Collaborative Open Environment for Project Centered Learning

A Question Answering service for information retrieval in Cooper

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Information Society Technologies

Overview

- What do we want with QA in Cooper?
- Latent Semantic Analysis
  - Technique
  - Demonstration
  - Assumptions/requirements
- Toolbox
  - Architecture
- Future assessment in Cooper
  - Implementation at ALaRI
  - Implementation at CoWare
- Conclusion, Discussion and questions

What do we want with QA in Cooper?

- Support of (standard) activities in Cooper.
- Relate documents to people, places and things.
- Solution: a search engine.
- But, lexical methods won't suffice:
  - Changing information needs
  - Context dependency
  - Small, specific domains
- Now what?

Latent Semantic Analysis

- '…a computational method by which a major component of language learning and use can be achieved.' (Landauer, 2007, p.10).

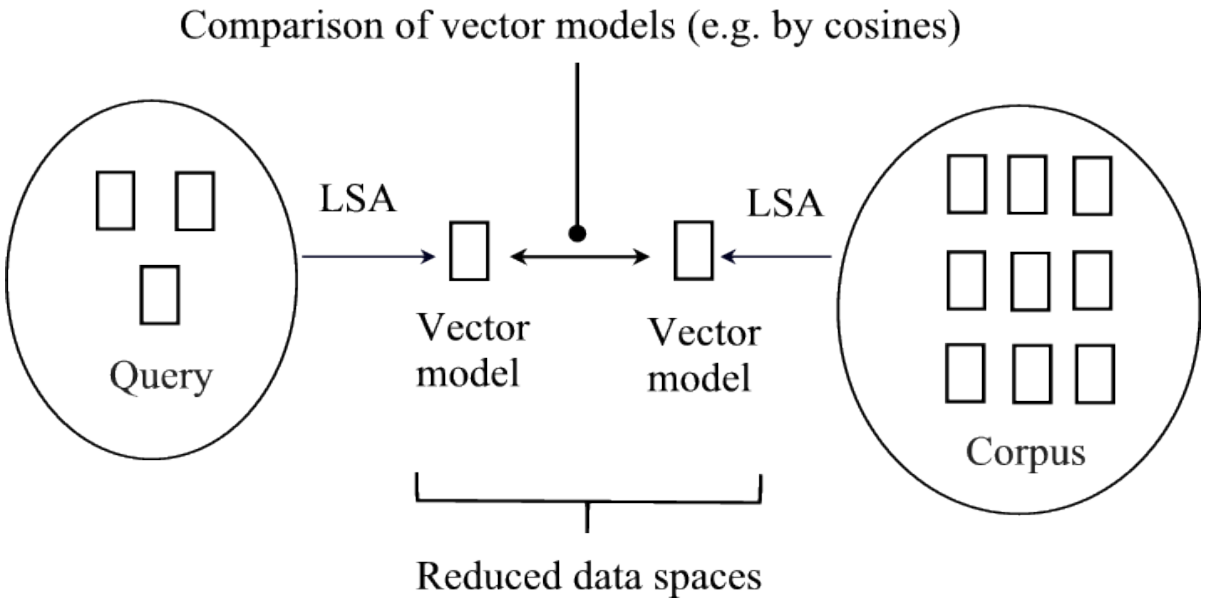
- Used in:
  - Cognitive science (memory research)
  - Education (assessment, automatic tutoring)
  - Information retrieval

- An analysis
  - Turn collection of documents into Term x Document matrix
  - Perform SVD on the matrix
  - Reduce the material , i.e. remove smallest singular values
  - Reproduce original
  - Represent document by vector
  - Calculate cosines between vectors

Latent Semantic Analysis (2)

- LSA explains the content of a text as the weighted sum of underlying constructs.
  - Similar to Factor Analysis and PCA

- Query:



