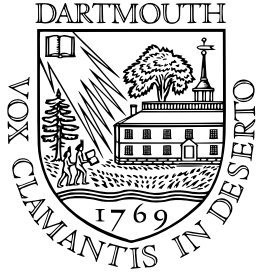
Debian: The ultimate platform for neuroimaging research

Michael Hanke & Yaroslav O. Halchenko

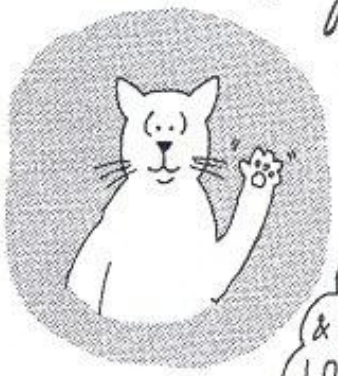
DebConf10, New York City



n the beginning there was just Debian. . .

. . . then there was need for two PhD degrees

Mapping of the CAT BRAIN



OBSESSION WITH IMAGINARY INSECTS

MYSTERIOUS ADORATION OF JUST ONE SPOT ON THE BED

BARF

GLAND

LICKING GLAND

SHORT CIRCUIT THAT MAKES A PURRING KITTY AN ARM-SHREDDING MANIAC IN TWO SECONDS

SEARCH & DESTROY LOBE FOR EXPENSIVE IMPORTED TEXTILES, CERAMICS

INEXORABLE FEAR OF VACUUM CLEANERS

TOTAL DRIVE TO BE WHERE THEY ARE FORBIDDEN TO GO

CAN OPENER SONAR

ASTHMATIC PERSON LOCATOR

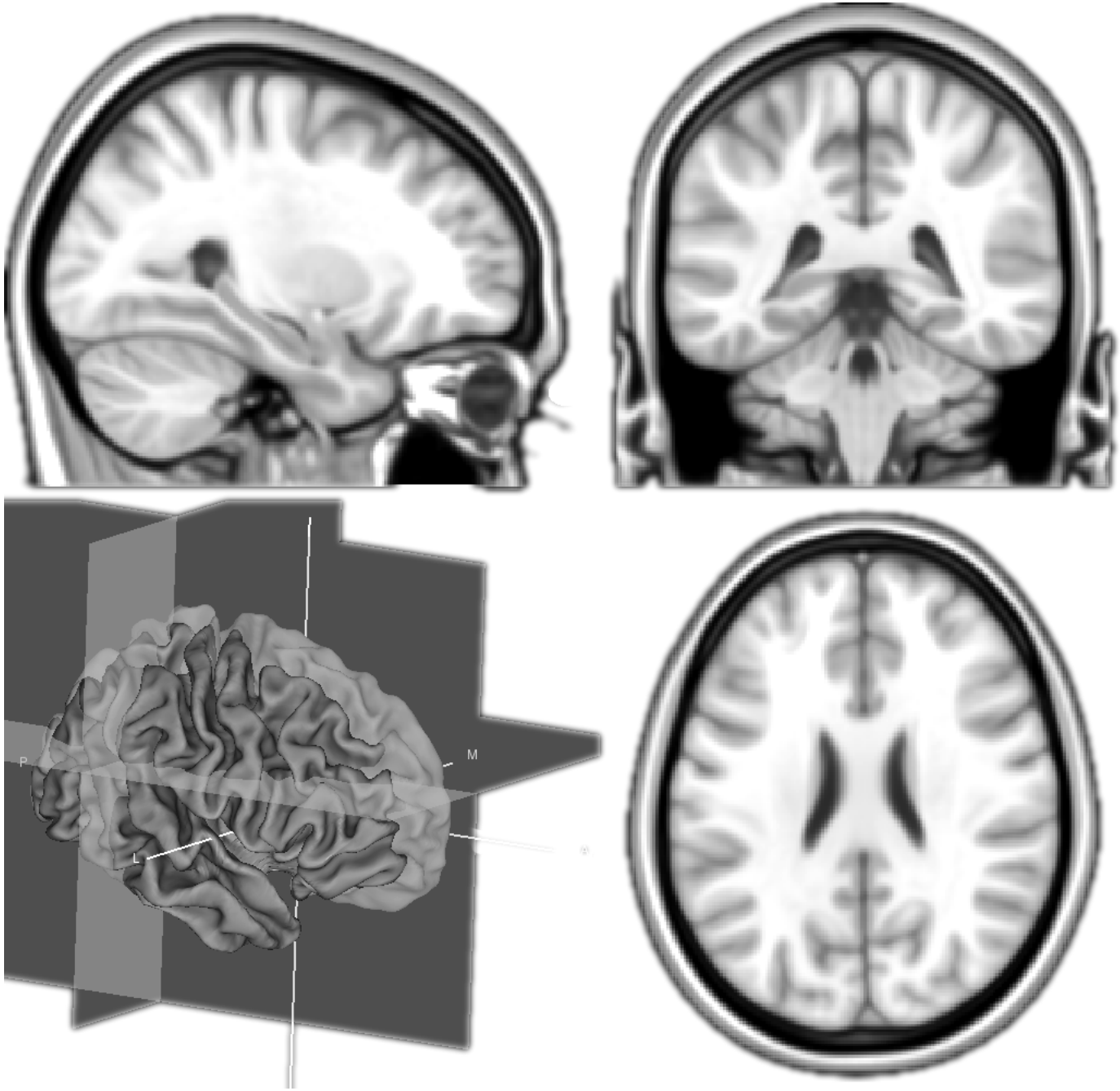
INABILITY TO GET ALONG WITH NEW CAT

SHEDDING ON FRESHLY VACUUMED SURFACES CORTEX

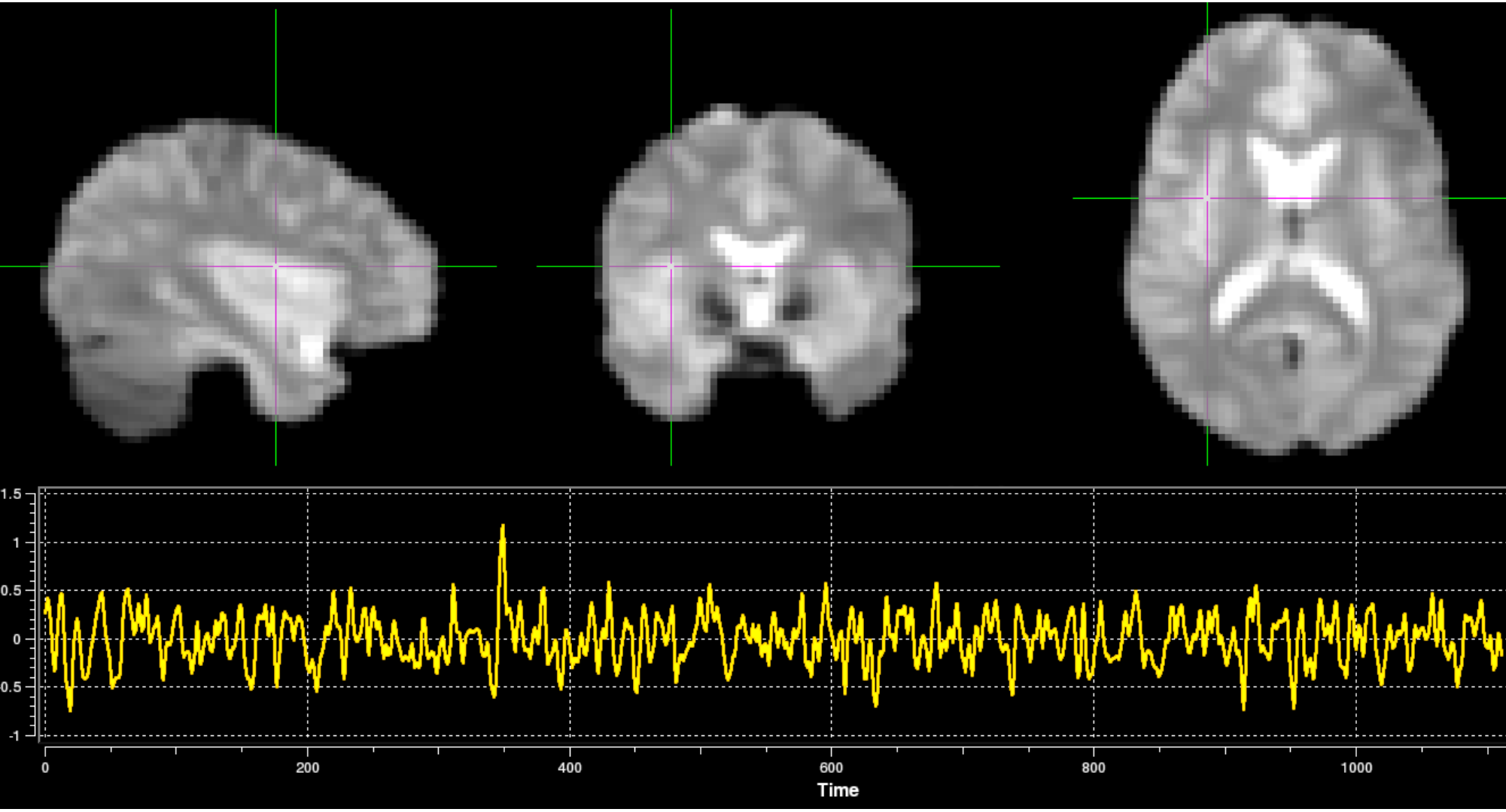
HATRED OF DOGS

INFATUATION WITH PEOPLE WHO HATE CATS

COMMITMENT SPOT (GETS LARGER WHEN CAN OPENER SONAR IS ACTIVATED)

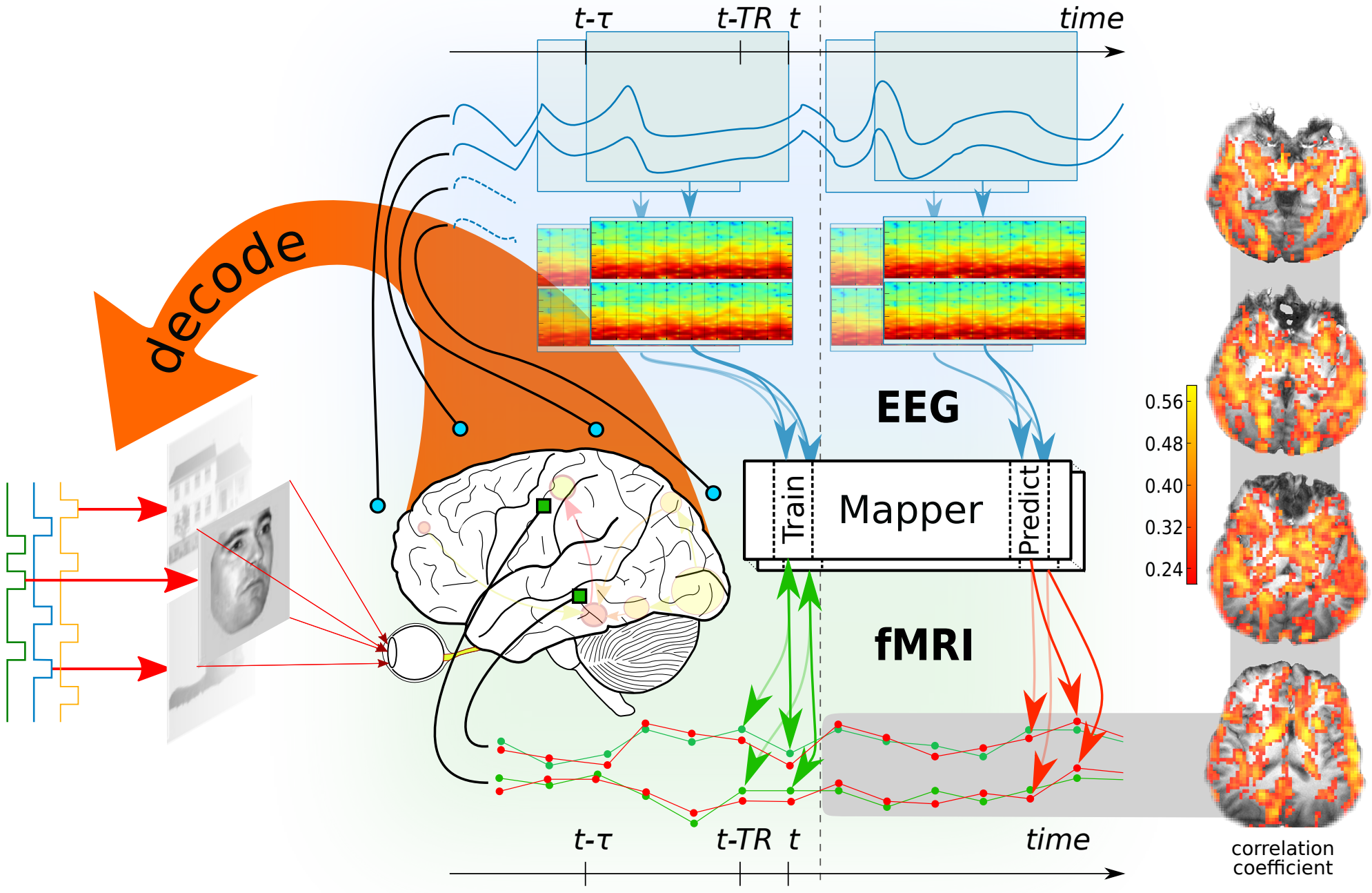


```
apt-get install caret
```




```
% du -h bold_run1.nii
418M    bold_run1.nii
% fslview bold_run1.nii &
```

```
apt-get install fsl
```




```
apt-get install python-mvpa
```

Neuro-imaging in Debian: 2005

Neuro-imaging in Debian: 2005

python

Mayavi

Neuro-imaging in Debian: 2005

MINC

DICOM

python

Mayavi

Neuro-imaging in Debian: 2005

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```
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Reading package lists... Done
Building dependency tree
Reading state information... Done
E: Couldn’t find package easy-phd
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WNPP

- Software for data collection (psychophysical/behavioral experiments)
- Software for data analysis (MRI file format support, algorithms, ...)
- Software for visualization (MRI-capable 3D/4D viewer, ...)

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WNPP

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- Software for data analysis (MRI file format support, algorithms, . . .)
- Software for visualization (MRI-capable 3D/4D viewer, . . .)

