PyMVPA and the larger scientific software ecosystem

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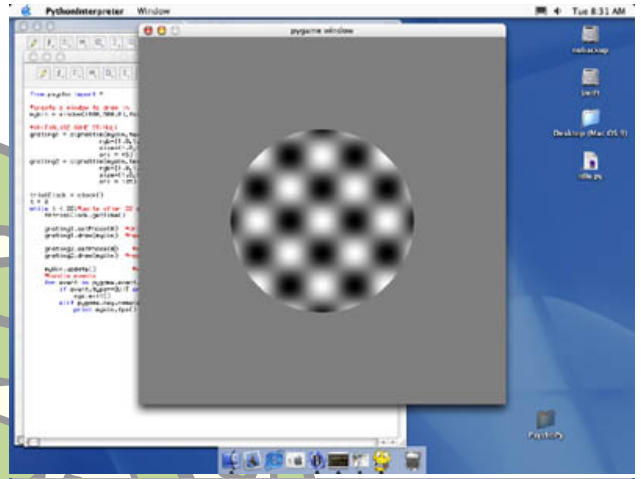
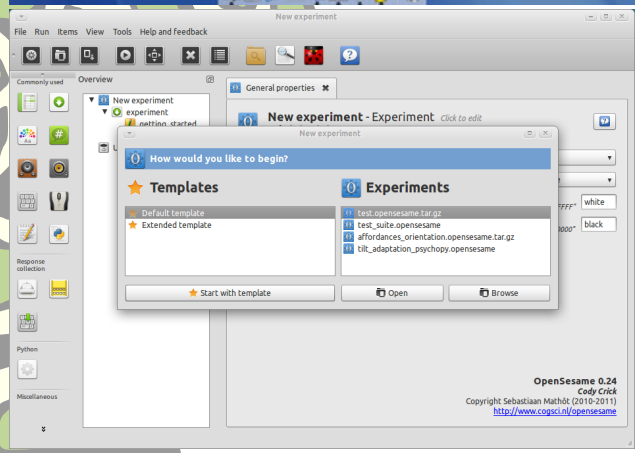
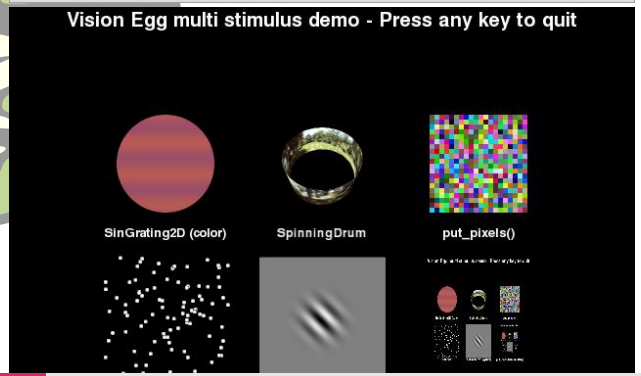
Python in Neuroimaging

