Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Building conceptual spaces for exploring and linking biomedical resources

R. Berlanga, E. Jiménez-Ruiz, and V. Nebot
Departamento de Lenguajes y Sistemas Informaticos
Universitat Jaume I, Spain

Semantic Web Applications and Tools for Life Sciences, Berlin, December 10th, 2010

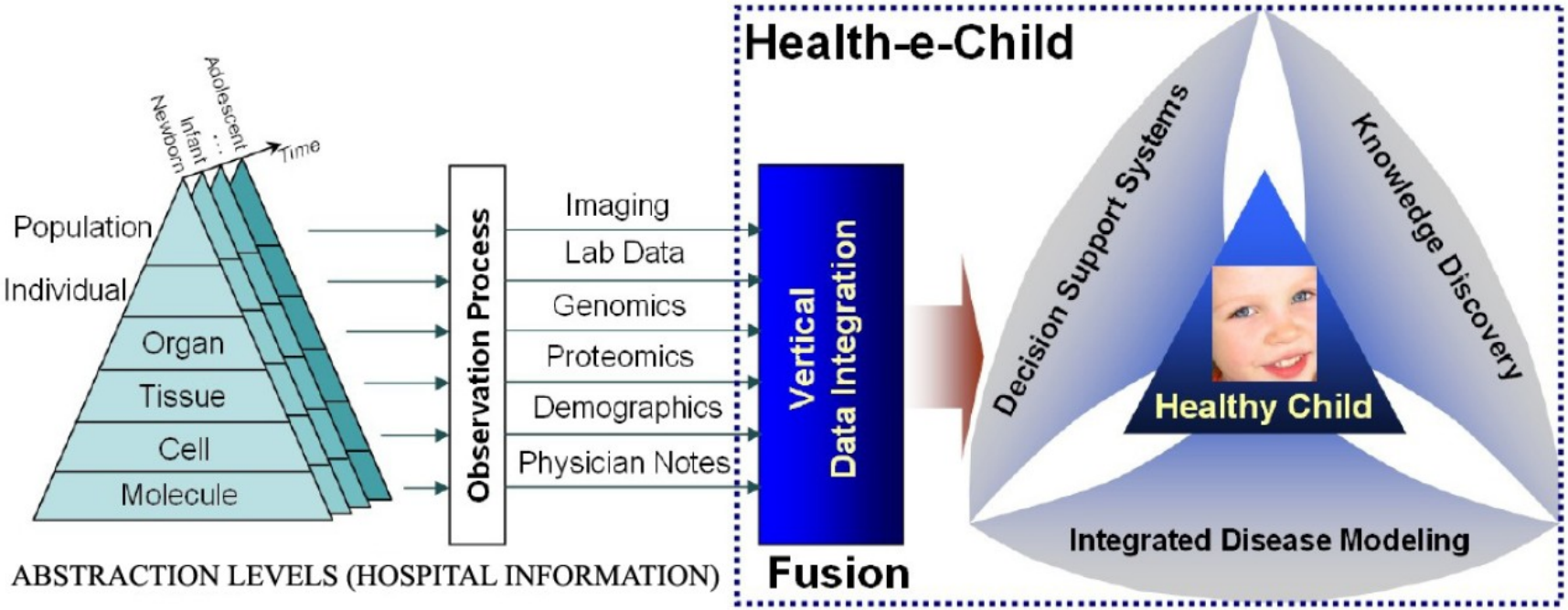
Outline

- Motivation
- Method
- Prototype Implementation
- Related Work

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Motivation: HeC



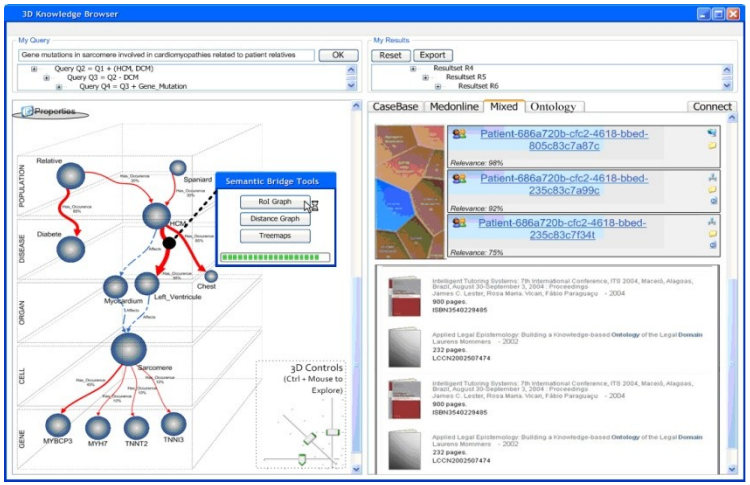
Motivation

- Linking, accessing and using
  - Biomedical terminologies (e.g. UMLS, Swissprot)
  - Text resources (e.g. Pubmed abstracts)
  - Patient data
- Providing an everyday environment
  - Clinicians use a web browser (IE or FF) to find papers/search public databases for information

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Proposal: 3D Knowledge Browser

- An interactive Web-based and 3D-like tool
- To explore Semantic Spaces
- To access external resources and patient data



Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Knowledge Normalization

- **UMLS** has been selected as the knowledge source to feed the **semantic/concept spaces**
- UMLS concepts are partitioned in several **dimensions** according their **semantic type** and the **HeC Levels**
- UMLS taxonomy is indexed using an interval-based **labelling schema**
  - *Nebot and Berlanga. Efficient retrieval of ontology fragments using an interval-based labelling scheme. 2009*

