

Collaborative curation of articles collections for meta-analyses in brain imaging: Brainspell-neo

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Authors:

Neel Somani¹, Sharabesh Ramesh¹, Anisha Keshavan², Roberto Toro³, Jean-Baptiste Poline⁴

Institutions:

¹University of California Berkeley, Berkeley, CA, ²University of Washington, Seattle, WA, ³Institut Pasteur, Paris, France, ⁴McGill University, Montréal, Quebec

Introduction:

Brain imaging generates on the order of thousands of articles per year, and it is likely that a majority of these are not well-powered, leading to possible replication issues [1,2,3]. To confirm results, a standard strategy is to perform meta analyses [5] using the results of similar studies to decide on the veracity of a specific result. A meta analysis therefore requires gathering a collection of articles with similar protocols and co-analyzing their results. These article collections need to be manually curated by one or a few individuals, generally in the same laboratory. However, this process is faster when realized by a group of distributed curators, and the curation benefits from discussions and a consensus decision, which is most efficiently done in a distributed manner through the web. We present Brainspell-neo, an evolution of the Brainspell software initially developed by R. Toro at the Pasteur Institute. Both versions leverage the Neurosynth database [4] and allow users to add new articles and curate existing literature. Brainspell-neo takes three directions: 1) a more modern software architecture, 2) an extension of functionalities for the curation of collections of articles, and 3) the use of a new front-end framework.

Methods:

We considered two refactorizations: one with the MEAN stack (MongoDB, ExpressJS, AngularJS, and Node), and another with a Python framework like Flask. A Python framework had the advantages that we could easily incorporate existing machine learning and data analysis libraries (eg. nilean, nipy), which didn't necessarily have a counterpart in Javascript. Initially we deployed a Flask server to an Amazon Web Services instance of Red Hat Enterprise Linux, to get started on development. We realized that we might also need to eventually incorporate WebSockets (e.g., when a user makes a long search or processing request) and therefore switched from the Flask to the Tornado framework. We also moved from AWS to Heroku using Git deployment for cost considerations. For the backend database, we needed an effective full-text search, since a key functionality of the project is to allow users to search through the annotated literature. We considered search engine libraries like Apache or Lucene/Solr, but found that Postgres offers full text search, which was appropriate for our needs. To migrate the database from MySQL to Postgres, we used Pentaho Kettle and hosted the DB on AWS. To modularize the database operations, we used the PeeWee ORM in Python. We separated the JSON API from the user interface, which makes asynchronous requests to the API.

Results:

The current design showed an improvement in performance, implemented the concept of collections of articles, and made it easier for new contributors to contribute to the code base. For instance, the search page was more than two times quicker even through a free tier Heroku). In addition, a collection of articles is version controlled through integration with GitHub, enabling researchers to collaborate on collections in the same way that software developers collaborate on code. In figure 1, we present a snapshot of the current of brainspell-neo interface and in figure 2, an example of a query through the API.

Brainspell

An open, human-curated classification of neuroimaging literature.

Add to Github Collections:

× 10-vision-papers

The role of multiple contralesional motor areas for complex hand movements after internal capsular lesion.

Lotze M, Markert J, Sauseng P, Hoppe J, Plewnia C, Gerloff C

Imaging techniques document enhanced activity in multiple motor areas of the damaged and contralesional (intact) hemisphere (CON-H) after stroke. In the subacute stage, increased activity within motor areas in the CON-H during simple movements of the affected hand has been shown to correlate with poorer motor outcome. For those patients in the chronic stage who recovered well, the functional relevance of an increased activation within the CON-H is unclear. Using trains of repetitive transcranial magnetic stimulation (TMS) during performance of complex finger movements, we tested the behavioral relevance of regional functional magnetic resonance imaging (fMRI) activation within the CON-H for sequential finger movement performance of the recovered hand in seven patients who had experienced a

subcortical stroke. TMS was navigated over fMRI activation maxima within anatomically preselected regions of the CON-H, and effects were compared with those of healthy controls. Stimulation over the dorsal premotor cortex (dPMC), the primary motor cortex (M1), and the superior parietal lobe (SPL) resulted in significant interference with recovered performance in patients. Interference with the dPMC and M1 induced timing errors only, SPL stimulation caused both timing and accuracy deficits. The present results argue for a persistent beneficial role of the dPMC, M1, and SPL of the CON-H on some aspects of effectively recovered complex motor behavior after subcortical stroke.

