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

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Introduction:

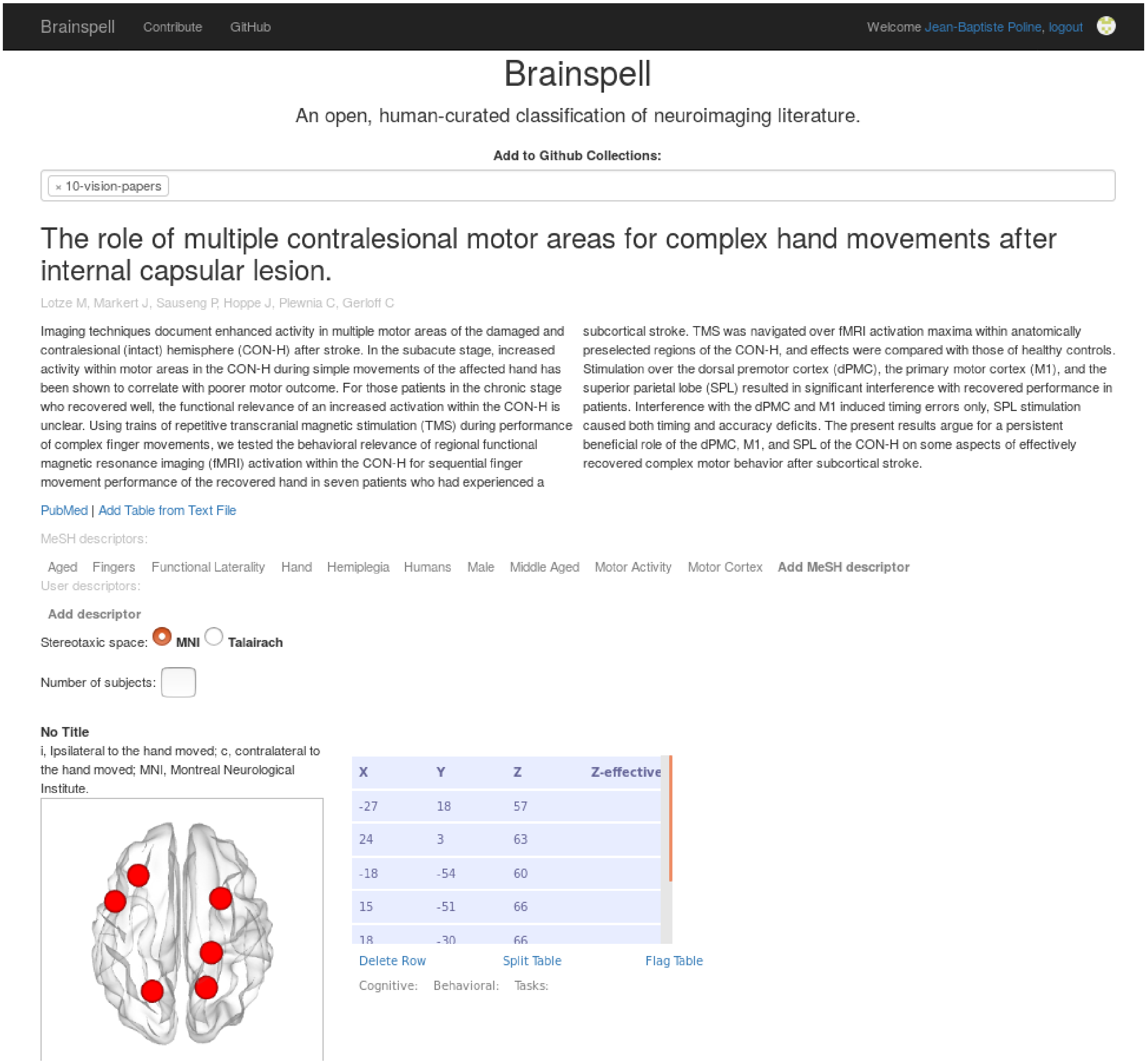
Brain imaging generates on the order of thousands of articles per year, and it is likely that a majority of these are not well-powered, leading to possible replication issues [1,2,3]. To confirm results, a standard strategy is to perform meta analyses [5] using the results of similar studies to decide 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:

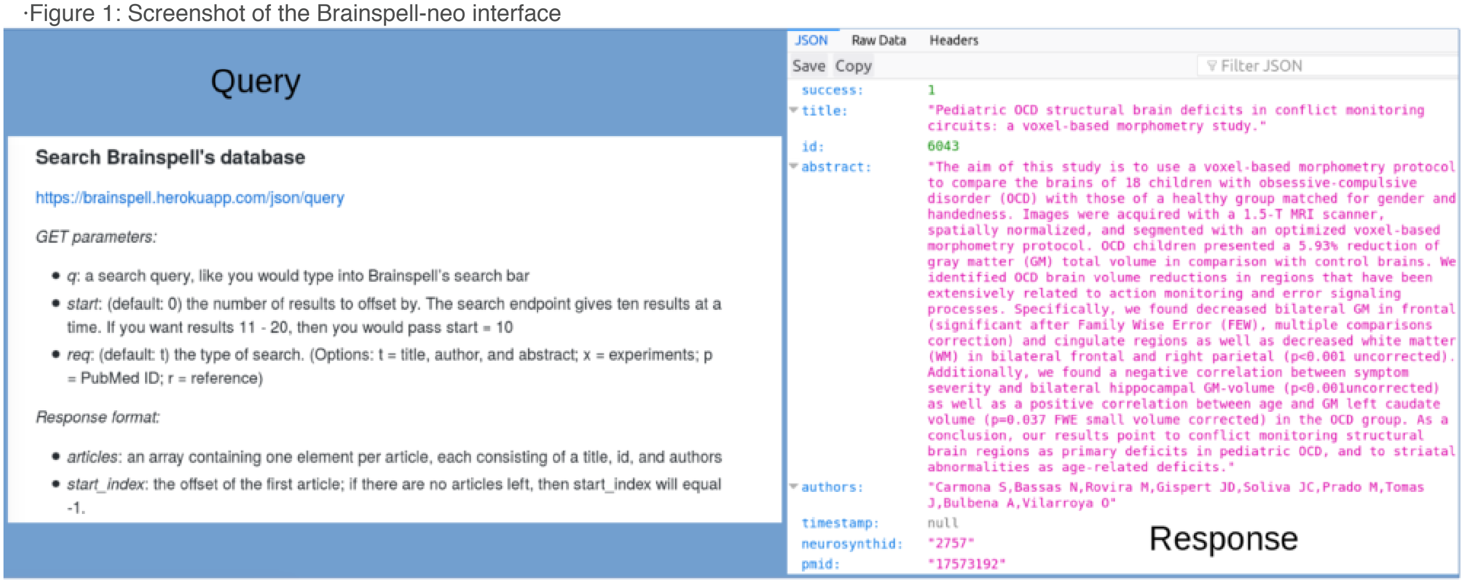
We considered two refactorizations: one with the MEAN stack (MongoDB, ExpressJS, AngularJS, and Node), and another with a Python framework like Flask. A Python framework had the advantages that we could easily incorporate existing machine learning and data analysis libraries (eg. nilean, nipy), which 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.



·Figure 1: Screenshot of the Brainspell-neo interface



·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

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