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

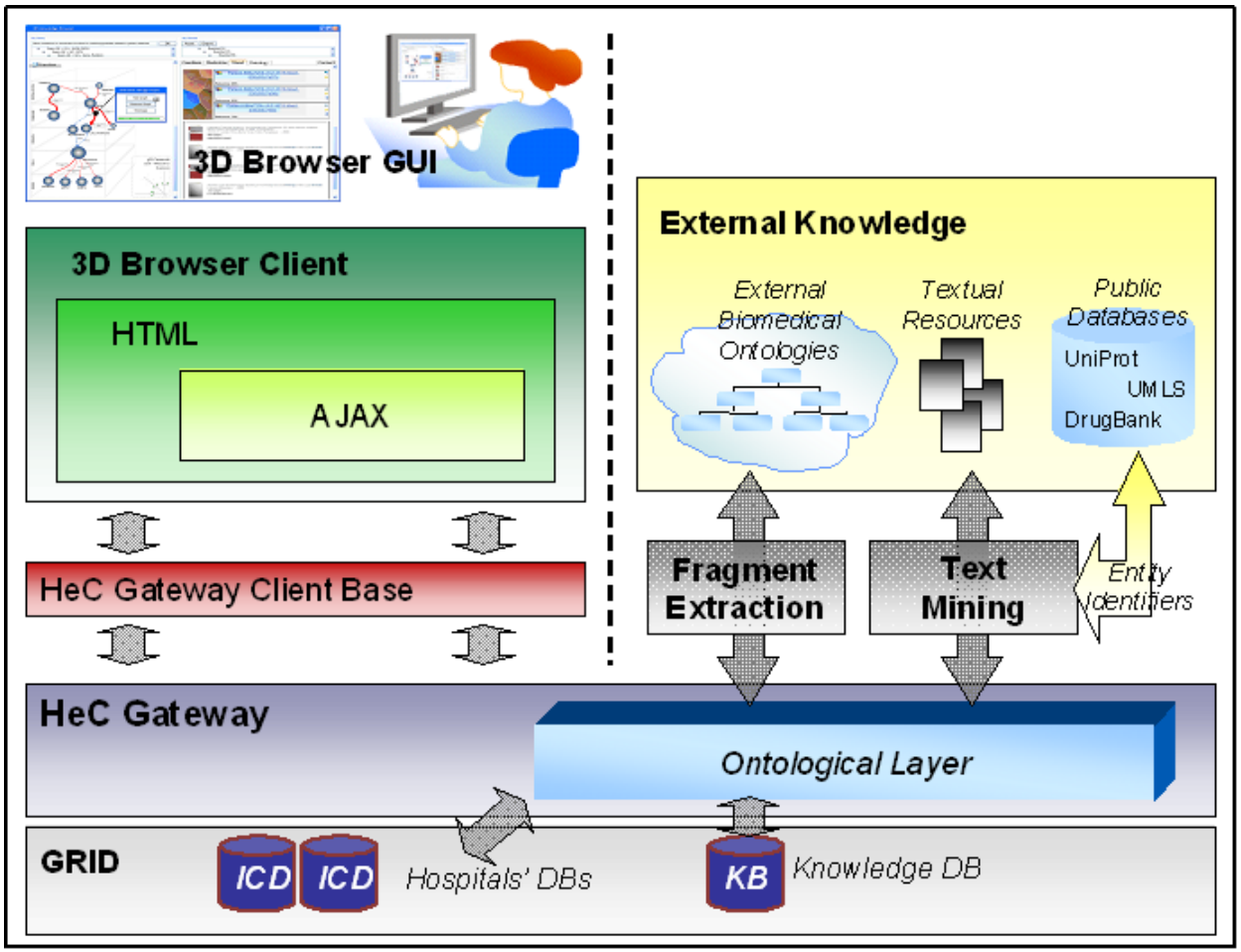
Normalization of Resources

- Documents are annotated using UMLS terms
  - *Berlanga, Nebot and Jimenez-Ruiz. "Semantic annotations of texts through concept retrieval". 2010*
- Documents are normalized with the **most relevant concept** for each selected dimension
- Example:
  - Individual.Disease→ C1384600:JIA
  - Molecular.InmunologicFactor→ C0021760:IL6
  - Population.Group→ C0007457:Caucasoid Race

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Prototype Architecture (I)



