View3D Toolbox

VIEW3D GUI for interactive viewing of 3D volumes

Hover with the mouse over the different GUI elements for additional tips.

INPUT

This tool is for viewing axis-aligned slices of 3D arrays (volumes)

Each voxel in the 3D volume can be a

- (i) scalar e.g. MRI
- (ii) color e.g. RGB
- (iii) vector e.g. dynamic PET, or
- (iv) tensor e.g. diffusion tensor MRI (2nd order, rank 3).

In the top editbox type a MATLAB expression that generates a 3D scalar, color, vector, or tensor field, then press the "display" button. You can also type a valid workspace variable name. The variable must be be of size, either: X*Y*Z (scalar field), X*Y*Z*3 (colour field), X*Y*Z*N (general vector field), or X*Y*Z*3*3 (tensor field). Several sample expressions are available from the drop-down list. You can choose one and then press "display".

VIEW PANELS

The 3 views or axes (all except the lower-right one) display the axis-aligned slices (XY, YZ, and XZ planes). Use the scroll bars under the slice views to change the selected slice. Clicking (and optionally dragging) the mouse on any of these 3 view will result in synchronized viewing (i.e. the two other views will update to match the clicked location) Use the checkboxes under the slice views to change the image as follows

- transpose: transpose (rotate) the image (rows <--> columns)
- v-flip: flip vertically (up <--> down)
- h-flip: flip horizontally (left <--> rigth)

3D VIEW PANEL

The lower-right view or axis is a 3D view that shows the slices in 3D context. Press "update 3D" to activate or refresh this view. Check the "auto" checkbox so that the 3D view is automatically updated. Check the "rotate" checkbox to be able to rotate the view with the mouse. Only slices that have the "3D" checkbox selected will be displayed in 3D view.

The 3D view is also used to display an isosurface: choose an iso-intensity value via the slider then press the "isosurf" button.

Check "auto" checkbox in the 3D view to obtain an automatic update of the 3D view of the slices and isosurface. Note: this may degrade performance. Click "erase" to clear the 3D view. This can improve performance. You can also improve 3D view perforamce by sub- or down-sampling the volume (only for 3D viewing). For example, the subsampling factors: [2],[2],[2] will sub-sample the volume to 1/8, i.e. 1/2 along the first, second, and third spatial dimensions.

VIEW SETTINGS

Voxel size: Enter the (relative) values of the voxel dimensions. For example, if the voxel size is 2 mm x 1 mm x 0.5 mm, you can enter: [4],[2],[1]. Then press the "set" to display the slices in the proper aspect ratio.

Intensity mapping: Use these two scroll-bars to control the intensity (grey-level) value that is used to display the minimum and the maximum values in the volume. Linear mapping is used for values in-between.

Vector-field: Controls how vector-fields will be displayed:

- max: display the maximum of the vector at each pixel
- avg: display the average of the vector at each pixel
- color: displays the 3 channels as RGB color (works only for three-channel vector-fields).
- channel: display a particular element in the vector. Use the slider or the editbox to set the index of the channel.
- loop: displays all channels one after the other with a delay specified in seconds.

Tensor-field: Controls how to display 2nd order rank 3 tensors (3x3 positive semi-definite array at every voxel):

- Use the edit box to enter an expression using the eigenvalues of the tensor, e1, e2, and e3, e.g. (e1+e2+e3)/3.
- Use the preset display options to view the diffusion tensor coefficients: MD, RD, AD, FA, RA, Cl, Cp, Cs, Ca, VR.
    - MD: mean diffusivity
    - RD: radial diffusivity
    - AD: axial diffusivity
    - FA: fractional anisotropy
    - RA: relative anisotropy
    - Cl: linear measure
    - Cp: planar measure
    - Cs: spherical measure
    - Ca: anisotropy measure
    - VR: volume ratio
- Note that all the display options under the vector-field panel can also be used for displaying a tesnor field, which will be treated as a 6-channel vector-field.
- Also please note that the Tensor image volume input format must be X-Y-Z-3-3. Therefore every voxel of the volume is a 3 by 3 matrix.