Stimuli delivery & Data access

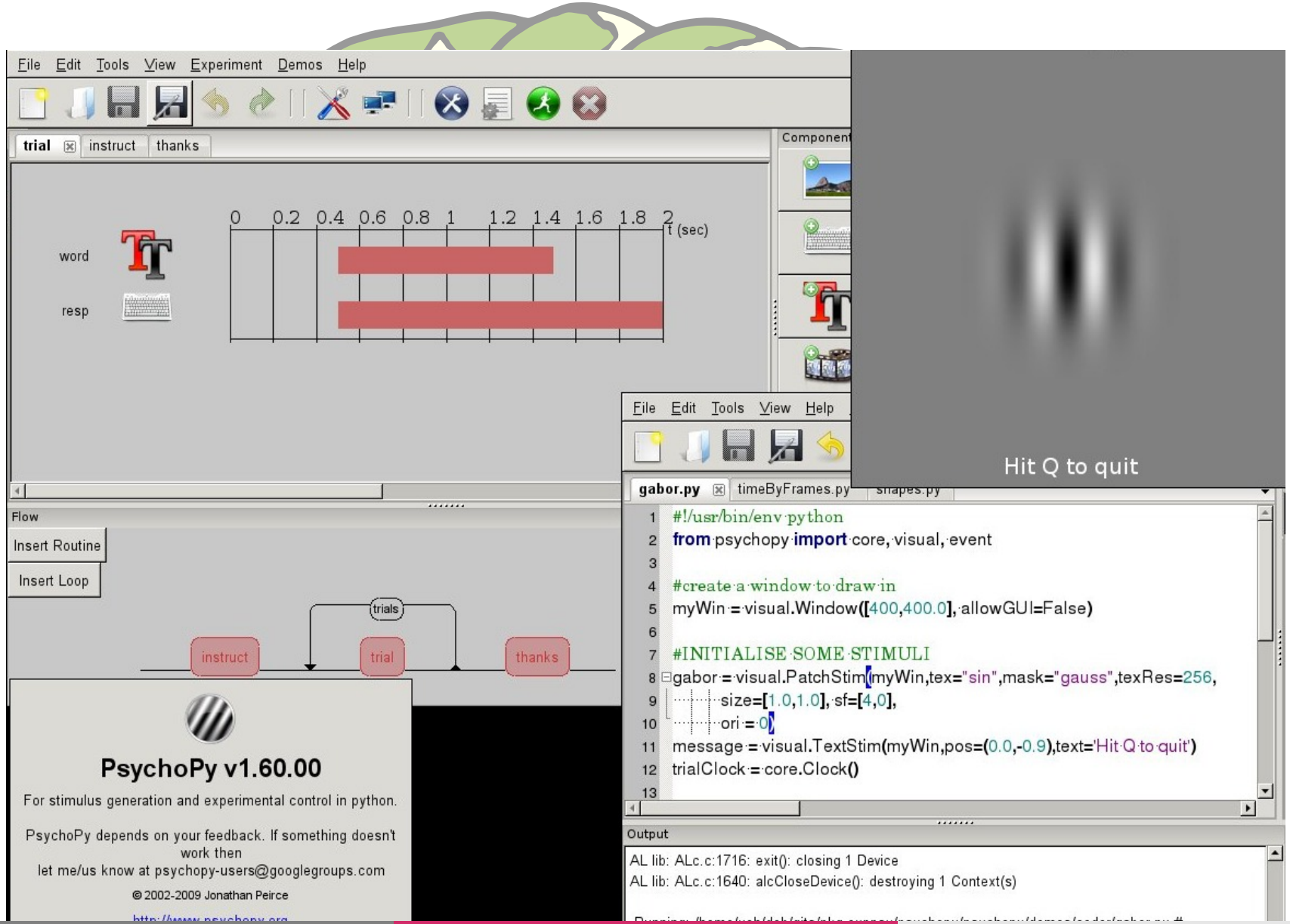
- PsychoPy, Opensesame, VisionEgg, Expyriment
- **Nibabel (superseeded PyNIfTI, PyMGH, etc.), h5py, PyTables**







Python in Neuroimaging: PsychoPy



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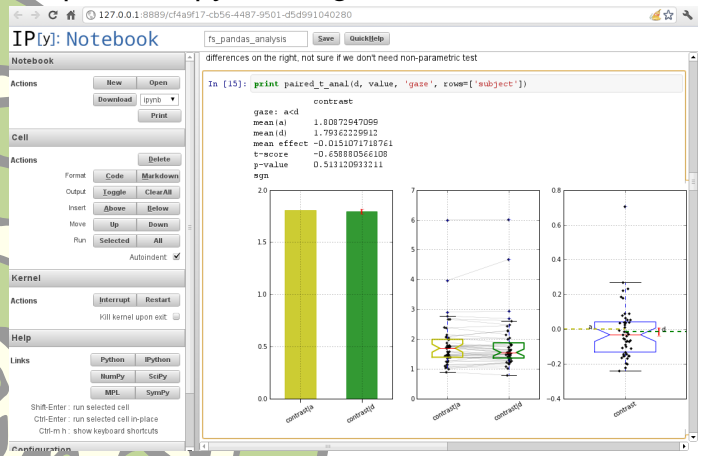
http://www.ipython.org/



