Infrastructure

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Infrastructure
Translational Software

Image & Data acquisition → Image Processing → Geometry Processing → Simulation & Validation → Visualization → Application

Application Framework

Core Functionality

User support
Project Management
Specific Aims

1- Consistent data flow pipeline between applications
2- Common look and feel of Center software
3- Open source data management
4- Comprehensive systematic software process
Developer Team

Ayla Khan  Dan White  Ally Warner

Chris Bright  Jonathan Bronson  New Hire
Seg3D

New: Qt 5, implicit models

Next: better implicit models, more tools
FluoRender

New: Time series support

Next: Large numbers of channels support, segmentation in the renderer
ShapeWorks

New: Stability and UI updates, new isosurface algorithm

Next: Stability for thin features
Cleaver

New: ITK preprocessing, UI and rendering updates

Next: Jonathan to work out some problems
New: InterfaceWithPython module, Python interface core finished, Completely headless

Next: Subnets, more vis options
map3d

New: Moving mesh support

Next: Larger mesh support
ImageVis3D

New: Stability and usability with mobile apps

Next: New desktop version


Fig. 4 K9-1 dataset. Single value, sequential color mapping of mean value (left) and standard deviation (right).

Dimensions were above (red) or below (blue) the isovalue. The remaining points are colored using a sequential color map (orange to blue-green) which partially indicates how many dimensions fall above or below the isovalue. An example is seen in Figure 3, right.

Fig. 5 K9-1 dataset. K-means clustering applied to the data using the L2-norm (left) and Pearson correlation coefficient (right) as distance metrics.

Coloring by Clustering: Clustering can reduce the set of data under investigation by grouping similar data together, such as points that respond similarly to variations in initial conditions. As points are placed into clusters, they are colored using a categorical color map. A collection of histograms showing the mean of each cluster is placed to the right.

We use k-means clustering [33] to exploring this space. We employ multiple distance metrics for comparing the underlying PDFs. The L2-norm (Figure 5 left) groups points that are similar in a Euclidean sense and is defined by

\[
d(X, Y) = \sqrt{\sum (x_i - y_i)^2}
\]

New: python port

Next: new algorithms
Figure 1: (a) Linked 3D view of number of patient outcomes at each voxel for Bradykinesia efficacy in DBS. Picked voxel and histogram of patient scores are shown in the right panel for the selected voxel at the white spherical glyph. (b) Linked 3D view of mean UPDRS for Bradykinesia with parallel coordinates. The parallel coordinates show patient scores for all loaded data sets. 3D view shows the VTA along with the subthalamic (STN) nucleus. The tool allows for any of the nuclei to be loaded for reference to targeted stimulation areas by clinicians.

Figure 2: Modeless dialog allowing user to select statistic to be displayed in the 3D view. The user may also adjust picking opacity, and the location of the x, y, or z aligned clipping planes. Selected voxel is then shown in the histogram view. This provides a user the ability to drill-down into the data by pinpointing where in the VTA they wish to see the patient results.

Parallel Coordinates View: Parallel coordinates are an alternative way to explore the high-dimensional space of the data. We supply a parallel coordinates interface where each dimension represents a single patient. The values for each patient correspond to their UPDRS outcome and are colored by the dataset / clinical measurement. This allows the user to gain an overview of patient outcomes across the loaded datasets. For example, in Fig. 1(b), there are six datasets simultaneously loaded and displayed in the parallel coordinates view.

3.2. Transfer Functions for Uncertain Voxels
Because of the complexity of the data, we have adopted a number of transfer functions to color the data, each designed to aid understanding in a unique way.

Value-based Coloring: Each statistic's range of values is mapped automatically by the tool, such that the minimum value is assigned to blue, the mean value to green, and the maximum value to red. For transfer functions that are intended to allow the user to find given ranges of values in a particular statistic, opacity is initially set to fully opaque. The user can adjust any points in the transfer function. The transfer functions use piecewise-hermite functions to allow interpolation between points set by either the user or the tool itself.

Value-based Opacity: For the mean, maximum, minimum, and number of patients, we also provide opacity mapping via the tool. An example of this can be seen in Fig. 3. We normalize the opacities of each voxel based as a fraction of each voxel’s own variance divided by the maximum variance from the data set. The variance is taken from the UPDRS scores. The lesser the variance in UPDRS score, the greater the applied opacity of the voxel is.

Figure 3: A transfer function for the maximum value statistic whose opacity is scaled based on the variance of the UPDRS scores at each voxel.

4. Preliminary Results
Our results were obtained from code written in Python and Pvtkpython [1]. We used data from computational models to analyze 39 PD patients who received unilateral DBS, 22 in globus

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New: Rendering and stability improvements
Next: New uncertainty techniques
Can we integrate medical imaging and clinical data to improve patient outcomes?

Database Summary

Neuromodulation Registry

Experimental Data and Geometric Analysis Repository

Mouse Atlas Database
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Looking for tools that can

Multi-level/resolution

Establish calendars/due dates

Check for problems tasks
Possible Tools

Are there any favorite tools?