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Brainomics - A management system for exploring and merging heterogeneous brain mapping data

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Introduction

- Number of large datasets for brain mapping have been released [1, 2].
- Neuroimaging datasets more routinely include clinical data or genetics data.
- Exploitation requires
 - An efficient organization to integrate all the

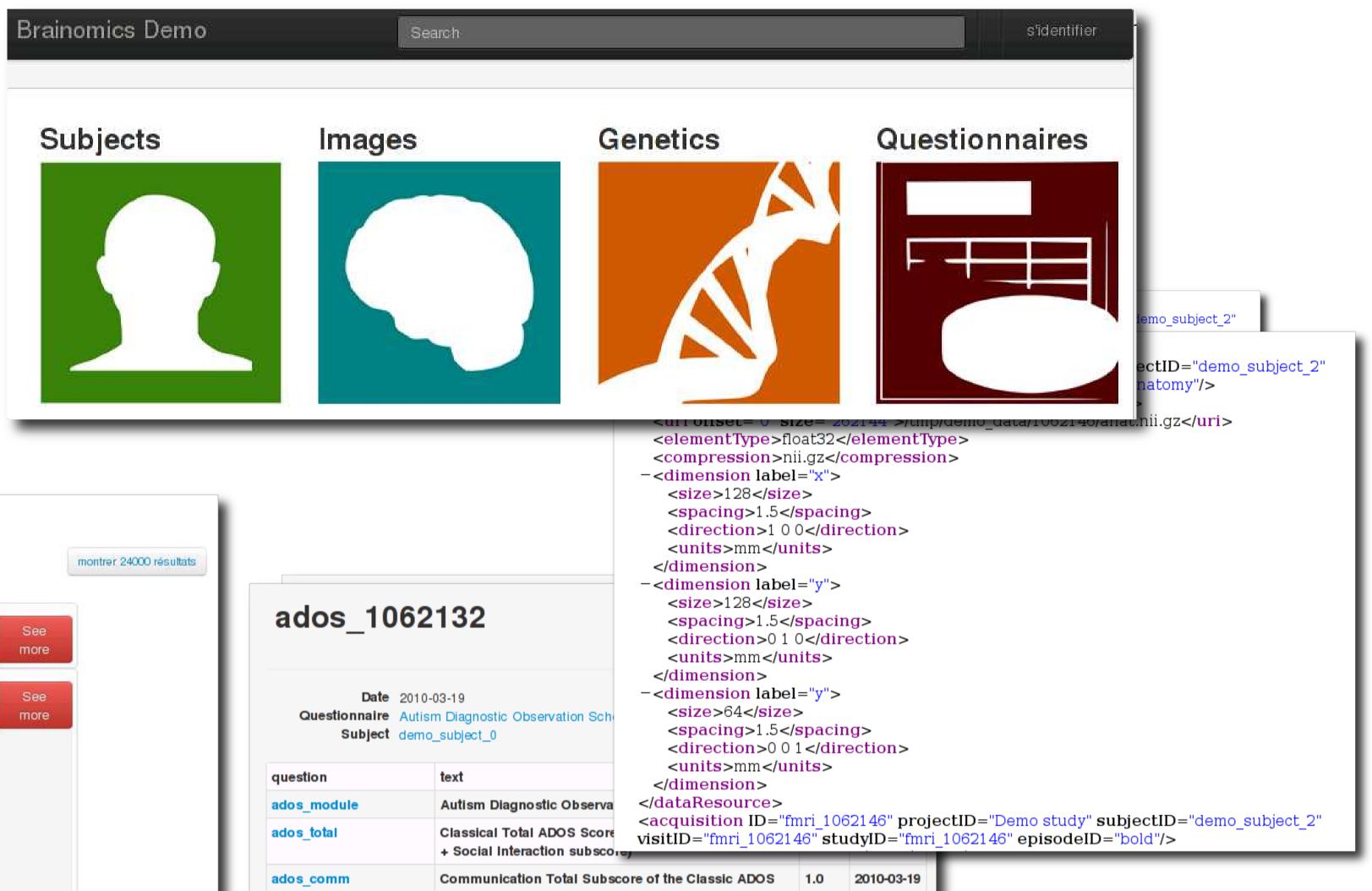
http://www.brainomics.net/demo/

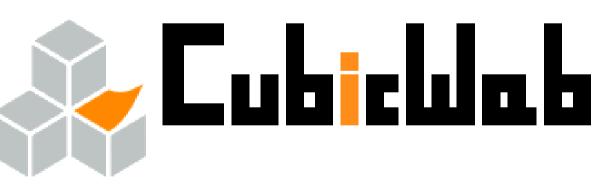
• Brings together brain imaging and genetics data. • Relies on a high-level query language (RQL). • Solution based on **CubicWeb**, a semantic framework. • Visualizing / exporting data in several formats.

measures

An easy access to the relevant information. Neuroimaging [3] and genomics[4] databases are dedicated to their own field of research.

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http://www.cubicweb.org/

✓ Data management framework, 10 years of industrial uses (e.g. [5]). Well established core technologies: SQL, Python, HTML5, Javascript. Licensed under LGPL since 2008.

✓ Used in production environments since 2005.

Fine-grained security system coupled to the data model definition. Migration mechanisms controls model version / ensures data integrity.

Data model

Described in Python, using reusable modules called "cubes". Modelisation of Scans, Questionnaires, Genomics results, Behavioral results, Subjects and Studies information. \checkmark Data model optimized for large volumes (> 2000 subjects). \checkmark Tested with several publicly available datasets [1, 2].

Query using RQL

✓ Similar to the W3C's SPARQL [6].

- Supports the basic operations (selection, insertion, etc.).
- Subquerying, ordering, couting, …

Query all the female subjects of the database, with an age greater than 3

Any S WHERE S is Subject, S age > 30, S gender "female"

Query all the Cmap scans of subjects with an age greater than 25, and that have a score greater than 4.0 for the "algebre" question

Any SA WHERE S is Subject, S age > 25, X is QuestionnaireRun, X concerns S, A is Answer, A questionnaire run X, A question Q, Q text "algebre", A value > 4, SA is Scan, SA concerns S, SA type "c map"

Each query result can be seen using different views. Views ✓HTML pages, ZIP files, spreadsheets, XCEDE XML, … \checkmark May include processing (stat. maps computed on the fly).

Conclusion

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Open source solution to manage brain imaging datasets and associated meta data. • Powerful querying and reporting tool, customized for emerging imaging-genetics field.

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■[1] http://openfmri.org/data-sets [2] fcon_1000.projects.nitrc.org/indi/abide/ ■[3] Olsen, M.D. (2007). The extensible neuroimaging archive toolkit. Neuroinformatics 5, 11–33

[4] Vallon-Christersson, J. (2009). 'BASE - 2nd generation software for microarray data management and analysis' [5] Publishing bibliographic records on the Web of data: opportunities for the BnF (French national Library). ESWC 2013 [6] http://www.w3.org/TR/rdf-sparql-query/