Data analysis

- **NumPy, SciPy**, NetworkX
- MDP, scikit-learn, statsmodels, pandas, sympy
- IPython (notebooks), Sage
- OpenMEEG, Dipy, NiPy, Nitime, NiPype, BrainVisa

http://nipy.org

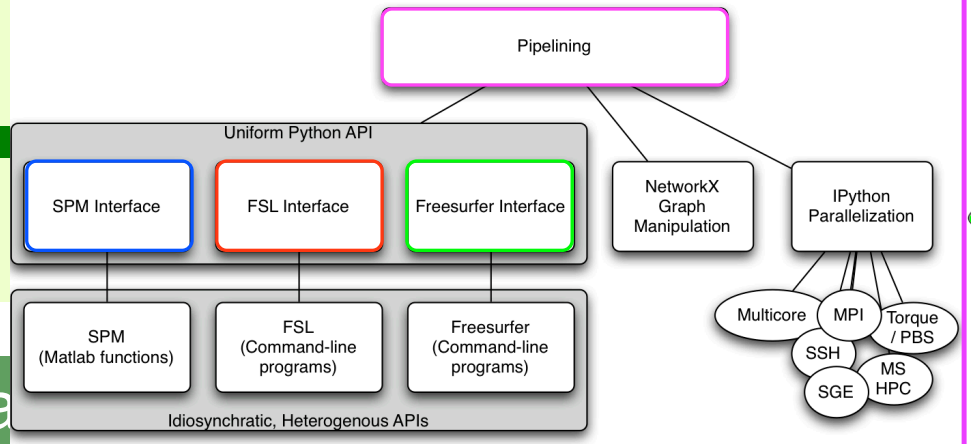
NIPY features

- **preprocessing** : space-time realignment of fMRI data
- **fMRI data analysis** : GLM model (model specification, fit)
- **inference** :
  - parametric tests (false discovery rate, Gaussian Random Field theory)
  - non-parametric tests (voxel-level, cluster-level, mixed effects, various statistics)
- **spatial models**:
  - anatomo-functional parcellation,
  - structural models (brain functional landmarks)