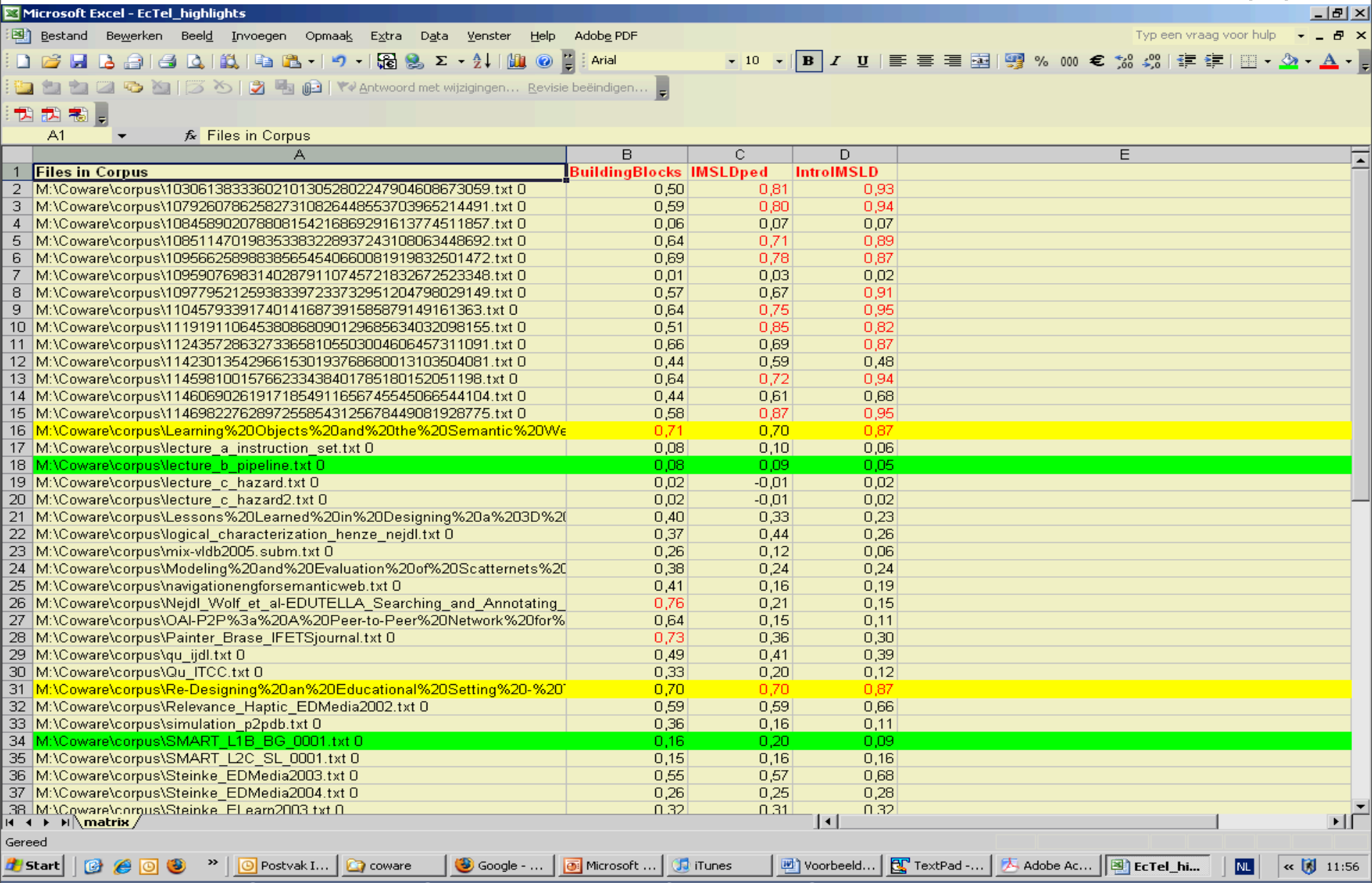
Demonstration

- Domain specific corpus: combination of CoWare, OUNL and L3S documents (300 total).
- For good mathematical representation, corpus should be large enough to let the machine 'learn the language'.
  - TASA as additional material
- Pre-processing
  - Convert to ASCII txt
  - If first line empty, remove
  - Remove certain diacritical marks
- Software
  - **GTP** (http://www.cs.utk.edu/~lsi/soft.html)
  - **R** (http://www.r-project.org/)
  - **Infomap** (http://infomap-nlp.sourceforge.net/)

Demonstration (2)

- Query: Three documents from OUNL repository:
  - IMS LD introduction
  - IMS LD pedagogy
  - Building Blocks for a Smart Space for Learning
- Results:
  - Documents with same terms are related (OUNL - OUNL)
  - Term doesn't have to occur to find relation (OUNL – L3S)
  - Term can occur but no relation is found (OUNL - CoWare)
  - Threshold: which docs to report and which not?