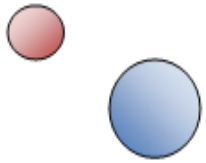
Prototype Architecture (II)

- The Graphical Engine propagates actions to the AJAX wrapper to perform the necessary queries
- A Web Service fetches queries from the AJAX side (graphical side) to the back-end (MySQL)
- then transforms the received data into XML format
- The GE takes as input that XML document with the graphical elements to draw.

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

3D Map Objects

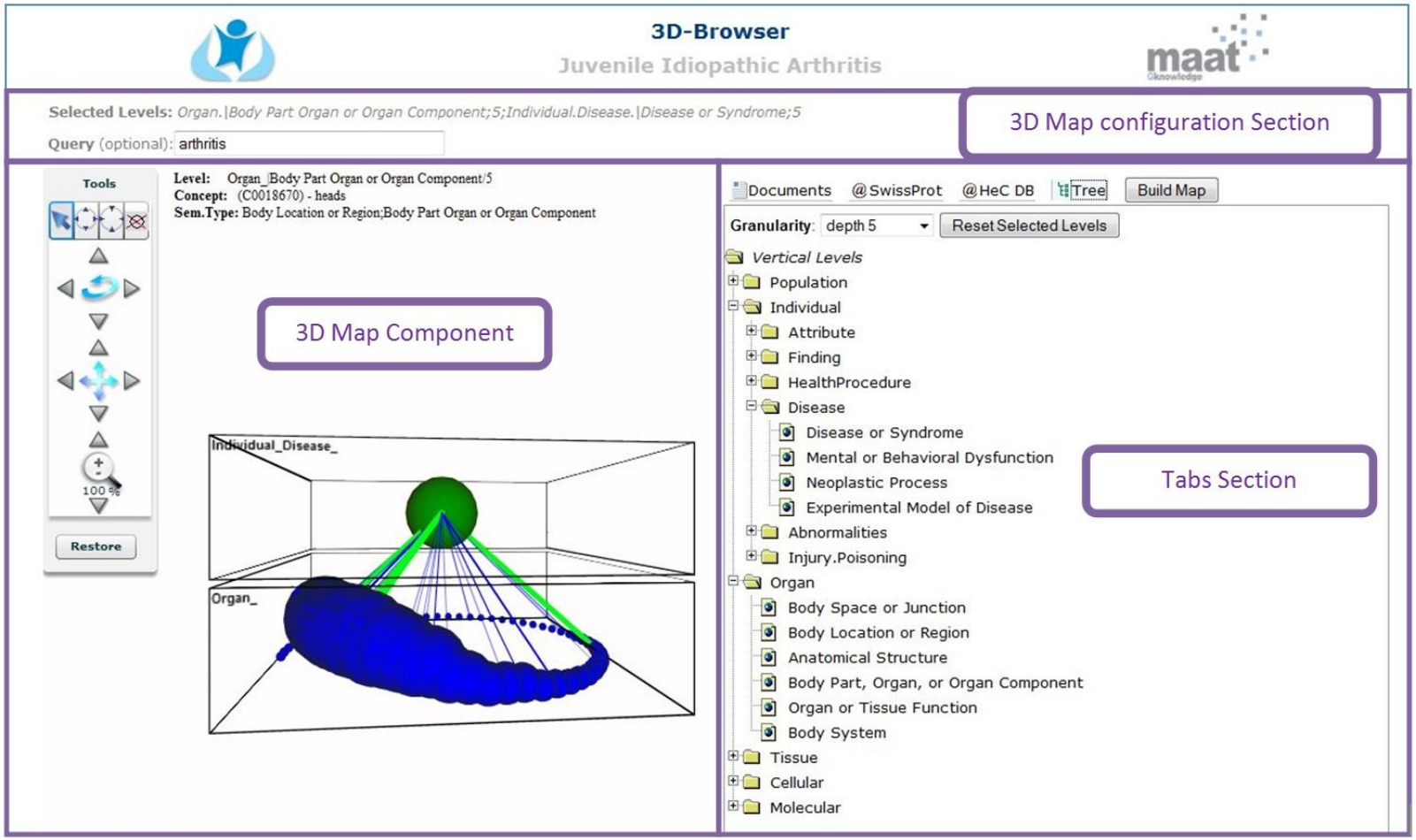
Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

