight path.

The Slice View module requests voxel data from the Pittsburgh Supercomputing Center server. Asynchronous downloading and caching of multi-resolution streams is supported. Slice images are constructed on-the-fly from the highest resolution data available. As the slice plane is moved through the volume, image updates use a combination of cached and newly requested data as necessary.

The iVoxel module set is available for UNIX/Linux and Windows platforms. A Mac version will be available soon.

Future enhancements to iVoxel include the addition of a label display system. Currently, anatomical labels will be stored as curves. To display these, iVoxel will need to interpret these curves and correctly draw the label they represent in the scene.



Figures 1 and 2: iVoxel's Volume View module without (left) and with (right) the addition of an arbitrary clip plane through the volume. Volume data is from the Visible Human Female dataset.

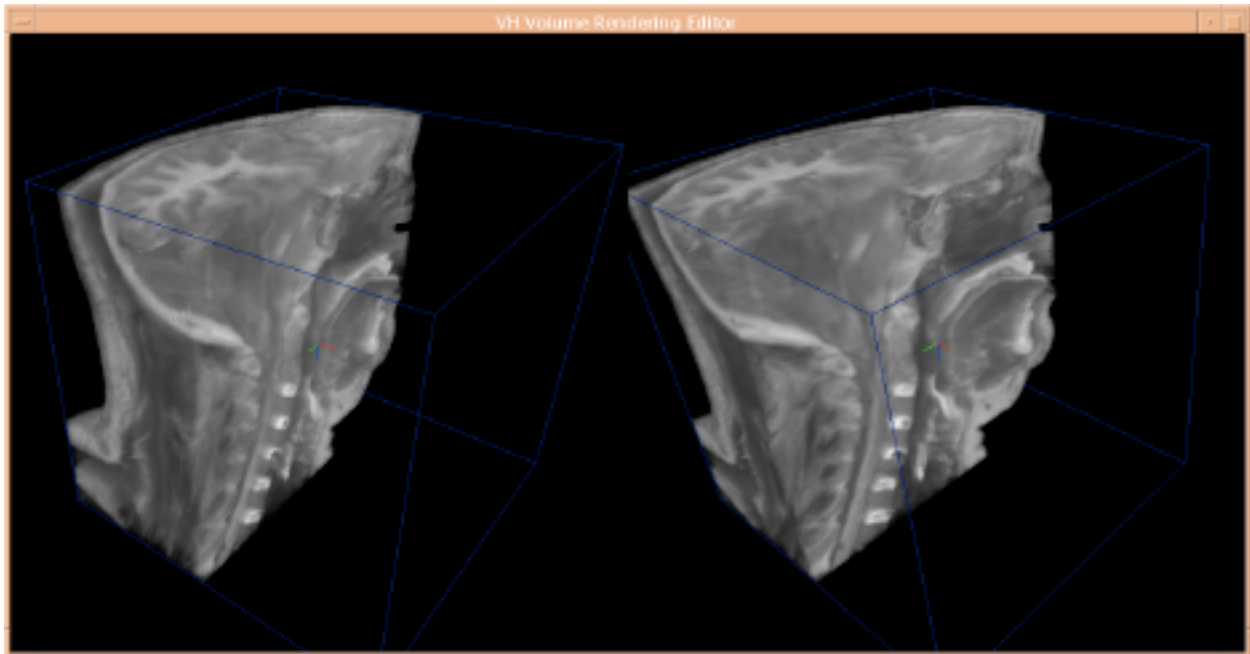


Figure 3: Stereo view of iVoxel's Volume View module. The figure shows a left-eye and right-eye view of the dataset. Views can be merged for use with stereo goggle systems or used independently for use in other novel stereo display devices. Volume data is from the Visible Human Female.

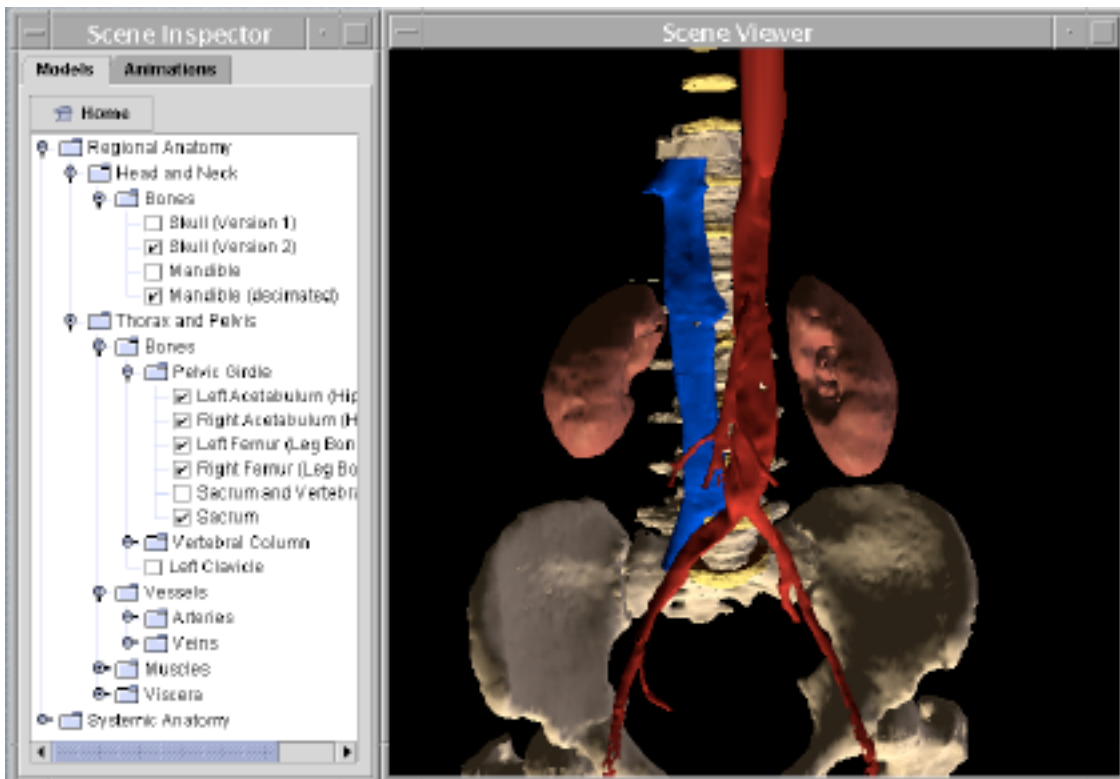


Figure 4: iVoxel's Model View module showing a rendered scene with various models and lights. Models are loaded from the web, cached, and toggled on or off via the selection mechanism on the left. Fly through animations along a predetermined path are supported.