Demonstration (3)

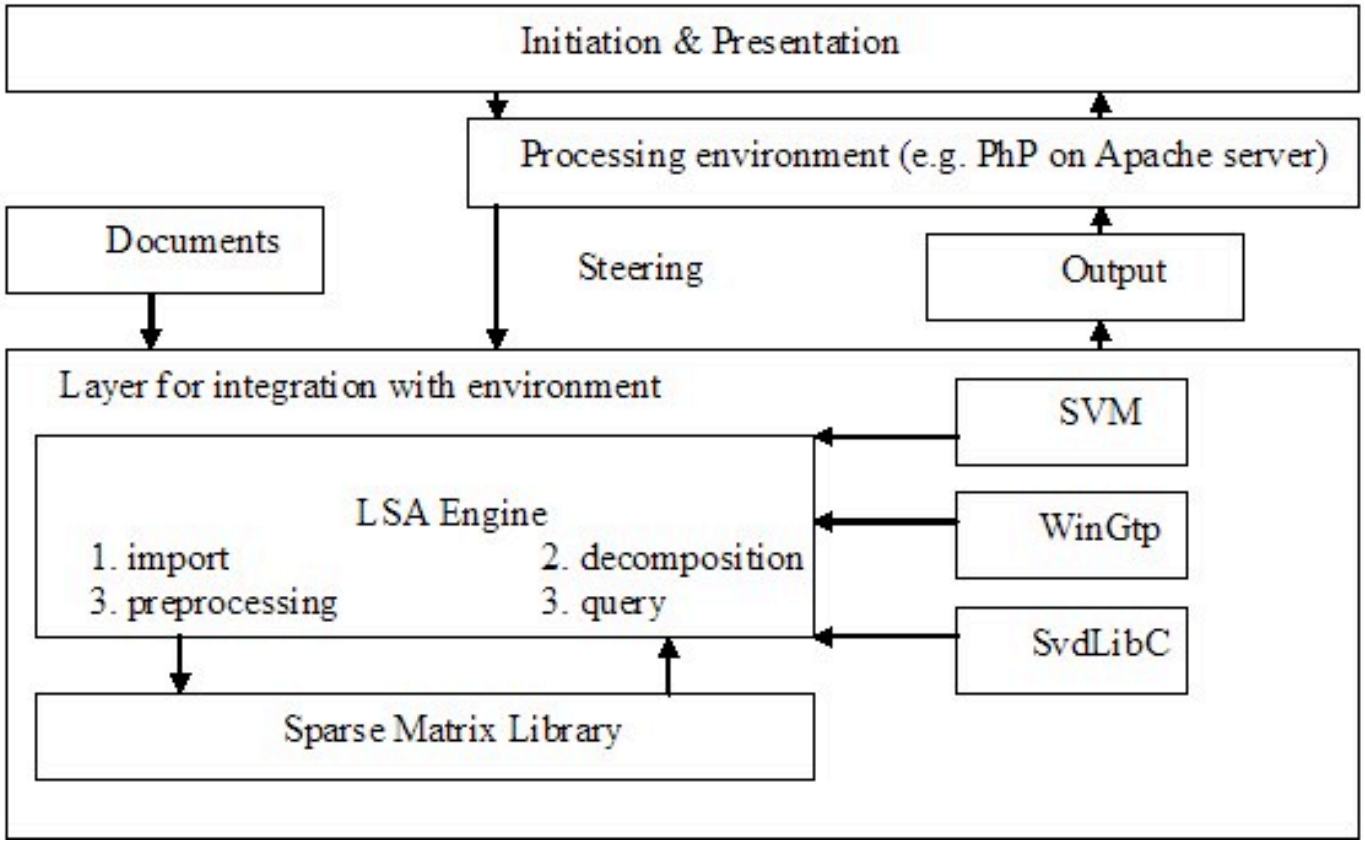


	A	B	C	D	E
1	Files in Corpus	BuildingBlocks	IMSLDped	IntroIMSLD	
2	M:\Coware\corpus\10306138333602101305280224790460867305 9.txt 0	0,50	0,81	0,93	
3	M:\Coware\corpus\10792607862582731082644855370396521 4491.txt 0	0,59	0,80	0,94	
4	M:\Coware\corpus\10845890207880815421686929161377451 1857.txt 0	0,06	0,07	0,07	
5	M:\Coware\corpus\10851147019835338322893724310806344 8692.txt 0	0,64	0,71	0,89	
6	M:\Coware\corpus\10956625898838565454066008191983250 1472.txt 0	0,69	0,78	0,87	
7	M:\Coware\corpus\10959076983140287911074572183267252 3348.txt 0	0,01	0,03	0,02	
8	M:\Coware\corpus\10977952125938339723373295120479802 9149.txt 0	0,57	0,67	0,91	
9	M:\Coware\corpus\11045793391740141687391585879149161363.txt 0	0,64	0,75	0,95	
10	M:\Coware\corpus\11191911064538086809012968563403209 8155.txt 0	0,51	0,85	0,82	
11	M:\Coware\corpus\11243572863273365810550300460645731 1091.txt 0	0,66	0,69	0,87	
12	M:\Coware\corpus\11423013542966153019376868001310350 4081.txt 0	0,44	0,59	0,48	
13	M:\Coware\corpus\11459810015766233438401785180152051 198.txt 0	0,64	0,72	0,94	
14	M:\Coware\corpus\11460690261917185491165674554506654 4104.txt 0	0,44	0,61	0,68	
15	M:\Coware\corpus\11469822762897255854312567844908192 8775.txt 0	0,58	0,87	0,95	
16	M:\Coware\corpus\Learning%20Objects%20and%20the%20Semantic%20We	0,71	0,70	0,87	
17	M:\Coware\corpus\lecture_a_instruction_set.txt 0	0,08	0,10	0,06	