Neuroimaging in Python

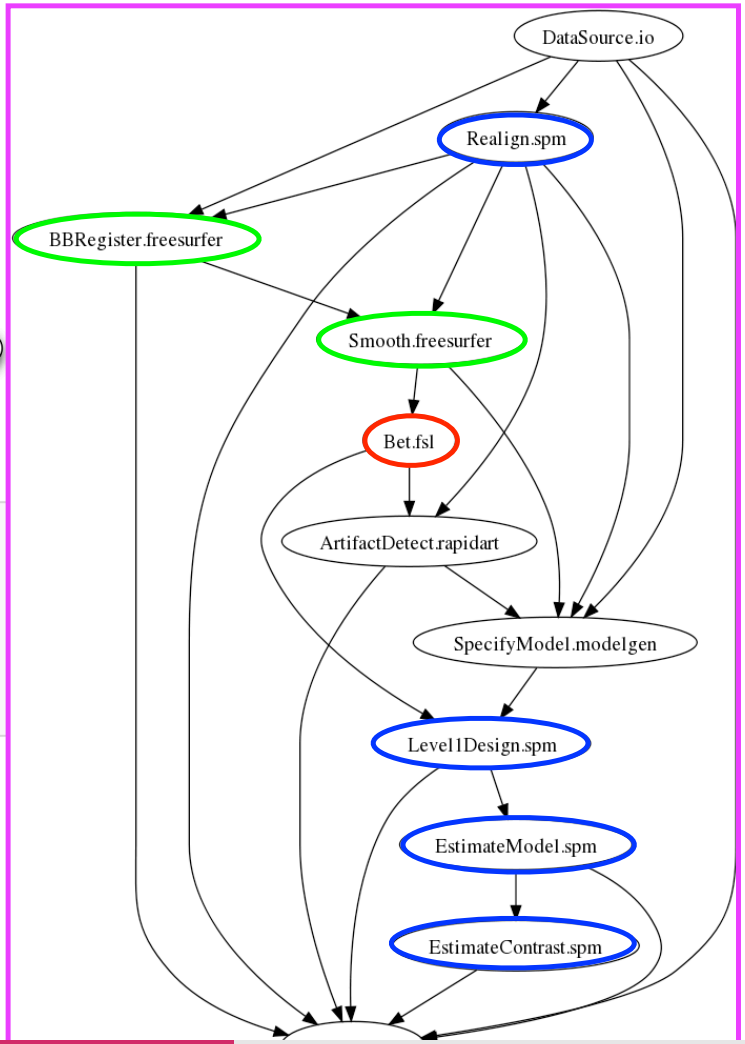
Python in Neuroimaging: NiPype

Neuroimaging in Python
Pipelines and Interfaces




```
import nipype.interfaces.fsl as fsl
mybet = fsl.Bet()
mybet.inputs.infile = 'foo.nii'
mybet.inputs.outfile = 'bar.nii'
result = mybet.run()
```

```
import nipype.interfaces.spm as spm
from glob import glob
allepi = glob('epi*.nii')
allepi.sort()
realigner = spm.Realign()
realigner.inputs.infile = allepi
result = realigner.run()
```

