Language Technologies for Lifelong Learning
Lifelong Learning & Language Technologies

Adriana Berlanga
Open University, NL

Gaston Burek
University of Tubingen, DE

Fridolin Wild
Open University, UK

European Summer School on Technology Enhanced Learning
Terchova, Slovakia. June, 2009
Outline

• Lifelong learning
• Critical supporting activities
• Language Technologies
• LTfLL Project: Language Technologies for Lifelong Learning
• LTfLL: Positioning of the learner in a domain
• Questions
• Discussion
Lifelong Learning
Critical support activities

• Assessment
  – Formative feedback

• Answering questions
  – Routing questions
  – Formulating personalised answer

• Monitoring progress
  – Drop out prevention

• Supporting groups and communities
  – Selecting and creating groups
  – Providing overviews

Van Rosmalen et al. (2008)
Critical support activities

Assessment
Answering
Monitoring
Groups
Natural Language Processing (NLP)

Natural Language = Human speech

Analyzes spoken or written language
Discover terms, generate text, translation, synthesis…
- Computational Linguistics
- Artificial Intelligence

→ Language Technologies
Working Principle

Landauer (2007)
Latent Semantic Analysis (LSA)

Input (e.g., documents)

Only the red terms appear in more than one document, so strip the rest.

\[ \{ M \} = \]

\[
\begin{array}{cccccccc}
\text{human} & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
\text{interface} & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
\text{computer} & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
\text{user} & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
\text{system} & 0 & 1 & 1 & 2 & 0 & 0 & 0 & 0 \\
\text{response} & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
\text{time} & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
\text{EPS} & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
\text{survey} & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\
\text{trees} & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
\text{graph} & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
\text{minors} & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
\end{array}
\]
How to support these activities in a (semi-) automatic way?
Language Technologies for Lifelong Learning
LTfLL – Objective

To create a set of next-generation **support and advice services** that will enhance **individual and collaborative building of competences** and knowledge creation in educational as well as organizational settings.

The project makes extensive use of **language technologies and cognitive models** in the services.
LTfLL - Themes

**Theme 1**
position of the learner in a domain

**Theme 2**
support feedback services

**Theme 3**
social and informal learning
To determine in a (semi-)automatic way learner’s prior knowledge – by analyzing her Portfolio and the domain of study – to recommend learning materials or courses to follow.

To provide formative feedback with regard to the learner’s profile in the domain of study and recommend remedial actions to overcome conceptual gaps.

Positioning

To offer recommendations based on an analysis of interactions in collaborative learning using chats and discussion forums.

To offer recommendations based on the analysis of textual outputs by the learner.

Learner Support & Feedback services

To provide recommendations on the basis of the learner’s profile, interests, preferences, network and learning task. This requires implementing a Common Semantic Framework (i.e. an ontology).

To provide a list of search results prioritized and categorized according to the conditions specified by the learner, and the opinions of the learner’s trusted network of contacts.

Supporting social & informal learning services
LTfLL - Themes

Theme 1: position of the learner in a domain

Theme 2: support feedback services

Theme 3: social and informal learning
Positioning
Positioning

• Automatically determine learner’s knowledge in a domain, given the chosen learning goal
To determine in a (semi-) automatic way learner’s prior knowledge—by analyzing her Portfolio and the domain of study—to recommend learning materials or courses to follow

Locate best suitable learning materials or courses to follow

To provide formative feedback with regard to the learner’s profile in the domain of study and recommend remedial actions to overcome conceptual gaps

Provide formative feedback and recommend remedial actions
Positioning - Adriana Berlanga & Fridolin Wild

FORMATIVE FEEDBACK
Formative feedback

- Services will offer semi-automatic measurement of conceptual development

- Diagnosing conceptual development
  - Person’s knowledge of a domain by looking on how s/he organizes the concepts of such domain
  - Novice vs. expert approach
The approach: Novice vs. Expert

Novices and experts differ in:
- How they express the concepts underlying a domain
- How they discriminate relevant from non-relevant information
- And how they use and relate the concepts to one another
Exploring the approach
SHOWCASE
Procedure

1. Ask learners what they know

2. Find out what learners should know
   “Expert-reference model”

3. Compare

4. Provide feedback and recommendations
A **think-aloud** protocol was designed. Learners must explain the relevant concepts in a domain and how they are related.

**Examples**

- Medical students (U Manchester) had a **think-aloud** session to explain concepts they just studied.
- Researchers (OUNL) had a **think-aloud** session to explain concepts they develop in their work.

