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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 measures
  - An easy access to the relevant information.

Data model

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

Conclusion

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

Query using RQL

- Similar to the W3C’s SPARQL [6].
- Supports the basic operations (selection, insertion, etc.).
- Subquerying, ordering, counting, ...

Query all the female subjects of the database, with an age greater than 30

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"

Views

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

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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.

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.

References

- [2] fcon_1000.projects.nitrc.org/indi/abide/
- [5] Publishing bibliographic records on the Web of data: opportunities for the BnF (French national Library). ESWC 2013

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