18	M:\Coware\corpus\lecture_b_pipeline.txt 0	0,08	0,09	0,05	
19	M:\Coware\corpus\lecture_c_hazard.txt 0	0,02	-0,01	0,02	
20	M:\Coware\corpus\lecture_c_hazard2.txt 0	0,02	-0,01	0,02	
21	M:\Coware\corpus\Lessons%20Learned%20in%20Designing%20a%203D%2(	0,40	0,33	0,23	
22	M:\Coware\corpus\logical_characterization_henze_nejdl.txt 0	0,37	0,44	0,26	
23	M:\Coware\corpus\mix-vldb2005.subm.txt 0	0,26	0,12	0,06	
24	M:\Coware\corpus\Modeling%20and%20Evaluation%20of%20Scatternets%2(	0,38	0,24	0,24	
25	M:\Coware\corpus\navigationengforsemanticweb.txt 0	0,41	0,16	0,19	
26	M:\Coware\corpus\Nejdl_Wolf_et_al-EDUTELLA_Searching_and_Annotating_	0,76	0,21	0,15	
27	M:\Coware\corpus\OAI-P2P%3a%20A%20Peer-to-Peer%20Network%20for%	0,64	0,15	0,11	
28	M:\Coware\corpus\Painter_Brase_IFETSjournal.txt 0	0,73	0,36	0,30	
29	M:\Coware\corpus\qu_ijdl.txt 0	0,49	0,41	0,39	
30	M:\Coware\corpus\Qu_ITCC.txt 0	0,33	0,20	0,12	
31	M:\Coware\corpus\Re-Designing%20an%20Educational%20Setting%20-%20'	0,70	0,70	0,87	
32	M:\Coware\corpus\Relevance_Haptic_EDMedia2002.txt 0	0,59	0,59	0,66	
33	M:\Coware\corpus\simulation_p2pdb.txt 0	0,36	0,16	0,11	
34	M:\Coware\corpus\SMART_L1B_BG_0001.txt 0	0,16	0,20	0,09	
35	M:\Coware\corpus\SMART_L2C_SL_0001.txt 0	0,15	0,16	0,16	
36	M:\Coware\corpus\Steinke_EDMedia2003.txt 0	0,55	0,57	0,68	
37	M:\Coware\corpus\Steinke_EDMedia2004.txt 0	0,26	0,25	0,28	
38	M:\Coware\corpus\Steinke_ELearn2003.txt 0	0,32	0,31	0,32	