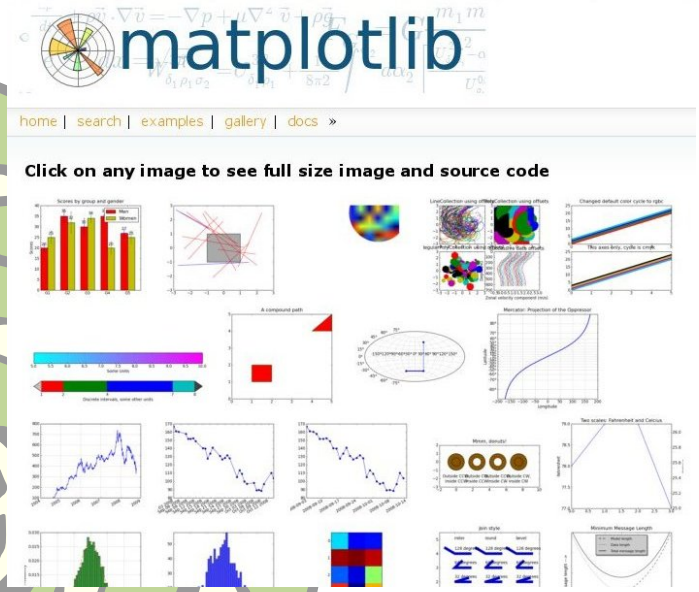


Python in Neuroimaging

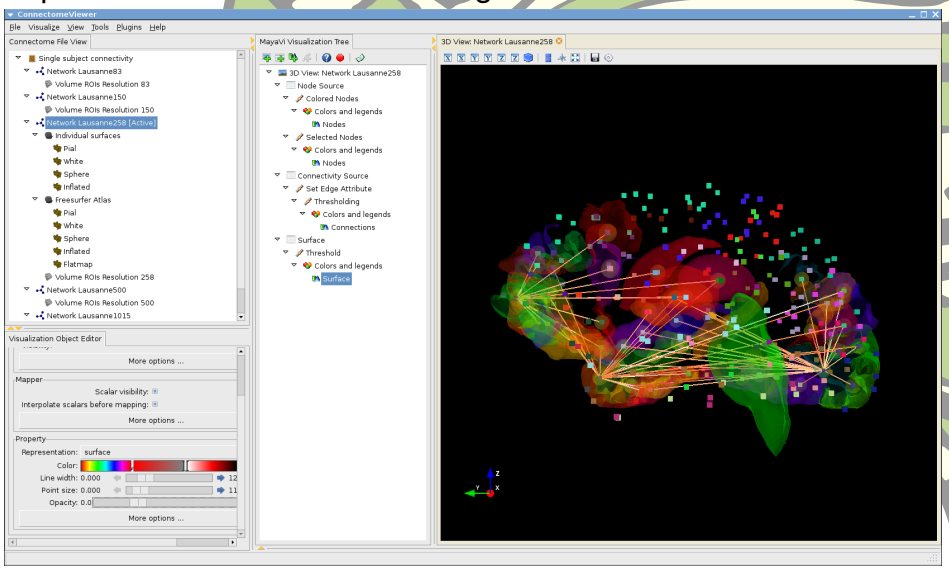
Data visualization

- **matplotlib**, guiqwt
- Seaborn, ggplot
- Mayavi2, PySurfer, Anatomist

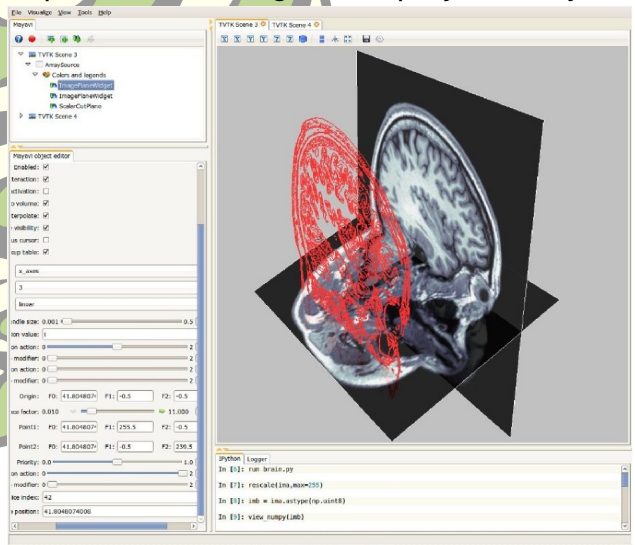
http://matplotlib.sourceforge.net/gallery.html



http://www.connectomeviewer.org



http://code.enthought.com/projects/mayavi/



Python in NeuroImaging

Find the community @ http://www.nipy.org

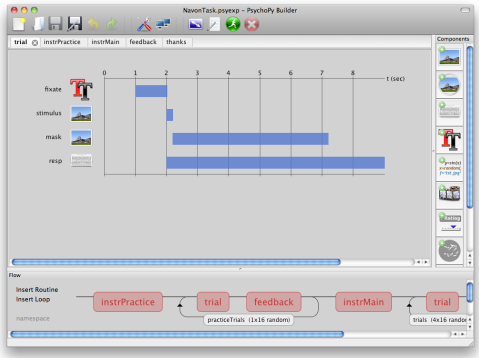
Stimuli Delivery

PsychoPy

http://www.psychopy.org

PsychoPy is an easy, precise, platform-independent package for stimulus presentation. Suitable for psychophysics, neuroimaging, and all areas of psychology.

- Huge variety of stimuli generated in real-time
- Cross-platform – run the same script on Linux, Win or OS X
- Flexible stimulus units (degrees, cm, or pixels)
- Coder interface for those that like to program
- Builder interface for those that don't
- Input from keyboard, mouse, joystick or button boxes
- Multi-monitor support
- Automated monitor calibration (supported photometers)

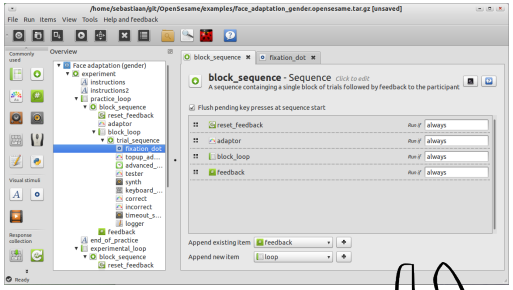


OpenSesame

http://www.cogsci.nl/software/opensesame

OpenSesame is a graphical experiment builder for the social sciences.

