Roundup of Useful AFNI Programs and Plugins

• Dataset Creation and Conversion
  to3d             Read image files, write AFNI format datasets
  3dAFNIto3D      Convert AFNI format dataset to .3D format (ASCII lists)
  3dAFNItoANALYZE Convert AFNI format dataset to ANALYZE format
  3dAFNItoMINC    Convert AFNI format dataset to MINC format
  3dANALYZEtoAFNI Convert ANALYZE format dataset to AFNI format
  3dMINCtoAFNI    Convert MINC format dataset to AFNI format
  3dThreetoRGB    Convert 3 scalar datasets to 1 RGB AFNI format dataset

• Auxiliary Programs for Dataset Creation from Images
  Ifile            Read GE realtime EPI files and runs to3d
  Imon             Read GE realtime EPI files as they are created
  Dimon            Read DICOM files on disk or as they are created
  rtfeedme        Dissect one dataset, sends images to AFNI realtime plugin
  plugin: RT Options Control options for AFNI realtime image input
  from3d          Write dataset slices into image files
  abut            Create zero-filled slices to put into dataset gaps

• Quality Checks for 3D+time Datasets
  3dToutcount      Check voxel time series for quality (temporal outliers)
  3dTqual         Check dataset sub-bricks for quality (spatial outliers)
• 3D+time Pre-Processing Programs
  3DTshift Shift slices to a common time origin (temporal interpolation)
  3dDespike Remove spikes from voxel time series
  3dDetrend Remove trends from voxel time series
  3DFourier FFT-based lowpass and highpass filtering
  3dTsmooth Smooth time series in the time domain

• 3D+time Analysis Programs
  3dDeconvolve Multiple linear regression and deconvolution
  3dSynthesize Compute 3d+time dataset from partial model
    plugin: Deconvolution Interactive deconvolution
  3ddelay Single regressor linear analysis with time shifting
  3dNLfim Nonlinear regression
    plugin: Nlfit & Nlerr Interactive nonlinear regression
  3dTcorrelate Correlate two input datasets, voxel-by-voxel
  3dAutoTcorrelate Correlate each voxel with every other voxel
  3dpc Principal component analysis

• Model 1D Time Series Generators
  sqwave Generate a square wave (a very old program)
  waver Generate hemodynamic responses to stimulus time series
• Dataset Histogram and Segmentation Programs
  3dAnhist Create and plot histogram of dataset, print peaks
  3dhistog Create histogram of dataset to a file
  plugin: Histogram Interactively graphs histogram of a dataset (or ROI)
  plugin: ScatterPlot Interactively graphs 1 sub-brick vs. another (or ROI)
  3dClipLevel Find value to threshold off outside-the-brain voxels
  3dUniformize Correct T1-weighted dataset for non-uniform histogram
  3dIntracranial Strip off outside-the-brain voxels
  3dSkullStrip Enhanced skull stripping
  plugin: Gyrus Finder Interactively segment gray and white matter

• Group Dataset Statistical Analysis Programs
  3dttest Paired and unpaired t-tests
  3dANOVA 1-way ANOVA (fixed effects)
  3dANOVA2 2-way ANOVA (fixed, random, mixed effects)
  3dANOVA3 3-way ANOVA (fixed, random, mixed effects)
  GroupAna n-way (1-5) ANOVA (MatLab script)
  3dFriedman Nonparametric Friedman test
  3dKruskalWallis Nonparametric Kruskal-Wallis test
  3dWilcoxon Nonparametric Wilcoxon test
  3dMannWhitney Nonparametric 3dMannWhitney test
  3dRegAna Voxel-wise linear regression analyses
  3dFDR False Discovery Rate analysis
  3dClustSim Monte Carlo simulation for multiple comparison correction
  1dSEM Structural Equation Modeling (path analysis)
• Programs for Manipulating Information in the Dataset Header
  3dinfo       Print out information from the header
  3dAttribute  Print out a single header attribute
  3dnewid      Assign a new ID code to a dataset
  3drefit      Lets you change attributes in a dataset header
  3dNotes      Lets you put text notes into a dataset header

plugin: Dataset NOTES     Interactive header notes editor
nifti_tool      Displays, modifies, copies nifti structures in datasets

• Programs for Changing Dataset Spatial Structure
  3daxialize    Rewrite dataset with slices in different direction
  3dresample    Rewrite dataset in new orientation, with new voxel size
  3dLRflip     Flip dataset Left ↔ Right

• Programs for Assembling Sub-bricks into 4D Datasets
  3dTcat        Assemble a 3D+time dataset from multiple input sub-bricks
  3dbucket     Assemble a bucket dataset from multiple input sub-bricks

