volview: A S-Lang Guilet For Volume Visualization Reference Manual, Version 0.1.0

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Preface

Volview is an extension module which adds volume visulization
capability to the S-Lang interpreter, using the Gtk widget set
and volpack rendering library.

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Chapter 1

Introduction

`volview` is an extension module which adds volume visulization capability to the S-Lang interpreter, using the `volpack` rendering library and Gtk widget set (see http://graphics.stanford.edu/software/volpack/ and http://www.gtk.org/). Like VWhere (http://arxiv.org/abs/astro-ph/0412003), `volview` is also an example of the notion of a *guilet* (pronounced "gooey-let"), by which we mean to connote visual interfaces of a small-ish, scriptable nature, that may be easily embedded within – and launched from – other programs, even applications with interactive command lines and no ostensible graphical interface. For example, `volview` is frequently used in ISIS (http://space.mit.edu/cxc/isis/), our platform for robust, high-performance astrophysical analysis and modeling, whose main interface is an interactive `Matlab`(tm)-style command line prompt. Guilets fill an important software niche, the middle ground between novice users – who often argue that visual interfaces make software easier to use – and power users – who frequently complain that GUIs are more cumbersome and inflexible than command lines. Experience suggests that the code size and development cycle of the typical guilet is considerably smaller than that of traditional, monolithic GUIs (by which we mean to connote applications coded from scratch to have only a visual interface, typically utilizing a compiled language in conjunction with lower-level toolkits such as Xt, Motif, or the Microsoft's Windows Foundation Classes). Moreover, given their scripting heritage, guilets can be more amenable to changing requirements or ad-hoc experimentation and customization by the end-user. This is especially important in the scientific and engineering research arenas.

1.1 Building

`volview` ships with a configure script generated by autoconf, and in most cases can be built by issuing the following standard commands within a UNIX-like (e.g. Linux or Cygwin) environment:

```
./configure [options]
make
make install
```

Beyond S-Lang itself, `volview` has three explicit dependencies: SLIRP, `volpack`, and SLgtk. The latter two of these, if not present on your system, may be automatically downloaded from our site and installed on your system by using the `--enable-download` configure option. Issue a `./configure`

`--help` command for more information. `volview` can be loaded at runtime into any suitably configured application which embeds the S-Lang interpreter, using either

```
require("volview");
```

or

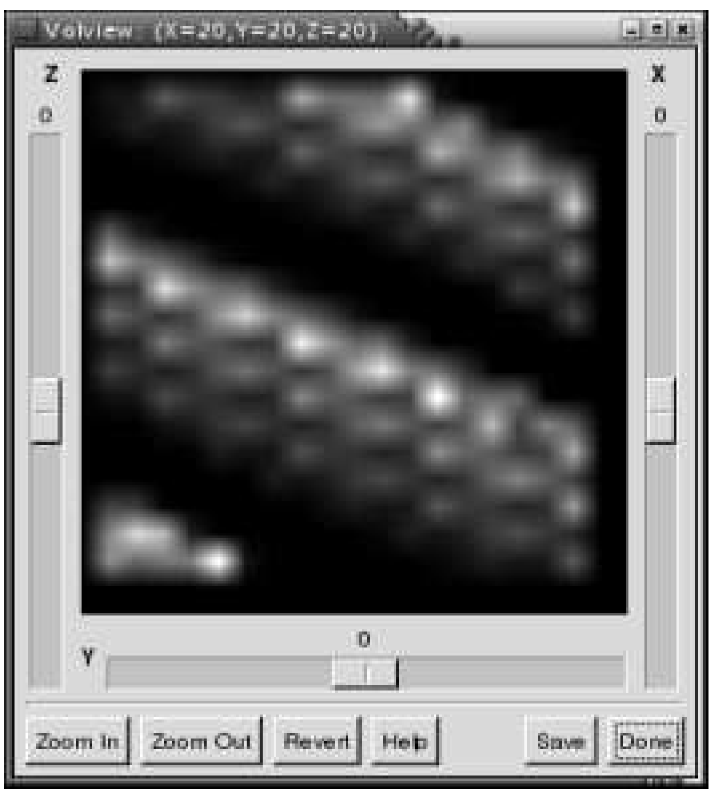
```
() = evalfile("volview");
```

1.2 Examples

Volumes are visualized from arrays, of either 3 or 4 dimensions, none of which may be zero in length. When a 4D array is given the first element is selected as the 3D volume to be visualized (using a 4D array to perform a 3D slideshow will be supported in the near future). For example, this statement sequence

```
variable volume = tan([1:8000]);
reshape(volume,[20,20,20]);
volview(volume);
```

yields



Since volumes are just arrays they may be read from virtually any source. For example, consider a classic brain MRI scan example, stored in HDF5 format and read using the `slh5` module:

