Archives of Neuroimaging Meta Analyses (ANIMA): a data sharing initiative

Andrew Reid[1], Danilo Bzdok[1,7], Sarah Genon[1,2], Robert Langner[1,2], Veronika Müller[1,2], Claudia Eickhoff[1,3], Felix Hoffstaedter[1,2], Edna Clarisse Cieslik[1,2], Angela Laird[4], Peter Fox[5], Katrin Amunts[1,6], Simon B. Eickhoff[1,2]

1. Institute for Neuroscience and Medicine (INM-1), Research Center Jülich, Jülich, Germany; 2. Institute of Clinical Neuroscience and Medical Psychology, Heinrich Heine University, Düsseldorf, Germany; 3. Department of Psychiatry, Psychotherapy and Psychosomatics, University Hospital Aachen, Aachen, Germany; 4. Florida International University, Miami, FL, USA; 5. The University of Texas Health Science Center, San Antonio, TX, USA; 6. C. and O. Vogt Institute for Brain Research, Heinrich Heine University Düsseldorf, Germany; 7. Parietal team, INRIA, Neurospin, bat 145, CEA Saclay, 91191 Gif-sur-Yvette, France

HEINRICH HEINE UNIVERSITÄT DÜSSELDORF

JÜLICH FORSCHUNGSZENTRUM

Introduction

- Databases of task-based fMRI results, such as **Brainmap.org** and **Neurosynth.org**, are commonly used for meta-analytic approaches, including activation likelihood estimation (ALE) [1] or meta-analytic connectivity modelling (MACM) [2].

- Results from such meta-analyses are often used for further research; for instance to define seed regions, volumetric masks, or as points of comparison for new results.

- The online **ANIMA** database (**http://anima.fz-juelich.de**) provides a means for researchers to share, query, and retrieve published meta-analytic results through an intuitive web interface.

- The accompanying stand-alone **Volume Viewer** application allows users to easily organize, visualize, and operate on downloaded ANIMA studies.
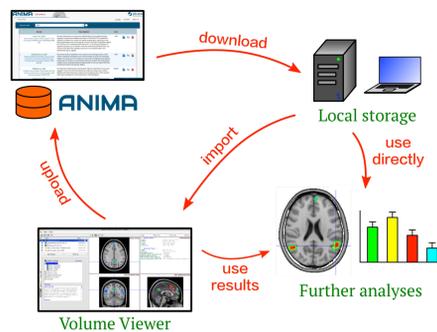
Click this QR code to visit the ANIMA site!

Concept

The ANIMA database was designed according to the following principles:

- **Freely available** to the community (no registration required unless you want to submit your data)

- **Intuitive interfaces** for retrieving, perusing, and submitting data

- **Accessible tools** for organizing, visualizing, and processing retrieved data (Volume Viewer software)

- Rich **data specification**, using standardized data formats

- **Provenance tracking** (versioning), allowing for proper referencing in journal articles

download
upload
import
Local storage
use directly
use results
Further analyses
Volume Viewer

Submitting Your Data

ANIMA [beta edition]

INSTRUCTIONS
QUERY   SUBMIT   ABOUT
LOGIN   STUDY   ELEMENTS   SUBMIT

Profile for Andrew Reid (andrew)

First name: Andrew
Last name: Reid
Country: Germany

New Study
Clear Study

On the **submit page**, users can register for an ANIMA account (above), and then submit data from their own published meta-analytic studies (below). Studies consist of metadata and individual data elements, which can be neuroimaging volume files, PDF or text documents, images, or Volume Viewer files.

Submitted studies are **reviewed** to ensure quality and suitability, and substantive changes are versioned to facilitate referencing.

ANIMA [beta edition]

INSTRUCTIONS
QUERY   SUBMIT   ABOUT
LOGIN   STUDY   ELEMENTS   SUBMIT

Enter a new study element

Name: Figure 1
Type: Volume file (nii, mnc, mgz)
Caption: Results that really explain stuff in terms of things.
File: excellent_results.nii.gz   Upload...

Add
Clear

Querying the Database

ANIMA [beta edition]

WELCOME
QUERY   SUBMIT   ABOUT

Search by author: Example Smith, jones   Sort by author A-Z   1-10 of 17

Study	Description	Size
Bzdok et al. 2012 — Parsing the neural correlates of moral cognition: ALE meta-analysis on morality, theory of mind, and empathy. *Brain Structure and Function*. 21(4): 783-96.	We tested the hypothesis that moral decisions might be implemented in brain areas engaged in "theory of mind" and empathy, by conducting a large-scale activation likelihood estimation (ALE) meta-analysis of neuroimaging studies, which assessed 2,607 peak coordinates from 247 experiments in 1,790 participants.	506.6K
Caspers et al., 2010 — ALE meta-analysis of action observation and imitation in the human brain. *NeuroImage*. 50: 1148-1167.	We investigated the neural correlates of action observation and imitation in the human brain, based on 139 functional image studies. For both types of task, bilateral networks were found. These did not only involve classic mirror neuron areas such as inferior frontal and inferior parietal cortex, but also dorsal premotor, superior parietal, posterior superior temporal and extrastriate visual areas. Additional analyses revealed the influence of effector used during the action, the instruction given to the subjects, and the visual aspect of objects used in the study.	1.9M

The **query page** (above) allows users to query, select, and download studies (**24** are presently available). Studies can be filtered by author, journal, publication date, and keywords. Detailed metadata can be perused for each study, and neuroimage elements can be viewed via the Papaya plugin (below).

ANIMA [beta edition]

STUDY INFORMATION
QUERY   SUBMIT   ABOUT
STUDY   ELEMENTS   VIEW

File   Options   aLPFC_FWE05

Figure 2A
MACM result for aLPFC
Quantity: T-statistic
Coordinate space: ICBM-152
Threshold method: FWE corrected

Volume Viewer

Volume Viewer is an **open source**, Java-based graphical user interface (GUI) for neuroimaging data, based upon the **ModelGUI** API [3]. Volume Viewer was designed to interact seamlessly with ANIMA data, through XML-format study files.

The Volume Viewer interface (above) offers numerous features:

- Organization of ANIMA studies into a **Library** panel

- Fast, intuitive **colour mapping** and **compositing** of multiple images

- Automatic **interpolation** into a common image space

- Availability of common **atlas** and **template** images with name mapping

- **Tools** for extracting "blobs", computing peaks and centroids, and performing mathematical operations

- Ability to save entire **sessions** and share as part of an ANIMA study

References

1. Eickhoff, S.B., Bzdok, D., Laird, A.R., Kurth, F., Fox, P.T., 2012. Activation likelihood estimation meta-analysis revisited. *Neuroimage* 59, 2349–2361.
2. Eickhoff, S.B., Bzdok, D., Laird, A.R., Roski, C., Caspers, S., Zilles, K., Fox, P.T., 2011. Co-activation patterns distinguish cortical modules, their connectivity and functional differentiation. *Neuroimage* 57, 938–949.
3. Reid A.T., Evans A.C. ModelGUI: an open-source, community-based approach to neuroscience software. *F1000Posters*. 6: 113 (poster)

Institute for Neuroscience and Medicine