• Programs for Changing Slice Structure
  3dZcat        Glue multiple sub-bricks together along the z-axis
  3dZcutup      Cut slices out of a dataset to make a ‘thinner’ dataset
  3dZeropad     Add zero slices around the edges of a dataset
  3dZregrid     Interpolate a dataset to a different slice thickness
• **Spatial Transformations of Dataset Geometry**

<table>
<thead>
<tr>
<th>Command</th>
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<tbody>
<tr>
<td>3drotate</td>
<td>Rigid body rotation of dataset in 3D</td>
</tr>
<tr>
<td>3dWarp</td>
<td>Non-rigid transformation of 3D coordinates</td>
</tr>
<tr>
<td>3dAnatNudge</td>
<td>Try to align EPI and structural volumes automatically</td>
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</tbody>
</table>
  
  **Plugin:** Nudge Dataset  
  Align EPI and structural volumes manually

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<tr>
<td>3dTagalign</td>
<td>Align datasets by matching manually placed ‘tags’</td>
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  **Plugin:** Edit Tagset  
  Place ‘tags’ in a dataset interactively

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<tr>
<td>adwarp</td>
<td>Transform dataset using warp from dataset header</td>
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<tr>
<td>Vecwarp</td>
<td>Transform 3-vectors using warp from dataset header</td>
</tr>
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• **Dataset File Manipulation**

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<tr>
<td>3dcopy</td>
<td>Copy a dataset to make new files</td>
</tr>
<tr>
<td>3drename</td>
<td>Rename dataset files</td>
</tr>
<tr>
<td>3ddup</td>
<td>Make an ‘empty’ duplicate (warp-on-demand) of a dataset</td>
</tr>
<tr>
<td>3dcopy</td>
<td>Copy a dataset to make new files</td>
</tr>
<tr>
<td>3dTwotoComplex</td>
<td>Create complex dataset from two sub-bricks</td>
</tr>
<tr>
<td>3dEmpty</td>
<td>Create header file only for specified dimensions</td>
</tr>
</tbody>
</table>
• ROI Generation and Usage Programs

  plugin: **Draw Dataset**  Manually draw ROI mask datasets
  3dAutomask         Generate a brain and skull-only mask
  3dAutobox          Automatically crop a dataset to remove empty space
  3dmaskave          Calculate dataset values averaged over a ROI
  3dmaskdump         Output all dataset values in a ROI
  3dROIstats         Calculate dataset values from multiple ROIs
  3dUndump           Create dataset from text (inverse of 3dmaskdump)
  3dOverlap          Create mask that is overlap of nonzero voxels from multiple datasets
  3dfractionize      Resample a mask dataset to a different resolution
  whereami           Get atlas region name for coordinates
• Simple Calculations on Datasets, Producing New Datasets
  
  **3dcalc**  
  Voxel-by-voxel general purpose calculator
  
  **3dmerge**  
  Various spatial filters, thresholds, and averaging
  
  **3dTstat**  
  Various statistics of multi-brick datasets, voxel-by-voxel
  
  **3dMean**  
  Average datasets together, voxel-by-voxel, for each timept
  
  **3dWinsor**  
  Nonlinear order statistics filter for spatial smoothing
  
  **3danisosmooth**  
  Edge preserving filter for spatial smoothing
  
  **3dLocalstat**  
  Find simple statistical values for neighborhoods around each voxel
  
  **3dLocalBistat**  
  Compute various bivariate statistics for neighborhoods around each voxel
  
  **3dMatcalc**  
  Applies matrix to datasets

• Computation of Various Numbers from Datasets
  
  **3ddot**  
  Dot product (correlation coefficient) of 2 sub-bricks
  
  **3dclust**  
  Find spatially connected clusters of nonzero voxels
  
  **3dStatClust**  
  Find statistically connected clusters
  
  **3dExtrema**  
  Find local maxima (or minima) of datasets
  
  **3dFWHM**  
  Estimate Full Width Half Max of dataset spatial correlation
  
  **3dFWHMX**  
  Estimate FWHM for all sub-bricks of dataset
  
  **3dBlurToFWHM**  
  Spatially variable blurring for uniform FWHM
  
  **3dBrickStat**  
  Simple statistics (max, min, mean) for scripts
  
  **3dGetrow**  
  Output voxel values for a row/column in x,y,z space
  
  **3dDWIToDT**  
  Compute diffusion tensor, eigenvalues from DWI data
  
  **3dDTTeig**  
  Compute eigenvalues from diffusion tensor data
• **Simulated Dataset Generators**
  
  3dTSgen  
  Generate 3D+time dataset from 1D model and noise  
  
  3dClustSim  
  Simulate datasets and estimate statistical power  
  
  3dConvolve  
  Simulate datasets via convolution  
  
  3dInvFMRI  
  Compute stimulus time series given activation map and 3D+time dataset  