ELEMENT	NAME
	Level or Semantic Layer
	Concept
	Semantic Bridge

```
<map>
(…)
  <element type='vlevel'
  id='Population_'/>
  <element type='concept'
  id='C0454713'
  label='European country'
  level='Population_' size='79'
  abslevel='3' color='blue'
  stype='Geographic Area'/>
(…)
</map>
```

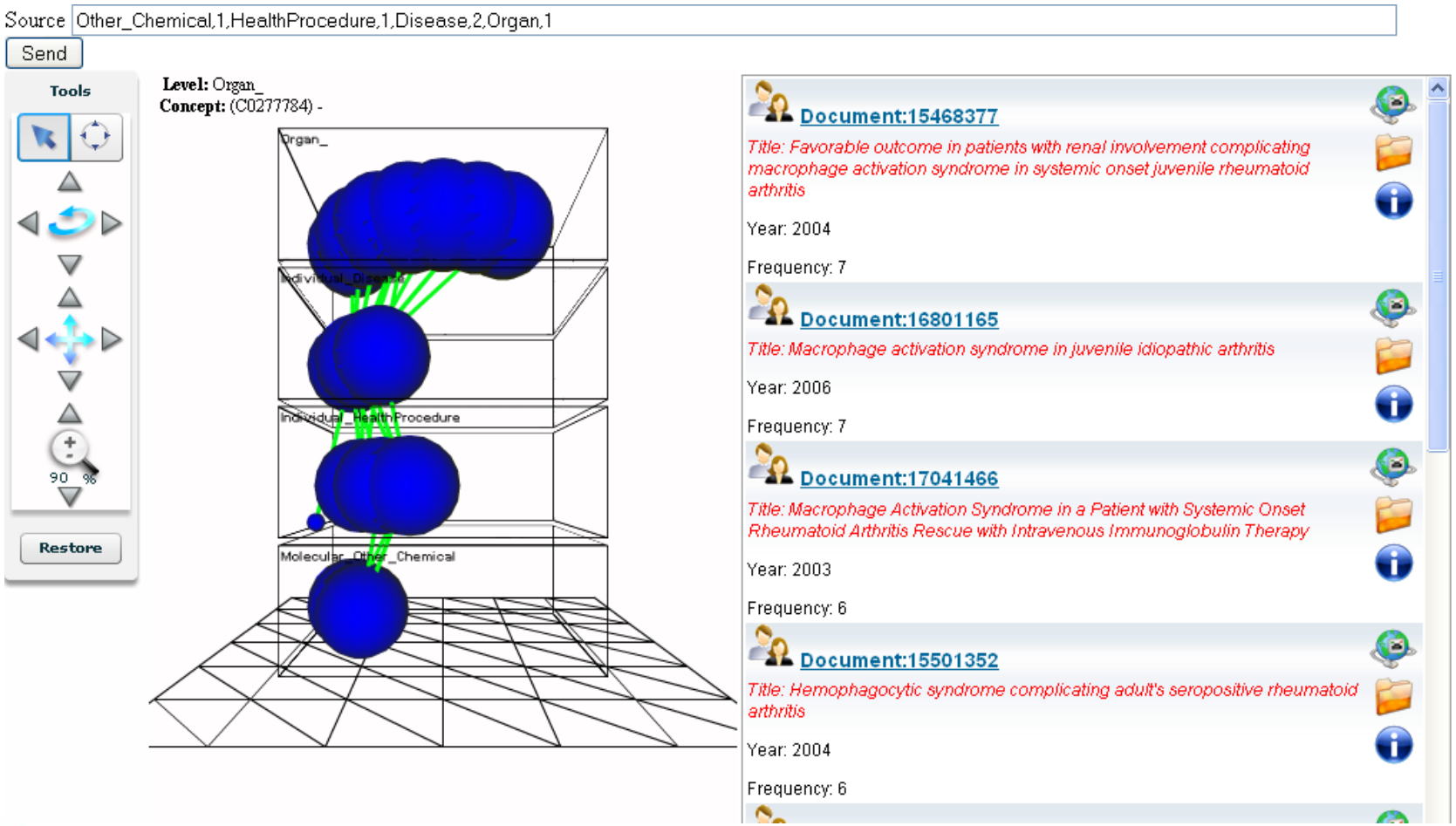
Prototype Implementation

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010



Prototype Implementation