There is free and/or open-source software for everything

Case study: FSL

- Comprehensive analysis suite
- Well documented
- Open-source
- Downloadable for free, but non-commercial license
- Multiple developers
- Heterogeneous code
- Languages: C++, C, Tcl/Tk, sh, csh
- Public mailing list
- No public bugtracker
- No public VCS

FSL: What’s in the tarball?

FOSS Visualization tool FSLView depends on Qt3 (25k lines of code)

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Preconditions for packaging

ITP/RFP: newmat, nifticlib, vtk5

FSL: Journey into Debian

Oct 2005 Prelimary core packages ready; first contact with upstream (very positive)

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Still not in Debian

FSL's data packages (data.debian.org)
Regression test-suite

Intermediate conclusions

1. Need to have a repository!

   Staging area for packages that are technically ready

   Essential backports researchers need latest scientific software on stable platforms

   Derivatives Most neuroscientific Debian users run Ubuntu

Intermediate conclusions

1. Need to have a repository!
   - **Staging area** for packages that are technically ready
   - **Essential backports** researchers need latest scientific software on stable platforms
   - **Derivatives** Most neuroscientific Debian users run Ubuntu

But also need to push packages into Debian!

- Quality/Manpower
- Infrastructure
- Visibility

Neuro-imaging in Debian: 2010

MINC

DICOM

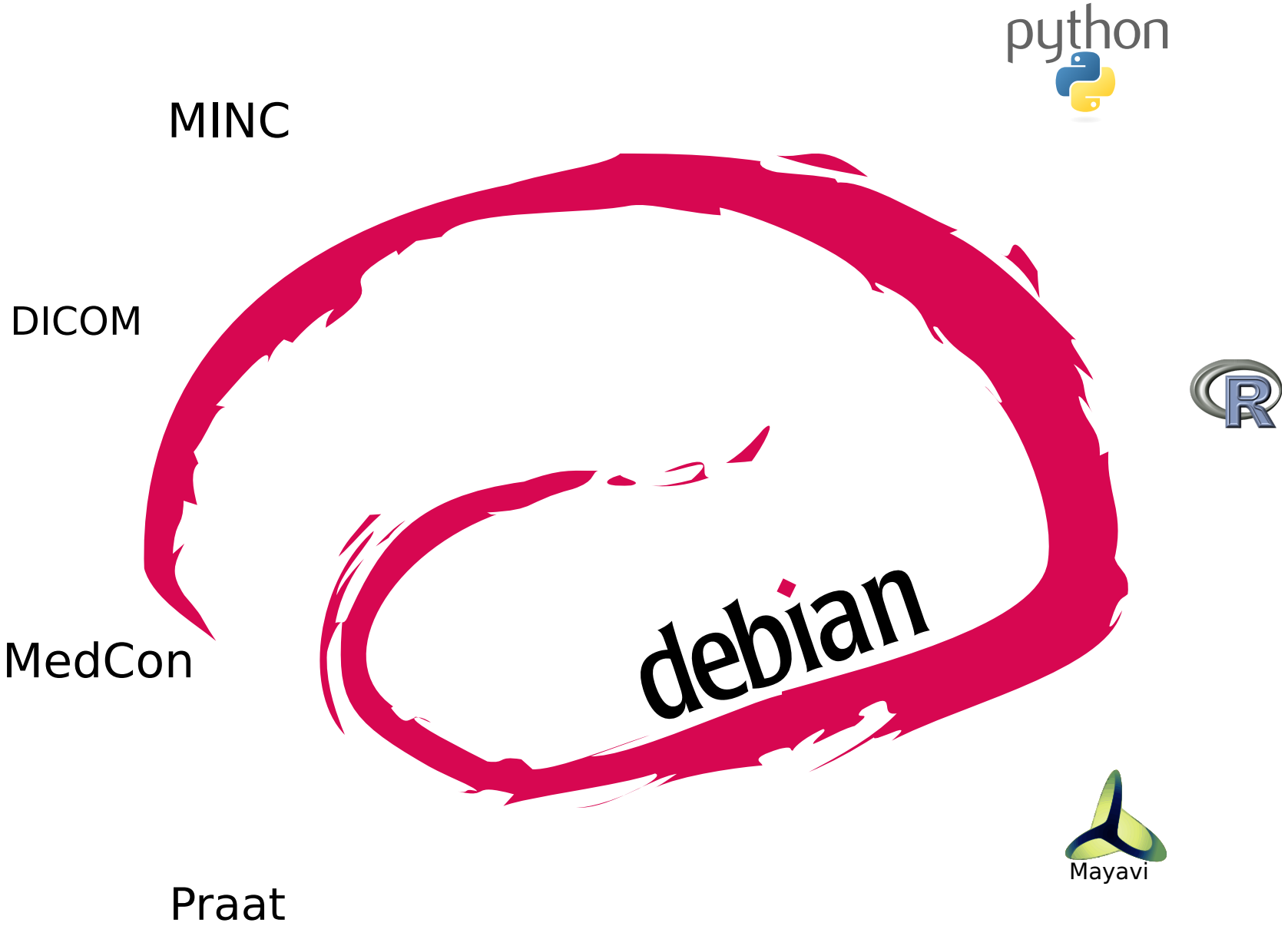
MedCon

Praat

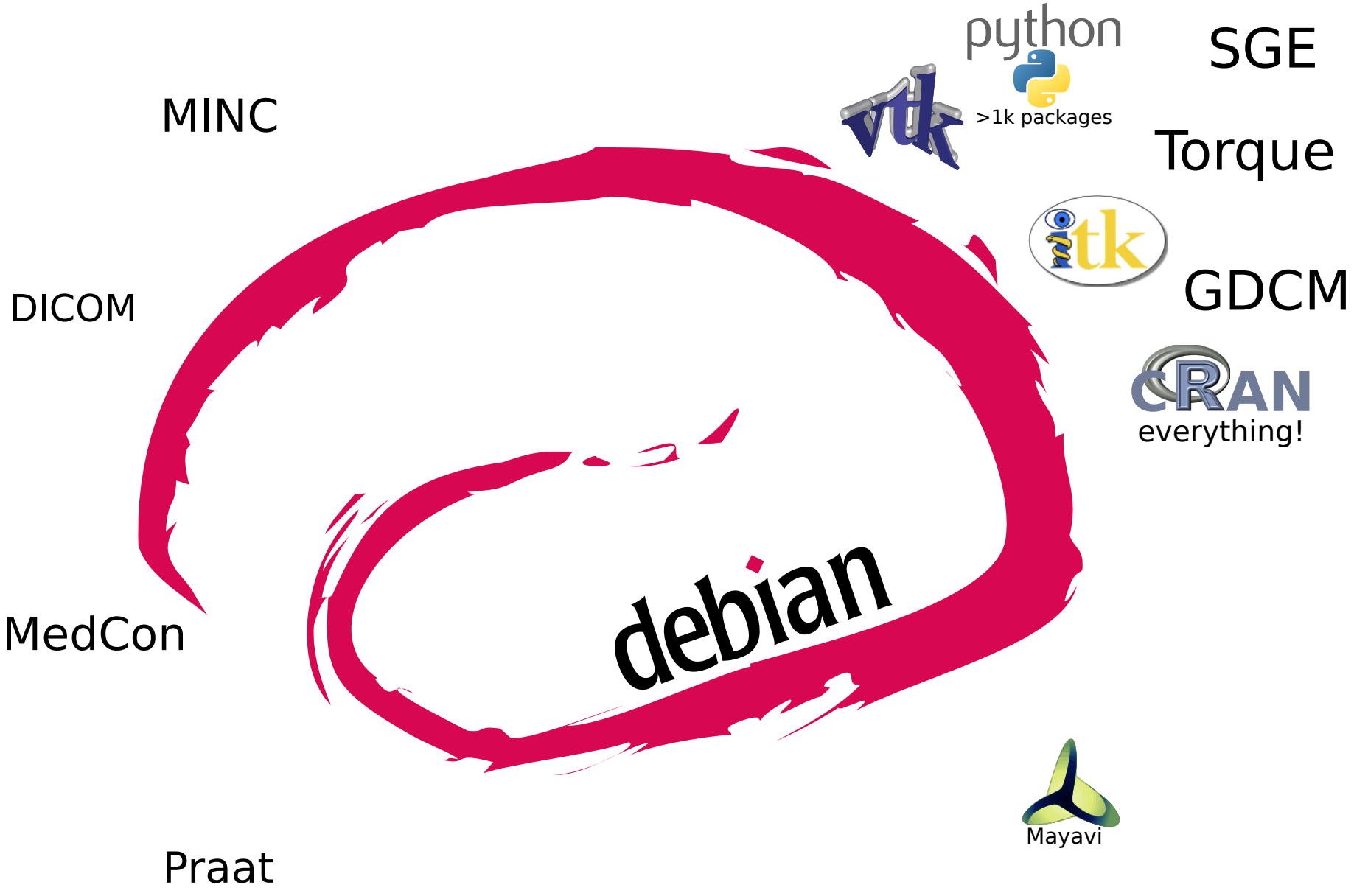
python

Mayavi

Neuro-imaging in Debian: 2010



Neuro-imaging in Debian: 2010



Neuro-imaging in Debian: 2010

NIfTI-1

MINC

GIfTI

Vista

MGH

DICOM

python

>1k packages

SGE

Torque

GDCM

everything!

MedCon

Mayavi

Praat

Neuro-imaging in Debian: 2010

NIfTI-1

MINC

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Vista

MGH

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python

>1k packages

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Torque

vtk

tk

GDCM

CRAN

everything!

PsychoPy

PyEPL

MedCon

3DSlicer

OpenMEEG

FSL

Lipsia

MRTRIX

Paraview

Caret

Mayavi

ANTs

Praat

PyMVPA

NiPy(PE)

ITK-SNAP

ODIN

VoxBo

Neuro-imaging in Debian: 2010

NIfTI-1

MINC

GIfTI

Vista

MGH

DICOM

SGE

Torque

GDCM

PyEPL

MedCon

debian

OpenMEEG

Lipsia

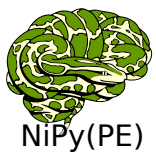
MRTRIX

Paraview

Praat

MRIcron

ANTs



VoxBo

ITK-SNAP

ODIN

Invesalius

Intermediate conclusions

1. Need to have a repository!

Intermediate conclusions

1. Need to have a repository!
2. Need for tailored presentations!

Availability	What is available for **my** field?
Activity	Are people actively working on the stuff that **I** care about?
Seriousness	Do they acknowledge necessities in the scientific world (justification of development resources, proper referencing)?

schematic - many more packages are available

debian-med

Help us to see Debian used by medical practicioners and researchers! Join us on the Alioth page.

Summary

Imaging
Cross-platform for visualizing, processing and analysing of bioimages
GoFigure2 is an open-source, cross-platform application for visualizing, processing and analyzing of multidimensional microscopy data. Users can visualize, segment and track cells through time, detect cell-division and ultimately generate lineages.

Translate description