→ The think-aloud audio is **transcribed**: text.
2. Find out what learners should know

“Expert-reference model”

1. **Theoretical expert model**, documents of a particular course (e.g., course material, tutor notes, presentations)

2. **Archetypical expert model**, state-of-the-art information (e.g., scientific literature)

3. **Emerging expert model**, concepts and the relations a group of people (co-workers, peers...) use to describe a domain

3. Compare
2. Find out what learners should know

“Expert-reference model” = **Theoretical expert model**

**Generation of expert and student concept maps**

**Leximancer**
2. Find out what learners should know

"Expert-reference model" = Archetypical expert model

Expert map generated from scientific literature
2. Find out what learners should know

“Expert-reference model” = **Emergent expert model**
4. Provide feedback and recommendations

- These are the concepts you mentioned the most
- From your peers these are the most mentioned concepts
- The differences are:
- This means that you might find useful to
  - Read this material
  - Do this activity
  - Contact this person
  - …
- Observations
To determine in a (semi-) automatic way learner’s prior knowledge—by analyzing her Portfolio and the domain of study—to recommend learning materials or courses to follow.

Locate best suitable learning materials or courses to follow.

To provide formative feedback with regard to the learner’s profile in the domain of study and recommend remedial actions to overcome conceptual gaps.

Provide formative feedback and recommend remedial actions.
LOCATE BEST SUITABLE LEARNING MATERIALS
## Positioning Principles

<table>
<thead>
<tr>
<th>Learner</th>
<th>Objectives indicated by learner</th>
<th>Evidence indicated by learner</th>
<th>Materials indicated by assessors</th>
<th>Automatic recommendations</th>
<th>Assessors decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>John S.</td>
<td>Topics 1</td>
<td>Self Assessment</td>
<td>Course documents</td>
<td>No automatic</td>
<td>Accept yes/no</td>
</tr>
<tr>
<td></td>
<td>Topics 2</td>
<td>Certificates</td>
<td>Course documents</td>
<td>No automatic</td>
<td>Accept yes/no</td>
</tr>
<tr>
<td></td>
<td>Topics 3</td>
<td>Portfolio Documents</td>
<td>Materials or docs accepted/rejected</td>
<td>LSA or knowledge rich approach</td>
<td>Accept yes/no</td>
</tr>
<tr>
<td></td>
<td>Topics 4</td>
<td>Formal assessment</td>
<td>Assessment samples accepted/rejected</td>
<td>LSA or knowledge rich approach</td>
<td>Accept yes/no</td>
</tr>
</tbody>
</table>
Objectives

- A plan for extending language technologies for positioning
- Implementing a showcase and scenarios to investigate and validate the approaches and give input to the design of the first release of the positioning (Wild, Hoisl and Burek, 2009)
- To implement a positioning service that assess learner competences and recommend a sequence of learning material according to learning goals.
Scope of the analysis (text)

- **Learning history** captured in the learner portfolio can be documented in different formats including text.

- **Texts** (learning materials, learner produced docs, etc.) may use long linguistic expressions to describe high level conceptualisations and terms for more precise descriptions.

- **Curricula** contain high level descriptions of learning activity materials and goals.

- Reduced number of samples generate sparse linguistic data.

- Learning materials and e-portfolios can be in different languages (future work).
Ongoing Analysis

- Finding prototypes
- Students discussions on safe prescribing:
  - Classified according expected learning outcomes related subtopics topics (A, B, C, D, E, F)
  - Graded by experts (poor, fair, good, excelent)
- Methodologies
  - LSA
  - KNN
  - Permutation tests
Scenario

Learning goal: specified by job descriptions

Stakeholders objectives:

- **Unemployed individual**: to acquire qualifications needed to find a job according to available vacancies
- **Individual currently employed**: to acquire the competences to be useful for his company and reduce the risk of loosing his/her job
- **Educational provider**: delivering high quality personalised technical education
- **Employment Governmental agency**: to reduce unemployment
- **Enterprises**: to develop employees competences for them to be capable to undertake duties required within the organisation according to predefined expectations
questions?
DISCUSSION
Guiding questions

1. How can you validate services for these areas?
2. Big challenges?
3. Other experiences?
4. Who is already working with NLP technologies for TEL?
Workshop A

NLP-based experiments in TEL

Today @ 16.15
Adriana Berlanga
adriana.berlanga@ou.nl
Gaston Burek
gaston.burek@googlemail.com
Fridolin Wild
f.wild@open.ac.uk

www.ltfll-project.org

DSpace
dspace.ou.nl/simple-search?query=LtfLL
References