CREDITS AND CONTACTS

- Ghassan Hamarneh: Original View3D developer (1999-2013). Ideas for improving View3D to its current state. Supervision and assistant developer.
- Hossein Badakhshannoory: Main developer of improved View3D (2012-2013)
- Brian G. Booth: Assistance in developing tensor field modules (2012-2013)

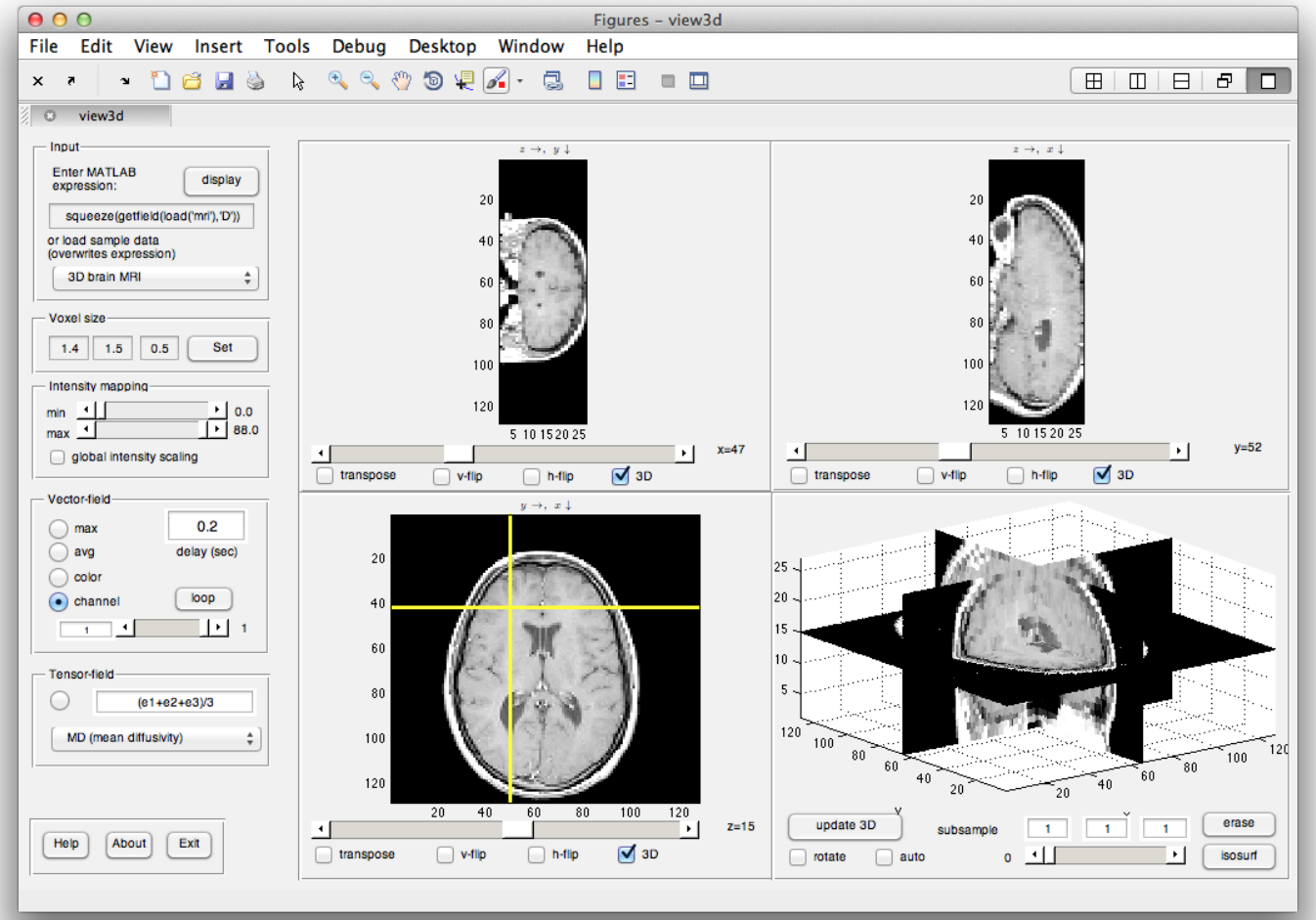
Send your feedback to: hamarneh@sfu.ca

SEE ALSO

SLICE, MONTAGE, ISOSURFACE

Software webpage http://www.cs.sfu.ca/~hamarneh/software/view3d/

See snapshot next page.


Figures - view3d
File Edit View Insert Tools Debug Desktop Window Help
view3d
Input
Enter MATLAB expression:
display
squeeze(getfield(load('mri'),'D'))
or load sample data (overwrites expression)
3D brain MRI
Voxel size
1.4 1.5 0.5 Set
Intensity mapping
min 0.0
max 88.0
global intensity scaling
Vector-field
max
avg
color
channel
0.2
delay (sec)
loop
Tensor-field
(e1+e2+e3)/3
MD (mean diffusivity)
Help About Exit
x=47
y=52
z=15
transpose v-flip h-flip 3D
update 3D
subsample
erase
rotate auto
isosurf