[PubMed](#) | [Add Table from Text File](#)

MeSH descriptors:

[Aged](#) [Fingers](#) [Functional Laterality](#) [Hand](#) [Hemiplegia](#) [Humans](#) [Male](#) [Middle Aged](#) [Motor Activity](#) [Motor Cortex](#) [Add MeSH descriptor](#)

User descriptors:

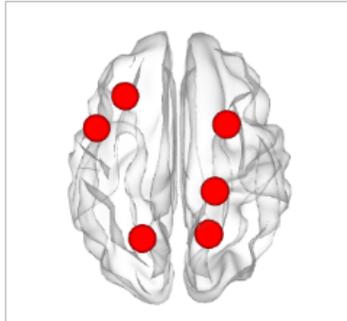
Add descriptor

Stereotaxic space: MNI Talairach

Number of subjects:

No Title

i, ipsilateral to the hand moved; c, contralateral to the hand moved; MNI, Montreal Neurological Institute.



X	Y	Z	Z-effective
-27	18	57	
24	3	63	
-18	-54	60	
15	-51	66	
18	-30	66	

Delete Row Split Table Flag Table
Cognitive: Behavioral: Tasks:

Figure 1: Screenshot of the Brainspell-neo interface

Query

Search Brainspell's database

<https://brainspell.herokuapp.com/json/query>

GET parameters:

- q:** a search query, like you would type into Brainspell's search bar
- start:** (default: 0) the number of results to offset by. The search endpoint gives ten results at a time. If you want results 11 - 20, then you would pass start = 10
- req:** (default: t) the type of search. (Options: t = title, author, and abstract; x = experiments; p = PubMed ID; r = reference)

Response format:

- articles:** an array containing one element per article, each consisting of a title, id, and authors
- start_index:** the offset of the first article; if there are no articles left, then start_index will equal -1.

JSON Raw Data Headers

Save Copy Filter JSON

```

success: 1
title: "Pediatric OCD structural brain deficits in conflict monitoring circuits: a voxel-based morphometry study."
id: 6043
abstract: "The aim of this study is to use a voxel-based morphometry protocol to compare the brains of 18 children with obsessive-compulsive disorder (OCD) with those of a healthy group matched for gender and handedness. Images were acquired with a 1.5-T MRI scanner, spatially normalized, and segmented with an optimized voxel-based morphometry protocol. OCD children presented a 5.93% reduction of gray matter (GM) total volume in comparison with control brains. We identified OCD brain volume reductions in regions that have been extensively related to action monitoring and error signaling processes. Specifically, we found decreased bilateral GM in frontal (significant after Family Wise Error (FWE), multiple comparisons correction) and cingulate regions as well as decreased white matter (WM) in bilateral frontal and right parietal (p<0.001 uncorrected). Additionally, we found a negative correlation between symptom severity and bilateral hippocampal GM-volume (p<0.001 uncorrected) as well as a positive correlation between age and GM left caudate volume (p=0.037 FWE small volume corrected) in the OCD group. As a conclusion, our results point to conflict monitoring structural brain regions as primary deficits in pediatric OCD, and to striatal abnormalities as age-related deficits."
authors: "Carmona S,Bassas N,Rovira M,Gispert JD,Soliva JC,Prado N,Tomas J,Bulbena A,Villarroya O"
timestamp: null
neurosynthid: "2757"
pmid: "17573192"
                    
```

Response

Figure 2: Screenshot of the Brainspell-neo API

Conclusions:

We are currently working to 1) merge the two versions of Brainspell, 2) test the new implementation on an example of a meta analysis, and 3) implement basic meta analyses as found in current software such as ALE and GingerALE [6]. Based on its current capacities and architecture, brainspell/-neo will be a key tool for collaborative brain imaging meta-analyses in the near future.

Informatics:

Databasing and Data Sharing ¹

Informatics Other ²

Modeling and Analysis Methods:

Other Methods

Keywords:

Computing

Informatics

Meta- Analysis

Modeling

MRI

Positron Emission Tomography (PET)

Statistical Methods