- A comprehensive and intuitive graphical user interface
- WYSIWYG drawing tools for creating visual stimuli
- Cross-platform
- Python scripting for complex tasks
- A plug-in framework
- Compatibility (through plug-ins) with commonly used devices: (e.g. Eyelink eye trackers, serial response boxes, Mantra object tracker)
- Compatibility with popular Python libraries: PsychoPy, PyGame, PyOpenGL, etc.



Data I/O

NiBabel

http://nipy.org/nibabel

Nibabel provides read and write access to some common medical and neuroimaging file formats, including: ANALYZE (plain, SPM99, SPM2), GIFTI, NIfTI1, MINC, as well as PAR/REC. NiBabel is the successor of PyNIfTI.

The various image format classes give full or selective access to header (meta) information and access to the image data is made available via NumPy arrays.

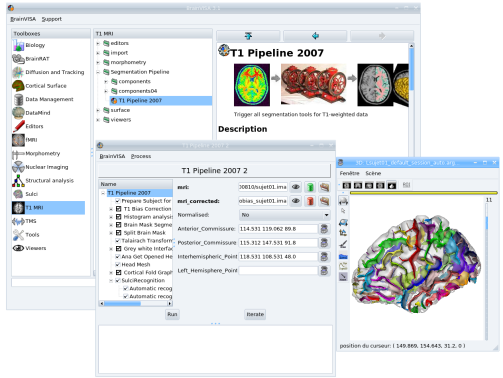
Analysis

BrainVISA

http://brainvisa.info

BrainVISA is an open-source, modular and customizable software platform built to host heterogeneous tools dedicated to neuroimaging research. It aims at helping researchers in developing new neuroimaging tools, sharing data and distributing their software.

- Databasing capabilities
- Massive computation facilities using Soma-workflow
- Open environment, with many toolboxes
- Specialized toolboxes for T1 MRI processing, sulci ang gyri morphometry, diffusion imaging and fibers tracking, surfacic and structural analysis, 3D histology...
- Links with other software like SPM, FSL, FreeSurfer, or CIVET



D. Geffroy, D. Rivière, I. Denghien, N. Souedet, S. Laguitton, and Y. Cointepas. BrainVISA: a complete software platform for neuroimaging. In Python in Neuroscience workshop, Paris, Aug. 2011.