The list to the right includes various software projects which are of some interest to the Debian Med Project. Currently, only a few of them are available as Debian packages. It is our goal, however, to include all software in Debian Med which can sensibly add to a high quality Debian Pure Blend.
For a better overview of the project's availability as a Debian package, each head row has a color code according to this scheme:

- Official Debian packages with high relevance
- Official Debian packages with lower relevance
- Debian packages in contrib or non-free
- Packaging has started and developers might try the packaging code in VCS
- Unofficial packages built by somebody else
- No known packages available but some record of interest (WNPP bug)
- No known packages available

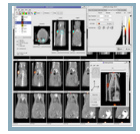
Debian Med Imaging packages

Amide
Software pro obrazy v lékařství
http://amide.sourceforge.net/
Maintainer: Debian Med Packaging Team (Dominique Belhachemi)

Popcon: 26 users (15 upd.)*
Versions and Archs
Debtags

License: DFSG free
Official Debian package
Svn
Fix translated description

AMIDE: (Amide's a Medical Imaging Data Examiner - Amide slouží ke zkoumání lékařských obrazů) AMIDE je nástroj pro prohlížení a analýzu souborů obrázků v lékařství. Mezi jeho možnosti patří zpracovávání mnoha souborů dat zároveň, import z mnoha různých formátů, spojování obrazů, kreslení a analýza 3D oblastí podle zájmu a porovnávání.



Fsl
analysis tools for FMRI, MRI and DTI brain imaging
http://www.fmrib.ox.ac.uk/fsl/
Maintainer: NeuroDebian Team (Michael Hanke)

Popcon: 21 users (21 upd.)*
Versions and Archs
Debtags

License: non-free
Debian package in contrib/non-free
Git

FSL is a comprehensive library of image analysis and statistical tools for fMRI, MRI and DTI brain imaging data. The suite consists of various commandline tools, as well as simple GUIs for its core analysis pipelines. Among others, FSL offers implementations of standard GLM analysis, white matter tractography, tissue segmentation, affine and non-linear co-registration, and independent component analysis.
This is a meta-package that depends on the latest FSL version.

Upload screenshot

Please register by following this link if you are using fsl.

Please cite: S.M. Smith, M. Jenkinson, M.W. Woolrich, C.F. Beckmann, T.E.J. Behrens, H. Johansen-Berg, P.R. Bannister, M. De Luca, I. Drobnjak, D.E. Flitney, R. Niazy, J. Saunders, J. Vickers, Y. Zhang, N. De Stefano, J.M. Brady, P.M. Matthews *Advances in functional and structural MR image analysis and implementation as FSL.* NeuroImage, 23:208-219 (2004)

Mni-colin27-nifti
Talairach stereotaxic space template
http://packages.bic.mni.mcgill.ca/tgz/
Responsible: NeuroDebian Team

License: custom, DFSG-compliant
Unofficial Debian package

This template MRI volume was created from 27 T1-weighted MRI scans of a single individual that have been transformed into the Talairach stereotaxic space. The anatomical image is complemented by a brain and a head mask. All images are in 1x1x1 mm resolution.
This package provides the template in NIfTI format.

Please cite: C.J. Holmes, R. Hoge, L. Collins, R. Woods, A.W. Toga, A.C. Evans: *Enhancement of MR images using registration for signal averaging.* J Comput Assist Tomogr, 22: 324-333 (1998)

Remark of Debian Med team: This package is waiting for the Debian data package archive to become available.

