Building conceptual spaces for exploring and linking biomedical resources

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Outline

- Motivation
- Method
- Prototype Implementation
- Related Work
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
Proposal: 3D Knowledge Browser

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

- UMLS has been selected as the knowledge source to feed the semantic/concept spaces.

- UMLS concepts are partitioned in several dimensions according to their semantic type and the HeC Levels.

- UMLS taxonomy is indexed using an interval-based labelling schema.
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 $\rightarrow$ C1384600:JIA
  - Molecular.InmunologicFactor $\rightarrow$ C0021760:IL6
  - Population.Group $\rightarrow$ C0007457:Caucasoid Race
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.
## 3D Map Objects

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level or Semantic Layer</td>
</tr>
<tr>
<td></td>
<td>Concept</td>
</tr>
<tr>
<td></td>
<td>Semantic Bridge</td>
</tr>
</tbody>
</table>

```xml
<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
Prototype Implementation

Source: Other_Chemical, 1. HealthProcedure, 1. Disease, 2. Organ, 1

- **Document: 15468377**
  - Title: Favorable outcome in patients with renal involvement complicating macrophage activation syndrome in systemic onset juvenile rheumatoid arthritis
  - Year: 2004
  - Frequency: 7

- **Document: 16801165**
  - Title: Macrophage activation syndrome in juvenile idiopathic arthritis
  - Year: 2006
  - Frequency: 7

- **Document: 17041466**
  - Title: Macrophage Activation Syndrome in a Patient with Systemic Onset Rheumatoid Arthritis: Rescue with Intravenous Immunoglobulin Therapy
  - Year: 2003
  - Frequency: 6

- **Document: 15501552**
  - Title: Hemophagocytic syndrome complicating adult's seropositive rheumatoid arthritis
  - Year: 2004
  - Frequency: 6
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
Concept Expansion (I)
Concept Expansion (II)
Concept Removal (I)
Concept Removal (II)
Object retrieval (I)

“Repair Fallot Tetrallogy” related concepts

Bridge: “Repair Fallot Tetrallogy” – “Death” related documents
Object retrieval (II)

Epilepsy diseases

Related Swissprot proteins
Related work

- **EBIMed**
  - [http://www.ebi.ac.uk/Rebholz-srv/ebimed](http://www.ebi.ac.uk/Rebholz-srv/ebimed)

- **MedEvi**
  - [http://www.ebi.ac.uk/Rebholz-srv/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)
Questions

- 3D Browser:
  - [http://krono.act.uji.es/Projects/hec-3dbrowser](http://krono.act.uji.es/Projects/hec-3dbrowser)

- Thank you!