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010



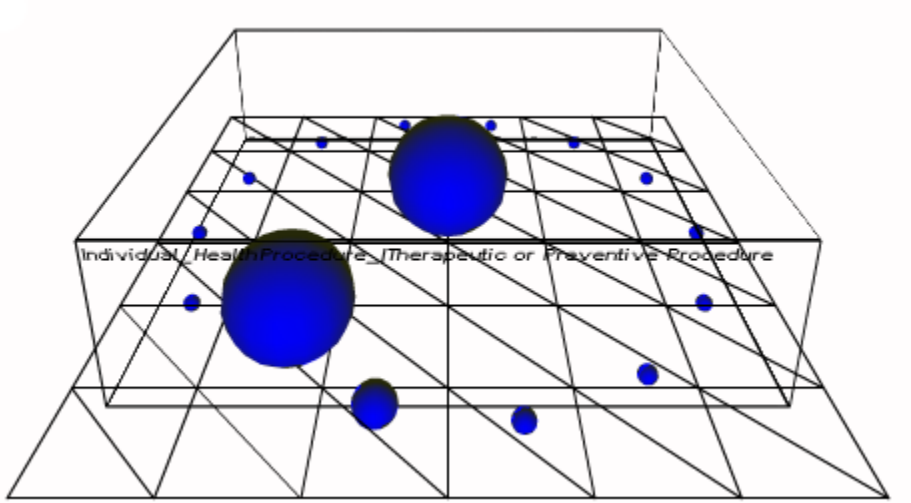
3D Map Operations

- Perform a query
  - Level Selection
  - Concrete term
- Visualization
  - Rotation, zoom, position
- Concept visualization
  - **Retrieval** of objects associated to the *clicked* concept/bridge
  - **Expansion** (i.e. subclasses) of referred concept
  - **Removal** of non related concepts
  - **Removal** of clicked concept