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Debian International
Security Information
Bug reports
Mailing Lists
Mailing List Archives
Ports/Architectures

Miscellaneous

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Developers' Corner

Site map

Search

What is Debian?

Debian is a free operating system (OS) for your computer. An operating system is the set of basic programs and utilities that make your computer run. Debian uses the Linux kernel (the core of an operating system), but most of the basic OS tools come from the GNU project; hence the name GNU/Linux.

Debian GNU/Linux provides more than a pure OS: it comes with over 25000 packages, precompiled software bundled up in a nice format for easy installation on your machine.

Read more...

Getting Started

The latest stable release of Debian is 5.0. The last update to this release was made on June 26th, 2010. Read more about available versions of Debian.

If you'd like to start using Debian, you can easily obtain a copy, and then follow the installation instructions to install it.

If you're upgrading to the latest stable release from a previous version, please read the release notes before proceeding.

To get help in using or setting up Debian, see our documentation and support pages.

Users that speak languages other than English should check the international section.

People who use systems other than Intel x86 should check the ports section.

News

Visibility Issues

Unnecessarily hard to discover how huge and diverse Debian actually is.

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But “raw” information is easily available

- Ultimate Debian Database and Debian Data Export
- Debian Pure Blends taskfiles

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Feasible to remix and generate an overview tailored towards a particular audience

Visibility Issues

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But “raw” information is easily available

- Ultimate Debian Database and Debian Data Export
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Feasible to remix and generate an overview tailored towards a particular audience – without the need to maintain additional information elsewhere

http://neuro.debian.net

Table Of Contents

Welcome to the Debian Neuroscience Repository
- News
- How to use this repository
  - Package authentication
- Installation
  - Virtual Machine
  - Debian
- The Team
- Contact

Next topic

Frequently Asked Questions

Quick search

Go

Welcome to the Debian Neuroscience Repository

This repository provides mostly neuroscience-related packages to be used on Debian systems (or Debian-derivatives like Ubuntu). It contains both unofficial or prospective packages which are not (yet) available from the main Debian archive, as well as backported or simply rebuilt packages also available elsewhere. Please see the *Frequently Asked Questions* for more information about the goals of this project.

This service is provided “as is”. There is no guarantee that a package works as expected, so use them at your own risk. If you encounter problems, please report them.

Please *spread the word about NeuroDebian*, if you like it.

News

NeuroDebian Project

NeuroDebian

Packages for the new gifticlib release 1.0.9 available: http://neuro.debian.net/... (and others)
6 days ago

New nifticlib 2.0.0 -- fixed handling of large compressed NIfTI images: http://neuro.debian.net/...
6 days ago

Fresh FSL 4.1.6 is available: http://neuro.debian.net/... (and other packages)
18 days ago

New PyNIfTI bugfix release 0.20100607.1: http://neuro.debian.net/...
18 days ago

twitter Join the conversation

Table Of Contents

fsl – analysis tools for FMRI, MRI and DTI brain imaging
- Package Details
  - Package popularity
- Binary packages
  - NeuroDebian
  - Debian
  - Ubuntu
- Packages for the complete FSL suite
- Report bugs
- Additional information
  - Usage information
  - Upgrading from FSL 3.x
  - Building binary packages yourself
    - Advanced: Arch-dependend compiler flags
  - FSL benchmarks

Previous topic

fiji – The Fiji image processing suite (based on ImageJ)

Next topic

fsl-atlases – MNI152 standard space brain atlases

Quick search

Go

fsl – analysis tools for FMRI, MRI and DTI brain imaging

FSL is a comprehensive library of image analysis and statistical tools for fMRI, MRI and DTI brain imaging data. The suite consists of various commandline tools, as well as simple GUIs for its core analysis pipelines. Among others, FSL offers implementations of standard GLM analysis, white matter tractography, tissue segmentation, affine and non-linear co-registration, and independent component analysis.

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External links:

Citable reference:

> *S.M. Smith, M. Jenkinson, M.W. Woolrich, C.F. Beckmann, T.E.J. Behrens, H. Johansen-Berg, P.R. Bannister, M. De Luca, I. Drobnjak, D.E. Flitney, R. Niazy, J. Sanders, J. Vickers, Y. Zhang, N. De Stefano, J.M. Brady, P.M. Matthews* (2004). Advances in functional and structural MR image analysis and implementation as FSL NeuroImage, 23:208-219. (DOI)

Note: The software authors ask users to register. Available user statistics might be helpful to acquire funding for this project and therefore foster continued developement in the future.

Package Details

Package popularity

- Debian [1]: 170 (more info)
- Ubuntu[1]: 458
- NITRC[2]: 1051

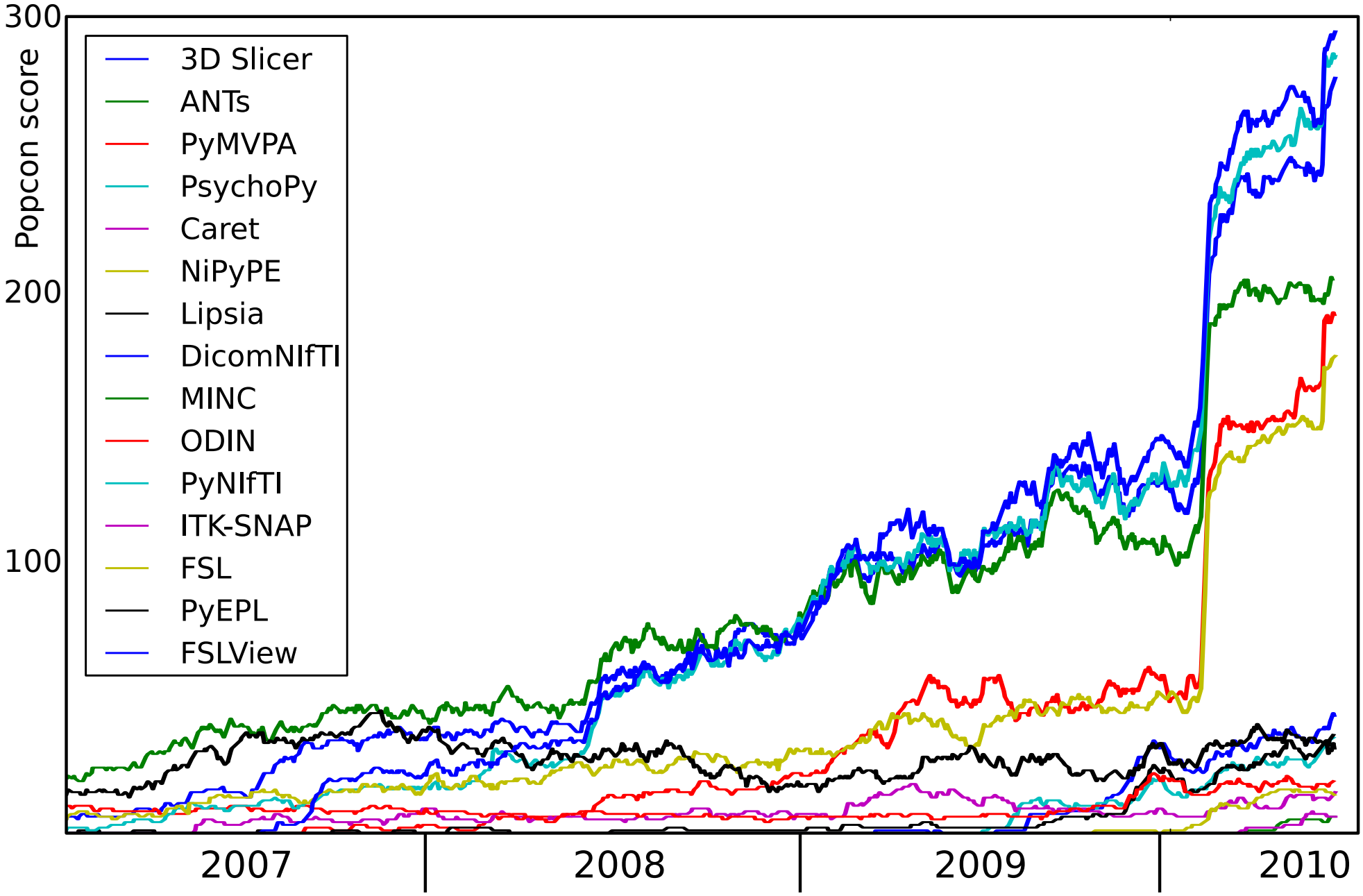
[1] *(1, 2)* Due to the nature of this data, the reported number can only be considered a conservative estimate of the lower bound of the true number of installations.