DiPy

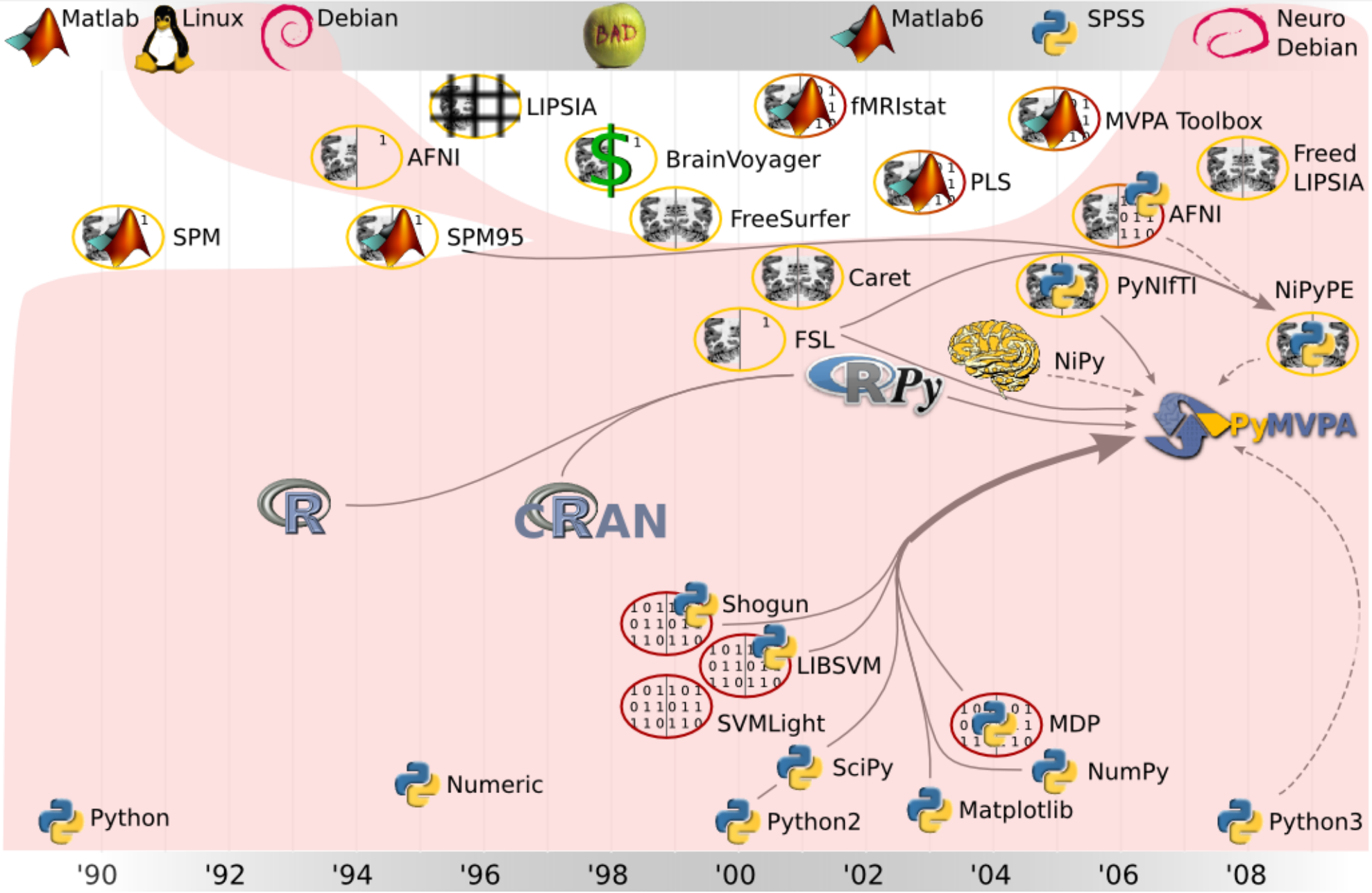
http://nipy.org/dipy

Dipy is an international FOSS project for diffusion magnetic resonance imaging analysis. Dipy is multiplatform and will run under any standard operating system such as *Windows*, *Linux*, *Mac OS X*. Some of our **state-of-the-art** applications are:

- Reconstruction algorithms e.g. GQI, DTI
- Tractography generation algorithms e.g. EuDX
- Intelligent downsampling of tracks
- Ultra fast tractography clustering
- Resampling datasets with anisotropic voxels to isotropic
- Visualizing multiple brains simultaneously
- Finding track correspondence between different brains
- Warping tractographies into another (e.g. MNI) space
- Support of various file formats e.g. Trackvis or NIfTI

http://neuro.debian.net/_files/nipy-handout.pdf

Deployment Resolution: NeuroDebian



NeuroDebian from a researcher's perspective

Install simple editor

```
apt-get install gedit
```

Install complex MRI analysis package

```
apt-get install fsl
```

Install software collection for psycho-physics

```
apt-get install science-psychophysics
```

Keep the whole system up-to-date

```
apt-get upgrade
```

NeuroDebian (`http://neuro.debian.net`) after X years and the contributions of many people:

Support: Where to Look for Help?

`http://www.pymvpa.org/support.html`

Mailing List

`pkg-exppsy-pymvpa@lists.alioth.debian.org`

`http://lists.alioth.debian.org/mailman/listinfo/pkg-exppsy-pymvpa`

IRC

#neurodebian on OTFC

Bug/Wishlist Tracking

`http://github.com/PyMVPA/PyMVPA/issues`

On Debian system, just use 'reportbug'.


Brain Download:
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ICANHASCHEEZBURGER.COM