Review

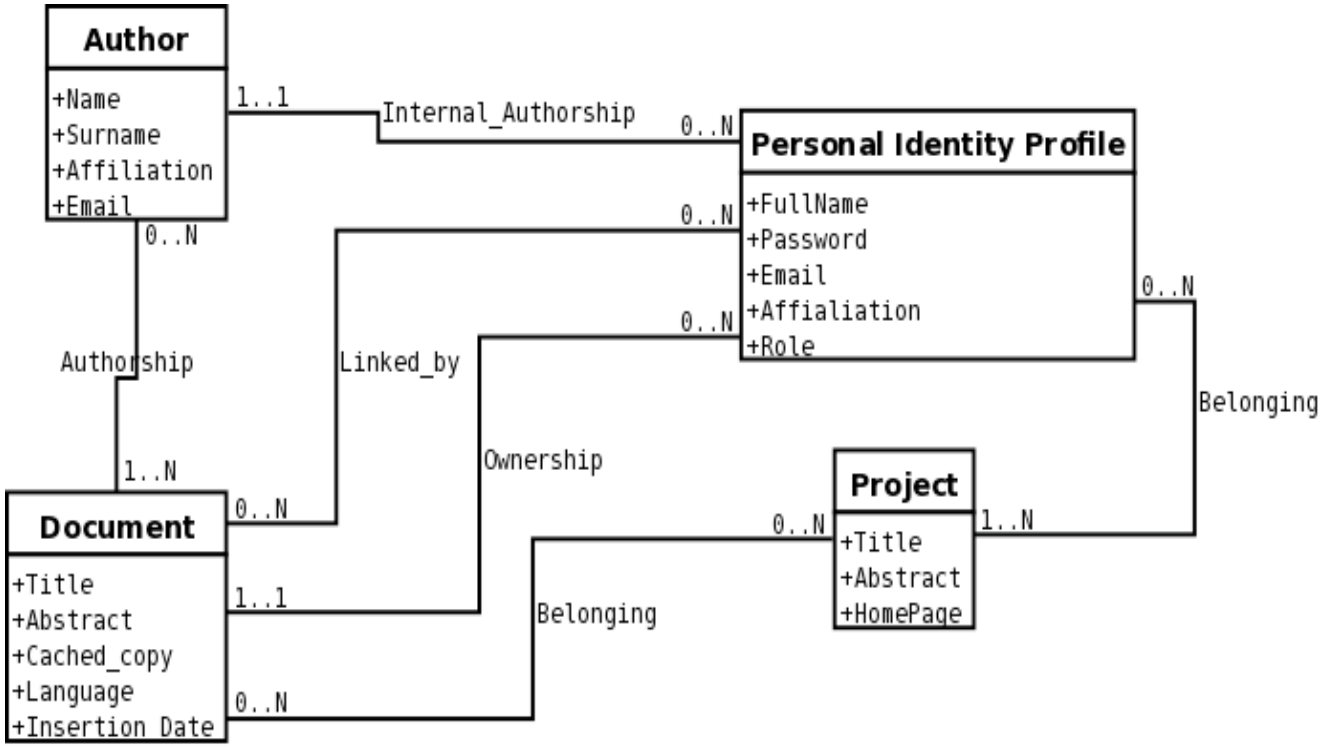
- Relate documents to people, places and things.
- More than lexical methods: Latent *Semantic* Analysis.
- LSA is usable, existing applications may not.
  - Pre-processing and post-processing necessary
  - Requirement to function as a webservice