[2] This is the total number of downloads from NITRC for this software, comprising all releases for all platforms – typically not Debian packages.

Binary packages

NeuroDebian

Do people use it? (Debian)



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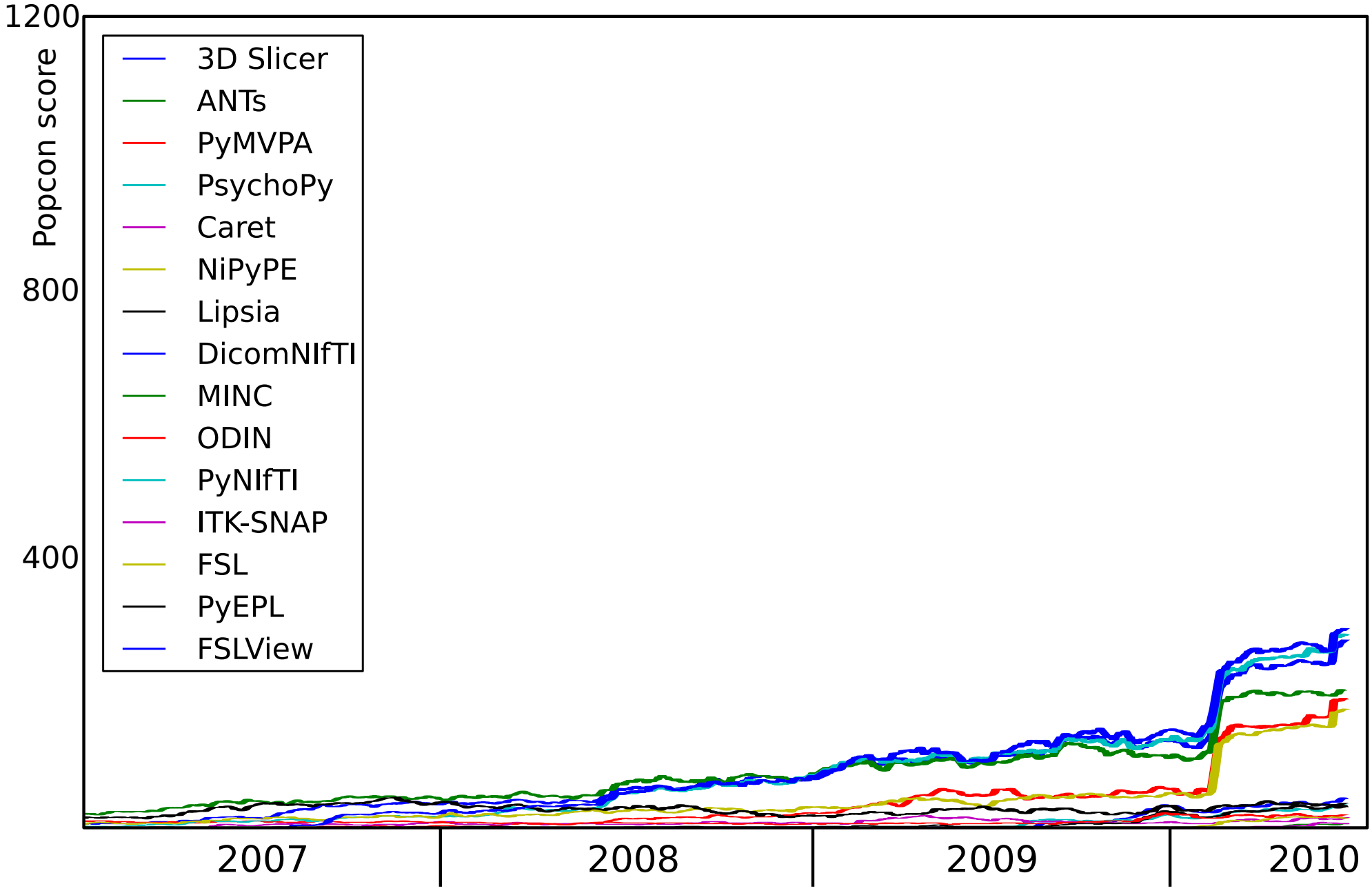
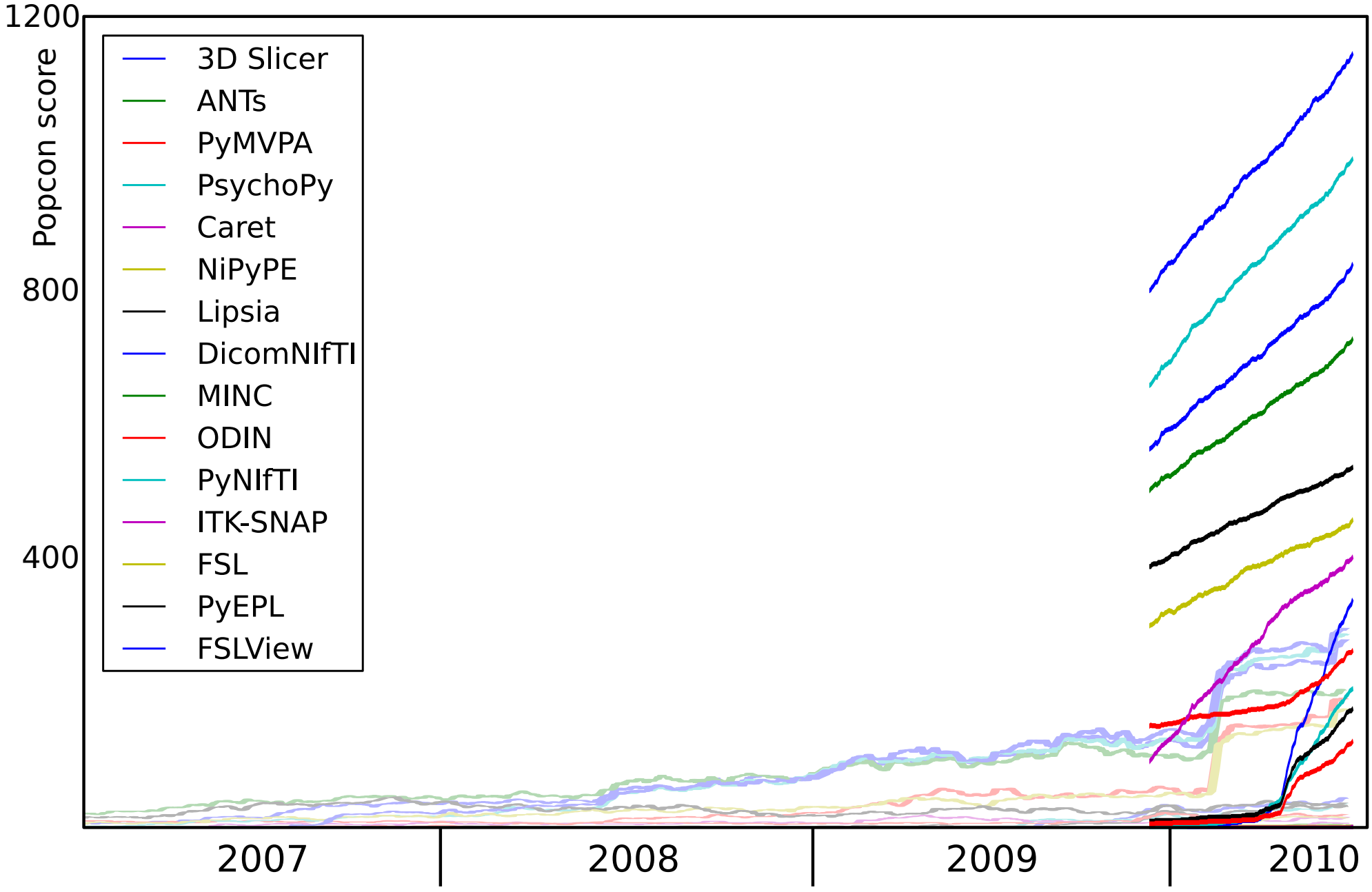