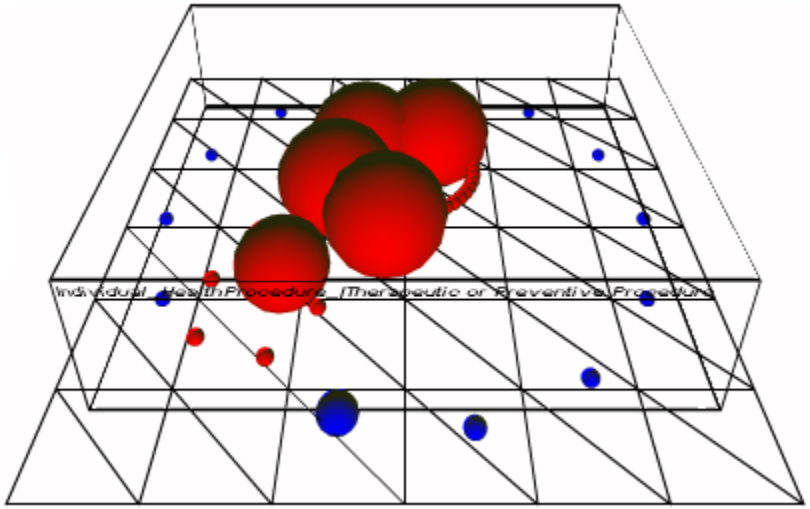
Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Concept Expansion (I)

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010



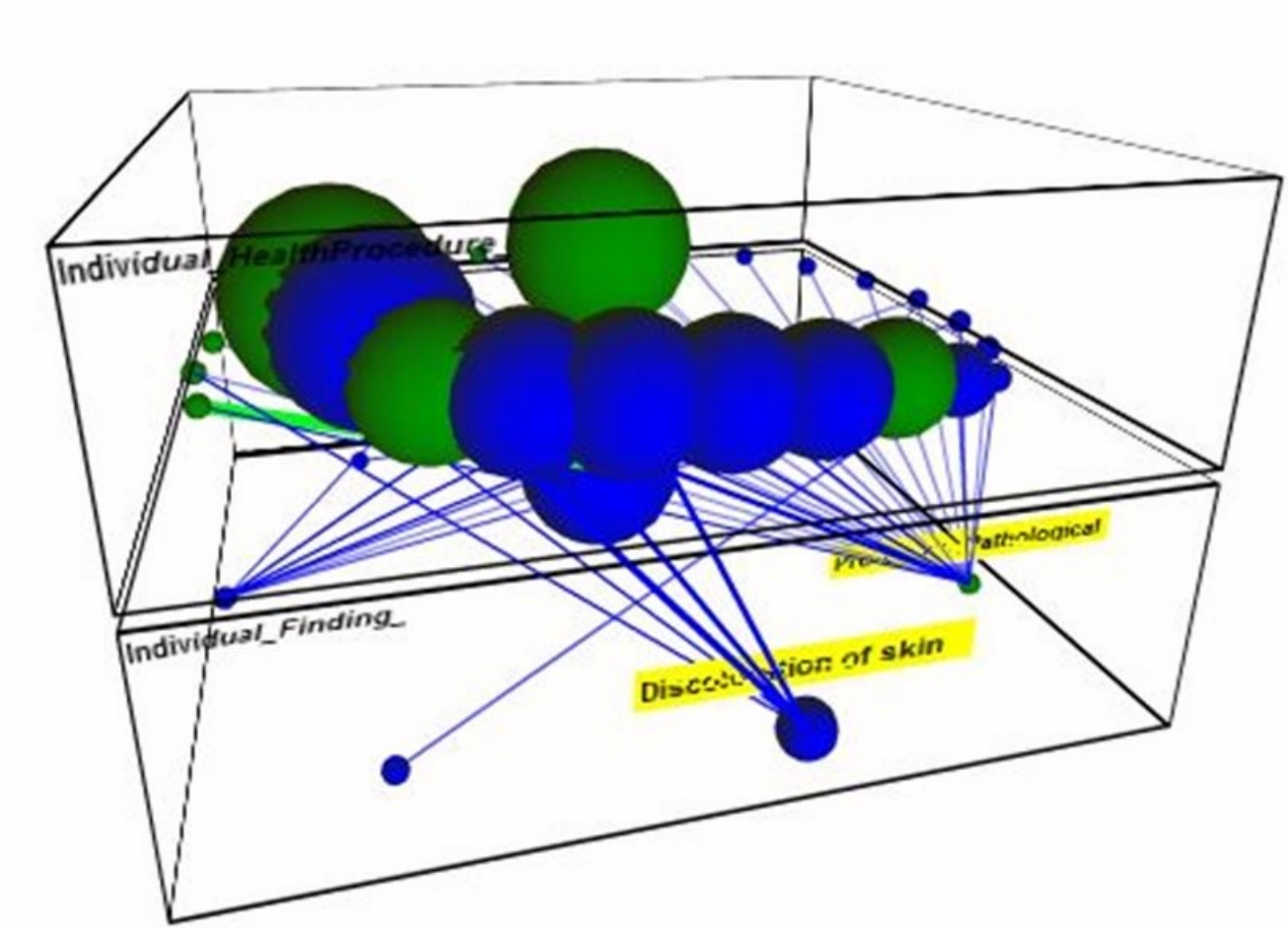
Concept Expansion (II)



Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

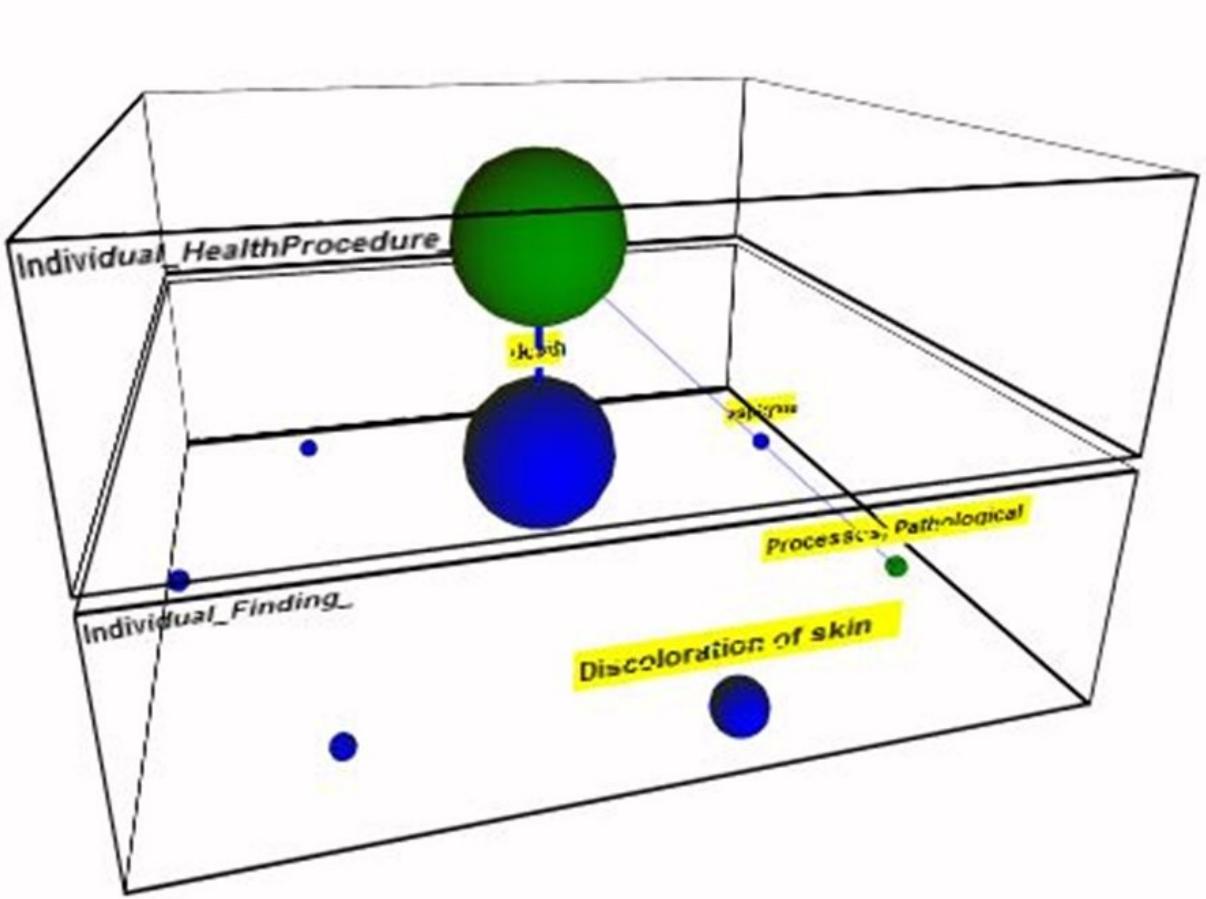
Concept Removal (I)