Toolbox and architecture



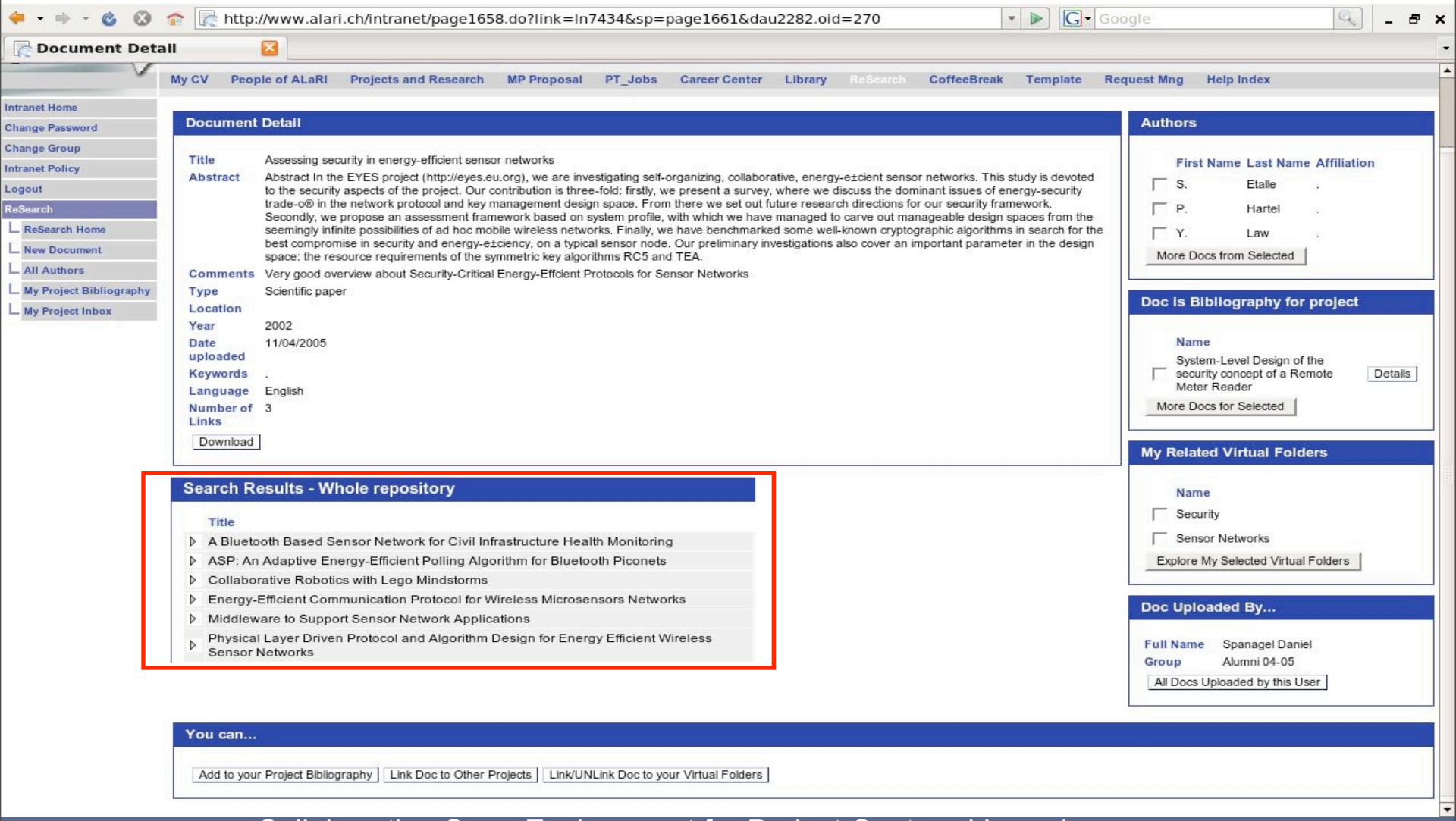
Future assessement: implementation at ALaRI

- Relate documents to people, places and things.
-



Future assessement: implementation at ALaRI

– Document Detail page at ALaRI:



Future assessement: implementation at CoWare

- Find related documents (no people and/or things).
- And: make a distinction between expert and novice documents.
- This is work in progress.

Conclusion and discussion

- QA to support Cooper activities.
- Not lexical, but semantic relations by using LSA.
- Development of toolbox and architecture that can:
  - Pre-process and post-process material
  - Perform complete SVD
  - Can be used as a webservice
- Implementation at ALaRI and CoWare.

Questions

Thank you for your attention!

Any questions?

References

- Landauer, T.K., McNamara, D.S., Dennis, S., Kintsch, W. (eds.): Handbook of Latent Semantic Analysis (2007). Mahwah, New Jersey: Lawrence Erlbaum Associates
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