Do people use it? (Ubuntu)



The truth and nothing but. . .

Popcon: 1% of all users are do neuroimaging stuff

NITRC: 15% of neuroimaging researchers use GNU/Linux

50% of those use Debian(-derivatives)

The truth and nothing but. . .

Popcon: 1% of all users are do neuroimaging stuff

NITRC: 15% of neuroimaging researchers use GNU/Linux
50% of those use Debian(-derivatives)

That is not enough!

Intermediate conclusions

1. Need to have a repository!
2. Need for tailored presentations!

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        - NeuroDebian poster at CNS2010 in Montreal

> brilliant! . . . NeuroDebian lets you try out all the cool toys of neuroscience research with a very straightforward ease of use (esp. with the **virtual machine**). very nice...keep up the good work!
>
> Best part for me is that I can run it in a **VM** without having to worry about replacing my native OS.
>
> –Anonymous reviewers at `www.nitrc.org`

Intermediate conclusions

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Intermediate conclusions

1. Need to have a repository!
2. Need for tailored presentations!
3. Need to let people know and try!
4. Need to work together!

Debian

Image (C) by AngMoKio, CC-BY-SA 2.5

Developers

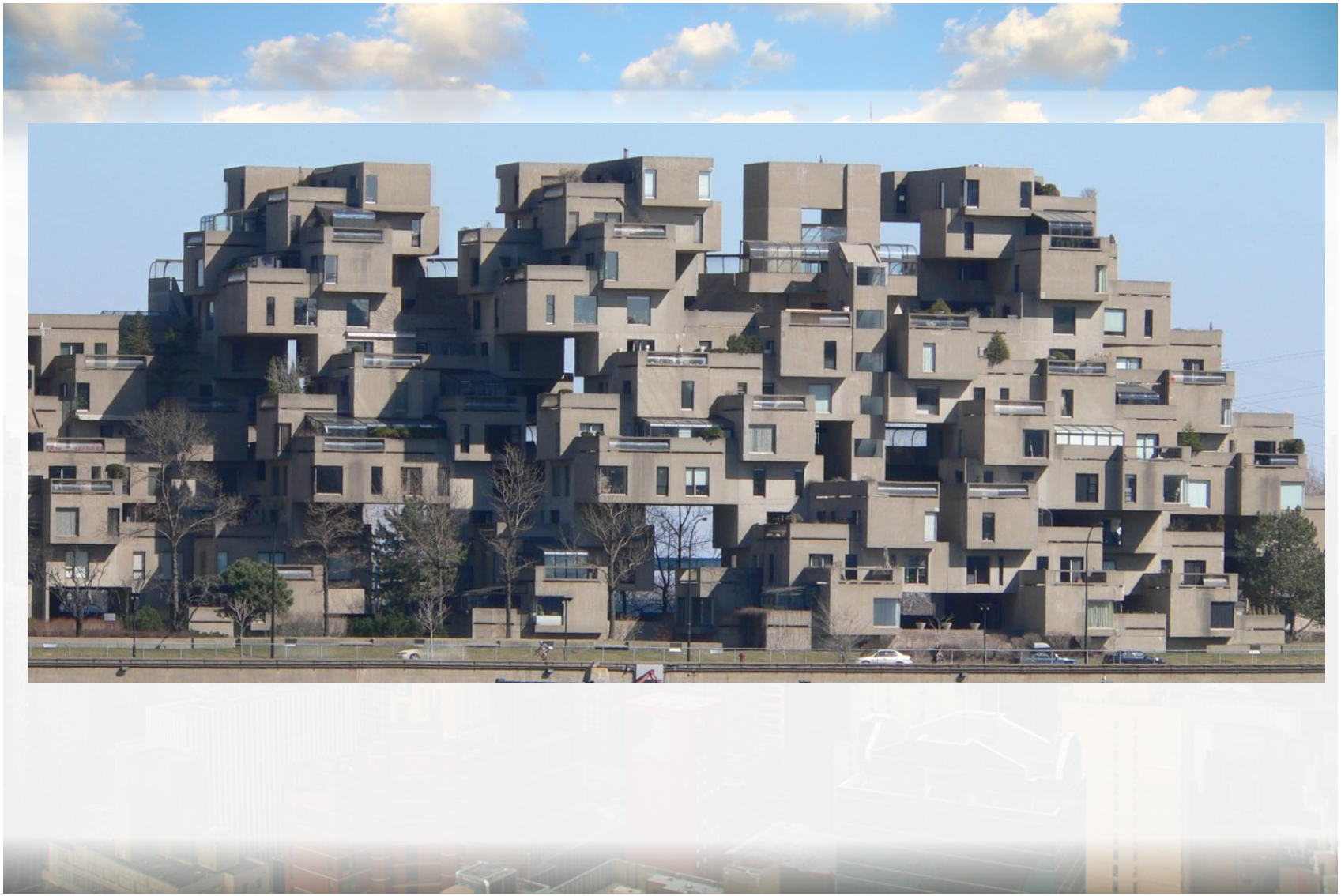
Image by Lewis Hine, 1930

Well-engineered software

Image by Lewis Hine, 1930

Image by Ad Meskens

Software



Debian Community

Image by Lewis Hine, 1930

Debian

Image (C) by AngMoKio, CC-BY-SA 2.5

Frequent pitfalls of scientific FLOSS

- Absent software engineering background or experience
- 1-man show or
  1-adviser show with 2-year rotation students
- Ivory tower development model
- Absent consistency in coding, structuring, versioning/releases
- Absent unit- and/or regression testing
- Illiteracy or confusion in licensing
- Lack of man-power for proper support

The Naked CIO: Is open source dead?