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010



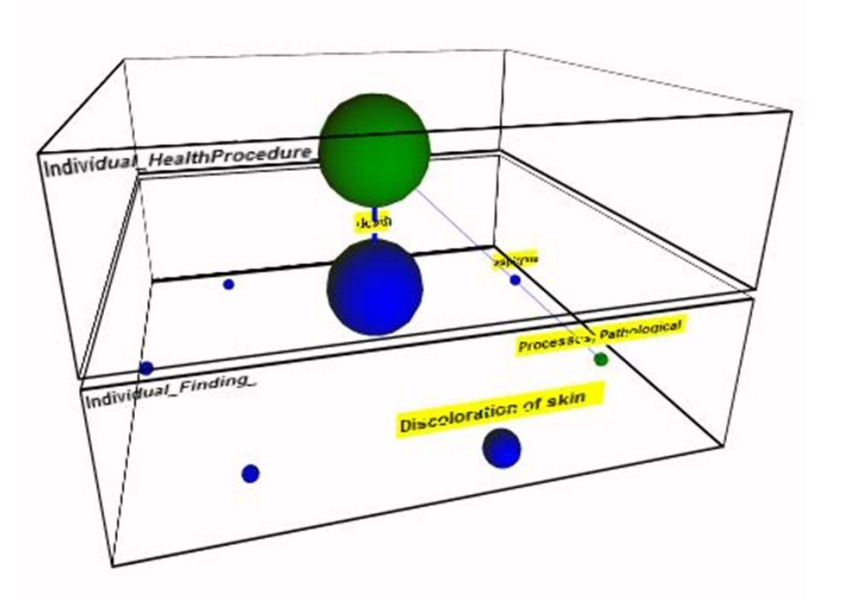
Concept Removal (II)

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010



Object retrieval (I)

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

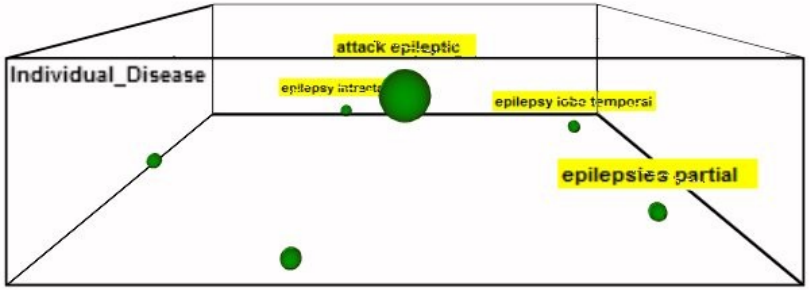


"Repair Fallot Tetrallogy" related concepts

Bridge: "Repair Fallot Tetrallogy"–"Death" related documents

Object retrieval (II)

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010



SP number: P35498 Go to NCBI Go to KEGG
Protein: NAC1
Relevance: 5

SP number: Q99250 Go to NCBI Go to KEGG
Protein: HBSC II
Relevance: 3

SP number: Q96QS3 Go to NCBI Go to KEGG
Protein: aristaless related homeobox
Relevance: 3

SP number: P17600 Go to NCBI Go to KEGG
Protein: brain protein 4.1
Relevance: 2

Epilepsy dieases

Related Swissprot proteins

Related work

- EBIMed
  - http://www.ebi.ac.uk/Rebholz-srv/ebimed
- MedEvi
  - http://www.ebi.ac.uk/Rebholz-srv/MedEvi/

- 3D Navigation
  - **Visualization**
  - Definition of **semantic spaces**
  - **Concept exploration**

- Link to other resources (e.g. patient records)

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

Questions

- 3D Browser:
  - http://krono.act.uji.es/Projects/hec-3dbrowser

- Thank you!

Nature Precedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010