• **Programs for Dealing with 1D Time Series**
  
  1dcat  
  Catenate them horizontally  
  
  1deval  
  1D calculator (like 3dcalc for 1D files)  
  
  1dplot  
  Graph values from columns in a file  
  
  1dgrayplot  
  Show values from columns in a file as bands of gray levels  
  
  1dtranspose  
  Transpose 1D files (interchange rows and columns)  
  
  1dmatcalc  
  Matrix calculator for 1D files  
  
  1dMarry  
  Combine ragged 1D files for use with 3dDeconvolve's -stim_times_AM2 option  

• **Image Registration Programs**
  
  3dvolreg  
  Volumetric registration (rigid body in 3D)  
  
  3dWarpDrive  
  Enhanced volumetric registration, includes warping  
  
  3dAllineate  
  Cross-modality affine volume registration  
  
  2dImReg  
  Slice-by-slice registration (rigid body in 2D)
### Miscellaneous File Manipulations

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<tr>
<td>2swap</td>
<td>Byte pair swap: ab → ba</td>
</tr>
<tr>
<td>4swap</td>
<td>Byte quad swap: abc → dcba</td>
</tr>
<tr>
<td>24swap</td>
<td>Mixed 2 and 4 byte swaps in same file</td>
</tr>
<tr>
<td>strblast</td>
<td>Find a string in a file and replace it with junk</td>
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### Miscellaneous Utilities

<table>
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<tr>
<td>byteorder</td>
<td>Report the byteorder of the current CPU</td>
</tr>
<tr>
<td>ccalc</td>
<td>A command line calculator (like 3dcalc)</td>
</tr>
<tr>
<td>cdf</td>
<td>Compute probabilities, thresholds for standard distributions</td>
</tr>
<tr>
<td>count</td>
<td>Generate numbered strings for command line scripts</td>
</tr>
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### Image File Header Printouts

<table>
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<tr>
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<tr>
<td>dicom_hdr</td>
<td>Print information from a DICOM file</td>
</tr>
<tr>
<td>ge_header</td>
<td>Print information from a GE I. file</td>
</tr>
<tr>
<td>mayo_analyze</td>
<td>Print information from an ANALYZE .hdr file</td>
</tr>
<tr>
<td>siemens_vision</td>
<td>Print information from a Siemens Vision .ima file</td>
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### Miscellaneous Visualization Tools

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<tr>
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<tbody>
<tr>
<td>aiv</td>
<td>AFNI Image Viewer program</td>
</tr>
<tr>
<td>plugin: <strong>Render[new]</strong></td>
<td>Interactive volume rendering</td>
</tr>
<tr>
<td>plugin: <strong>Dataset#N</strong></td>
<td>Graph extra dataset time series in AFNI graph viewer</td>
</tr>
</tbody>
</table>
- **Surface mapping tools**

  - **SUMA**  
    Surface Mapping display
  - **DriveSuma**  
    Send commands to SUMA program from script
  - **@SUMA_Make_Spec_FS**  
    Convert Freesurfer surfaces to SUMA spec files
  - **@SUMA_Make_Spec_SF**  
    Convert SureFit surfaces to SUMA spec files
  - **3dSurf2Vol**  
    Compute volume equivalent from surface or pair of surfaces
  - **3dVol2Surf**  
    Assign values to surface nodes from volumetric data
  - **3dSurfMask**  
    Generate volumetric mask for inside of surface
  - **CompareSurfaces**  
    Compute distances between two surfaces at each node
  - **ConvertSurface**  
    Convert surface files among various formats
  - **IsoSurface**  
    Extract isosurface from a volume
  - **SurfClust**  
    Find clusters on surfaces
  - **SurfDsetInfo**  
    Display information about surface dataset
  - **SurfInfo**  
    Show information on surface
  - **SurfMeasures**  
    Compute various measurements for surface or pair of surfaces
  - **SurfMesh**  
    Reduce number of points in surface mesh
  - **SurfPatch**  
    Extract patch of surface or compute volume from specified nodes
  - **SurfQual**  
    Quality check for surfaces
  - **SurfSmooth**  
    Smooth surfaces
  - **SurftoSurf**  
    Interpolate data from one surface onto mesh of another surface
  - **SurfaceMetrics**  
    Provides information on surface mesh
  - **MapIcosahedron**  
    Create new version of surface mesh using mesh of icosahedron
• **Miscellaneous Scripts and Script Tools**

  * **afni_proc.py**  
    Python program to generate tcsh script for processing single subject FMRI data

  * **@auto_tlrc**  
    Automatic transformation of dataset to match Talairach template

  * **@CommandGlobb**  
    Execute AFNI commands for multiple datasets

  * **@make_stim_file**  
    Make stim file for 3dDeconvolve from user input or file

  * **@UpdateAfni**  
    Sample script for updates (also AFNI_UPDATER)