"Open source lacks **true and defined standards**, **best-of-breed capabilities**, **fully functional integration** and **knowledgeable staff to support it cost-effectively**."

---

http://www.silicon.com/management/cio-insights/2008/05/06/the-naked-cio-is-open-source-dead-39213367/

Debian in CIO eyes

~~Open source lacks~~Debian provides ~~true and~~clearly defined **standards**, best-of-breed **capabilities**, fully functional **integration**, robust delivery and maintnance **infrastructure**, and knowledgeable ~~staff~~community to **support** it cost-effectively.

Debian as an ecosystem

Debian provides an ecosystem with clearly defined **standards**, best-of-breed **capabilities**, fully functional **integration**, robust delivery and maintenance **infrastructure**, and knowledgeable community to **support** it cost-effectively.

Standards

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- *GNU-standards*

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ANTS-2 will follow ITK coding style and meet (Neuro)Debian distribution standards

–Brian Avants (ANTs)

Standards Capabilities

NIfTI-1

MINC

GIfTI

Vista

MGH

DICOM

python

>1k packages

SGE

Torque

GDCM

everything!

PsychoPy

PyEPL

MedCon

debian

3DSlicer

OpenMEEG

Lipsia

MRTRIX

Mayavi

Paraview

Caret

Praat

PyMVPA

NiPy(PE)

ANTs

VoxBo

ITK-SNAP

ODIN

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python

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Vist

CM

If you use Debian or Ubuntu, NeuroDebian is indispensable. Many of these tools are a huge hassle to install and maintain by hand.

PyE

–Anonymous reviewer at `www.nitrc.org`

G

ew

Praat

ANTs

VoxBo

ITK-SNAP

ODIN

Debian is not just the largest software archive, it is an ecosystem (symbiotic human/software being) regulated by the standards and common practices

- Uniform deployment mechanisms (installation, upgrades)
- Distribution-wide QA, transitions, BTS

Debian is the largest deployment facility with transparent facilities to reach the target audience in seconds

- archiving, delivery, transitions, snapshotting
- i18n
- buildd (diverse architectures), rebuilds

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- Taking deployment burden (and bugreports) away
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I have always found my friends Debian developers to be pretty good at getting me do boring but useful stuff.

–Gael Varoquaux (mayavi2, joblib, . . .)

Debian maintainers are deployment experts

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- Science Deployment Guide: `http://github.com/neurodebian/SciDeployGuide`

Standards Capabilities Integration Infrastructure Support

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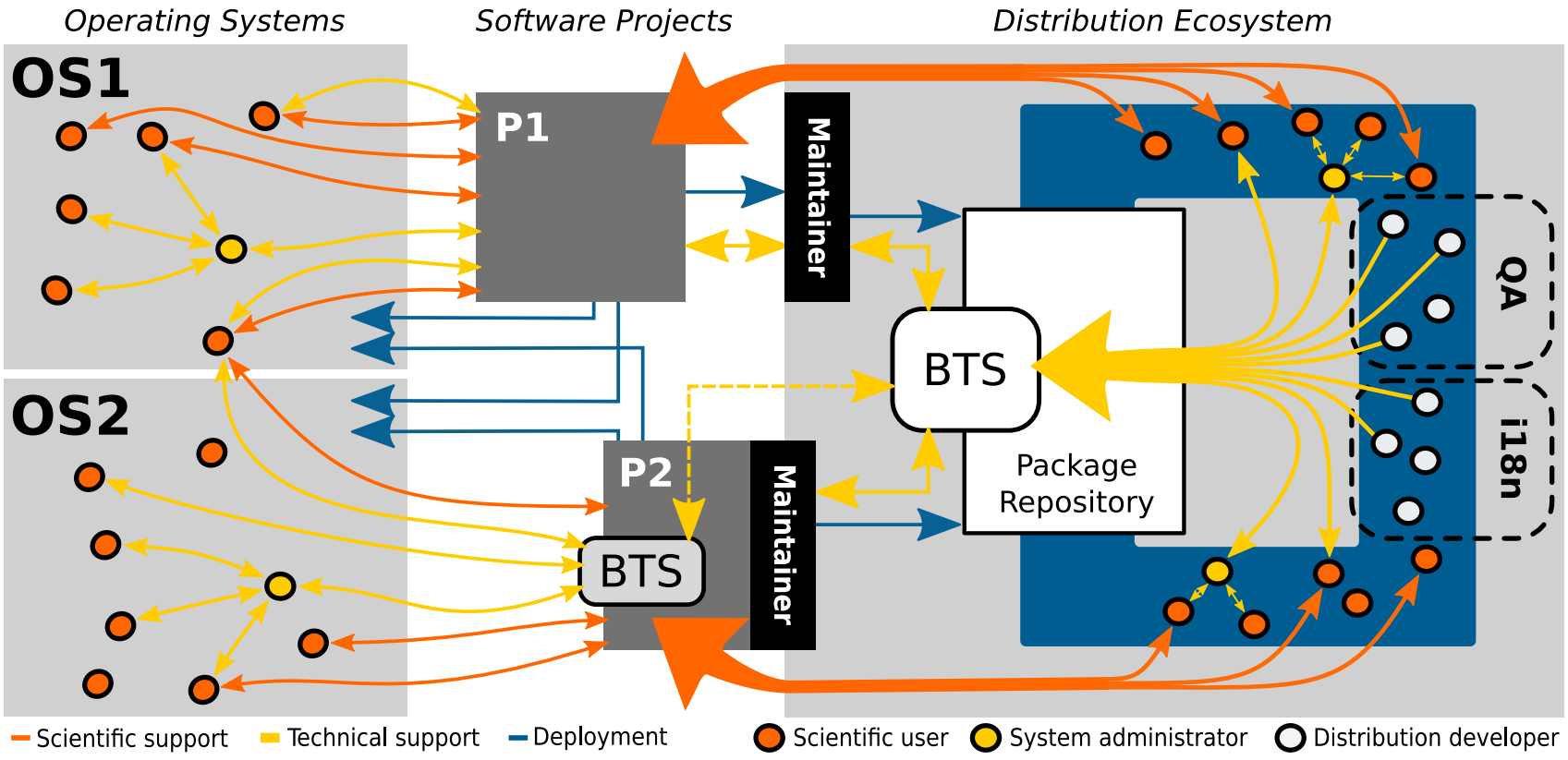

Conclusion

Debian is the ultimate platform for neuroimaging research because

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It got electrolytes

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Debian

- is rich and versatile
- is tailored toward neuroimaging research
- provides robust deployment infrastructure
- works together with upstream
- raises standards in scientific FLOSS

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- Better coverage of neuroscience software

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- Extended QA: Infrastructure for regression and heavy testing
- Further dissemination of Debian
  (Debian booths, papers)

Global Positioning Coordinates

Contact

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Brain Download:
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