Reading and displaying standardised neuroimaging results in a user-friendly environment

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Abstract

There is increased interest in the neuroimaging community to record data provenance, i.e. all steps leading to the creation of a dataset, in order to improve transparency and reproducibility of studies.

The NIDM-Results specification provides a software-independent standardised format for representing neuroimaging results. But currently, there is no mechanism to read this format from the standard neuroimaging tools. Here, we introduce an NIDM-Results viewer for SPM, publically available at: https://github.com/incf-nidash/nidmresults-spmhtml

Introduction

A growing number of efforts are emerging in the neuroimaging community to increase reproducibility of research findings (e.g.[1,2]). One such effort is the NIDASH (Neuroimaging Data Sharing) group of the International Neuroinformatics Coordinating Facility (INCF)[3]. In an attempt to standardise neuroimaging results, NIDASH has specified an outline for data storage in the form of NIDM (the Neuroimaging Data Model). The focus of our development is NIDM-Results [4,5], the component representing statistical data produced by mass-univariate neuroimaging analysis.

In a typical neuroimaging experiment, results are usually displayed using internal functions of the software package used to perform the analysis. For example the neuroimaging software packages Statistical Parametric Mapping (SPM)[6,7] and FMRIB Software Library (FSL)[8,9] display their results respectively as a Matlab figure and as a series of HTML files.

Currently NIDM-Results "packs" can be generated from SPM and FSL. Whilst the NIDM-Results specification provides a standardised representation of neuroimaging results in a software-independent fashion, at the moment few tools exist to read and display NIDM-Results. This is still hindering the distribution and acceptance of NIDM within the neuroimaging community.

In this work, we targeted the most widely-used neuroimaging analysis software, SPM and included reading capability for NIDM-Results packs. This allows SPM users to visualise NIDM documents in their usual environment and also facilitate communication across software packages.

Methods

Using a publicly available set of NIDM-Results packs generated with SPM and FSL and designed to cover the main use-cases of fMRI analyses[10,11], we created a HTML based display for NIDM-Results using the SPM layout.

A NIDM-Results pack consists of a turtle file, which stores provenance information, alongside several brain images and csv files. To the best of our knowledge, there is no SPARQL query engine for Matlab (on which SPM is based) on which we could have based our tool to query the information included in the turtle file. To circumvent this issue, we relied on a json serialisation converted from the NIDM-Results turtle file with the RDF translator[12].

Results

The viewer is publicly available at https://github.com/incf-nidash/nidmresults-spmhtml. Figure 1 presents sample results page for an example FSL and SPM studies respectively.
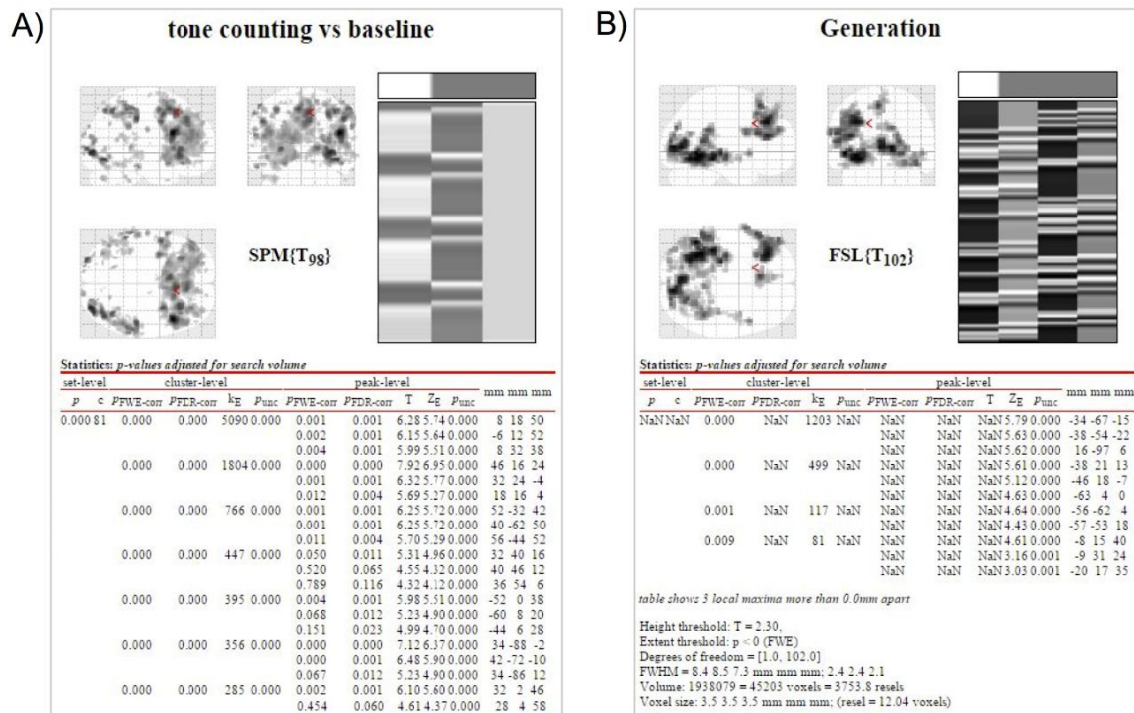

Figure 1: Examples of display for (A) the SPM dataset "ex_spm_default" and (B) the FSL dataset "fsl_full_examples001", both datasets are available in [10].

Discussions & Conclusion

The viewer was tested on 6 datasets of our test data repository[10]. In the future, we plan on extending the viewer to display any NIDM-Results document, and in particular, all the example datasets available.

This work is part of a growing ecosystem of tools for NIDM-Results (e.g. NIDM-Results viewer for FSL[13]). Our main aim is to integrate NIDM format across all mainstream

neuroimaging software to allow widespread usage and recording of provenance. We hope that the viewer will facilitate adoption of the NIDM-Result format and support sharing of statistical results in the neuroimaging community.

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