**BrainVISA: an extensible software environment for neuroimaging data processing**

**Introduction**

BrainVISA is a modular and customizable software platform built to host heterogeneous tools dedicated to neuroimaging research. As it is extensible, it allows neuroimaging methodologists to share their data and processing tools. Several toolboxes have already been developed in various domains.

BrainVISA is developed by French government-funded research organizations (mainly CEA, INSERM, INRIA, CNRS) grouped in a federative research institute: IFR 49. It is a free and open-source software and can be downloaded from: [http://brainvisa.info](http://brainvisa.info).

**Methods**

BrainVISA Main features include:

- Harmonization of communications between different software.
- Ontology based data organization allowing databases sharing and automation of mass of data analysis.
- Interactive visualization of multimodal data using Anatomist, a software for 3D visualization and manipulation of structured objects.
- Automatic generation of graphical user interfaces.
- Workflow monitoring and easy data quality checking.
- Extensible and customizable.
- Runs on Linux, Mac and Windows.

Adding new functionalities to BrainVISA is a matter of writing small scripts in Python. BrainVISA processes may use any processing software, and can combine home-made algorithms, software contained within the core BrainVISA package, or third-party software (some toolboxes use FSL, SPM, nipy, R-project, etc.). Custom processes may be used either for quick and convenient developing and testing purposes, or for creating complete toolboxes. Recent developments in BrainVISA infrastructure have focused on modularity: a toolbox can now be a separate package which includes a set of processes, a data organization extension, documentation, and any needed software and data. Toolboxes may be distributed as separate add-on packages.

**Results**

BrainVISA infrastructure advantages have encouraged several teams to develop their own toolboxes.

Some toolboxes are included in BrainVISA package:

- **T1 MRI**: automatic segmentation of brain hemispheres and sulci from T1 MR images.
- **Sulci**: automatic sulci identification and object-based morphometry (Cachia, 2008).
- **Cortical Surface**: analysis of the cortical surface geometry and of functional data projected on this surface (Operto, 2008).
- **Connectomist**: Diffusion MR images analysis (DTI and Qball models) and fiber tracking.
- **BrainRat**: automated processing of histological and autoradiographic sections (A. Dubois, 2008).
Other toolboxes are external:

- **fMRI**: individual and group analysis of fMRI data.
- **MEEG**: visualization and analysis of MEG and EEG data (Barbot, 2005).
- **nuclear imaging**: PET images segmentation and analysis
- **RIC**: cortical measurements such as gyriﬁcation index or cortical thickness (Kochunov, 2005).
- **Odyssee-BrainVISA add-ons**: Inria tools for visualization and analysis of diffusion MRI data (Delmaire, 2009)
- **SACHA**: automatic segmentation of hippocampus

**Conclusion**

BrainVISA has now 8 years of maturity. It has been successfully used by various research groups and contributed achieving novel neuroscience results. Some studies use built-in functionalities: morphometry in psychiatry (Cachia, 2008), tractography in psychiatry (Houenou, 2007), pediatrics (J. Dubois, 2008), clinical and neurosurgical applications (Besson, 2008). Other applications use dedicated add-ons: diffusion in clinical applications (Delmaire, 2009), nuclear imaging (Kas, 2007), aging studies (Kochunov, 2005). See [http://brainvisa.info/biblio/en/index.html](http://brainvisa.info/biblio/en/index.html) for a list of publications relying on BrainVISA processings.

BrainVISA teams are now working to widen the fields of applications by encouraging the development of new independent toolboxes.

**References**


7. Dubois, J., Dehaene-Lambertz, G., Soarès, C., Cointepas, Y., Le Bihan, D. & Hertz-Pannier,


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**Figures**

![Diagram of brain imaging and analysis software interface.](image-url)