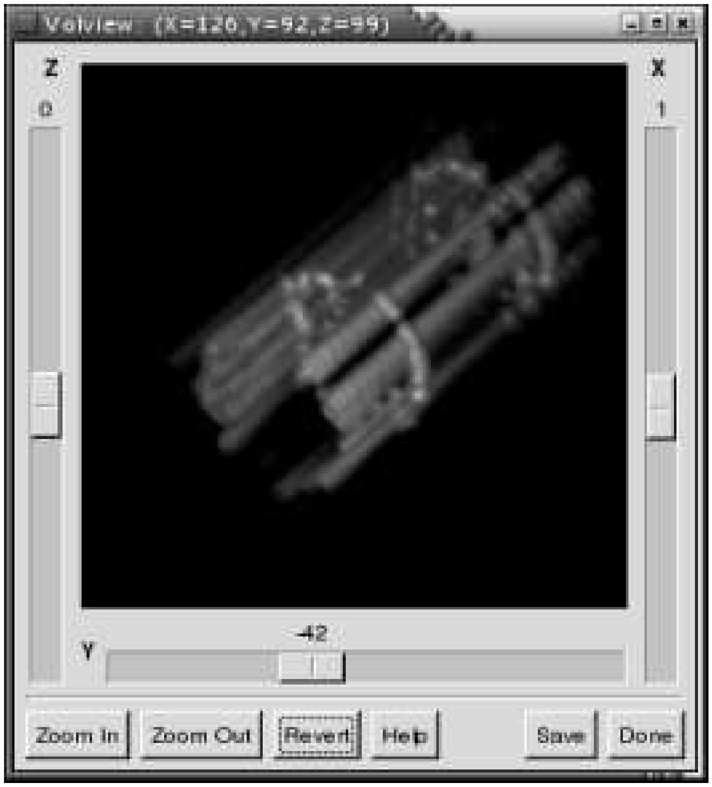
```
require("h5");
volview( h5_read("brain.h5"));
```

Here the HDF5 file was converted from a "raw volume" format used by `volpack` (representing an MRI scan of a human head, derived from public domain data provided by SoftLab at UNC Chapel Hill).

Our final example is drawn from astronomy, and utilizes a spectral cube in the FITS file format, generated by CUBISM (http://ssc.spitzer.caltech.edu/archanaly/contributed/cubism) from Spitzer observation 3310 of the Cassiopeia A supernova remnant and graciously provided by Dr. Tracey Delaney. The visual is useful because many popular astronomical visualization tools only support visualizing 2D slices of 3D images, which does not reveal interesting structure in the 3rd dimension (e.g. here wavelength). By visualizing the entire volume as a single array

```
require("fits");
volview( fits_read_image("casa_ll2_s12.fits") );
```

we see instantly the clumpy areas which correspond to areas of strong emission:


Volview (X=126,Y=92,Z=99)
Z
X
Y
-42
Zoom In
Zoom Out
Revert
Help
Save
Done

Chapter 2

Command Reference

```
volview

 SYNOPSIS
   Display a 3D volume array within a graphical user interface

 USAGE
   volview(3D_or_4D_volume_array)

 DESCRIPTION
   This function will launch a GUI in which the given volume will be
   displayed.  From there the volume may be rotated along any axis,
   zoomed in or out, or saved to a variety of output file formats.

   Right-clicking on the image after rendering will launch a menu from
   which rendering parameters (e.g. colormap, opacity) may be modified.

 NOTES
   The input array may have either 3 or 4 dimensions, none of which may
   be zero in length.  When a 4D array is given the first element is
   selected as the 3D volume to be visualized.

 SEE ALSO
   volpack, SLgtk
--------------------------------------------------------------
```