

Ontology of the Learner's Annotation Objectives

Hakim MOKEDDEM¹, Faiçal AZOUAOU¹, Cyrille DESMOULINS²

¹ *National School of Computer Science (E.S.I)*

Oued Smar Algiers, Algeria

{h_mokeddem, f_azouaou}@esi.dz

² *CLIPS- IMAG, University Joseph Fourier*

BP 53 38041 Grenoble cedex 9 France

{Cyrille.desmoulins}@imag.fr

Abstract. This article aims at defining semantic annotation ontology of the learner, in order to use it in a pedagogical annotation tool. All the annotations created by the learner with this tool constitute a pedagogical memory for him.. To identify and model the annotation semantics, we develop an ontology of annotation objectives using the approach proposed by [1], then we describe the ontology implementation in the EasyAnnotation semantic tool.

Keywords. e-learning, annotation, learner, ontology, active learning situation.

Introduction

Learner carries out various learning activities, during which, he handles different types of learning objects. The latter can be an exercise, a simulation, a text, a course, etc. The handling of these objects occurs in the context of active learning in which the learner becomes an actor responsible of his own learning.

When doing these activities, the learner needs to memorize his ideas directly on the learning objects he is using in order to reuse them later. Consequently, we consider the set of annotations created by the learner, as his pedagogical memory, which contains prints of his learning.

Each of the created annotation can be described using several properties (shape, anchor...), but the most important one is its semantics, which corresponds to the learner's implicit objective during the annotation creation. These objectives can be: to memorize an error, to memorize a question, etc. The lost of the annotation semantics makes it often useless.

So that these annotations can be handled by software agents, and shared with other learners, annotation semantics has to be formalized each time an annotation is created. Among the various possible models to represent this semantics, a solution is to choose an ontological representation, as it enables *a formal and explicit specification of a shared conceptualization* [2].

To design a quality ontology, in this work we follow the methodology proposed by Noy [1] and made popular by the protégé tool [3].

We start this article by developing the annotation objectives ontology following the Noy's methodology [1] and then, we describe the annotation tool, EasyAnnotation, in which it has been implemented.

1. Ontology of the Objectives of Annotation

In order to model the annotation semantics, we use the concept of ontology [5], *which offers a specification of a conceptualization of a domain knowledge* [6]. This domain of knowledge is in our case the learner's annotation objectives.

There are several methods for the development of ontologies. To design the ontology of the learner's annotation objectives, we follow the iterative method for the development of ontologies proposed in [7]. We describe below how we follow each stage of this method.

1.1. Domain and scope of ontology

We start the development of ontology by defining its domain and scope, this is by answering to the following questions:

- What is the field covered by the ontology?
 - The field of our ontology is the objective of the learner's annotations in an active learning situation. Our ontology includes the concepts which describe the objectives of the annotations produced by the learner in the realization of his learning activities.
- What are the ontology development's goals?
 - Ontology is designed with an aim of formalizing and clarifying the semantic (objective) of the annotations produced by the learner. This formalization enables us to implement the semantics of the annotations in an annotation tool dedicated to the learner..

1.2. Re-use of related work

The objective of this stage is to re-use the existing ontologies even if they have a different objective. We can re-use all or a part of these ontologies after having adapted them to our needs.

Mille proposes in [4] a formalization of ontology of the learner's annotation objectives which only contains generic concepts hence, it does not clarify the pedagogical semantics of the learner's activities.

However, in the literature, we can find specifications that clarify the pedagogical semantics like: LOM [8] that identifies the concepts of description of the learning resources, and IMS-LD [9] that identifies the necessary concepts to modelling the learning process. Nevertheless these two specifications are not specific to learner's annotation activity.

1.3. Identification and structuring of the ontology concepts

We present the resulting ontology in figure 1 (see below) that shows the learner's annotation objectives structured by the relation "is-a".

- ▼ ● To_add_a_remark
 - ▼ ● To_clear_up
 - To_clarify_a_concept
 - To_clarify_an_answer
 - To_clarify_an_idea
 - ▼ ● To_critique
 - ▼ ● To_critique_a_course
 - To_add_examples
 - To_critique_a_form
 - To_critique_a_structure
 - ▼ ● To_critique_a_result
 - of_a_solved_exercise
 - of_an_experimentation
 - of_research
 - ▼ ● To_develop
 - ▼ ● To_develop_a_concept
 - To_add_an_explanatory
 - To_add_instances
 - ▼ ● To_develop_a_result
 - To_deduce_other_results
 - To_generalize_a_result
 - ▼ ● To_develop_an_idea
 - To_add_arguments
 - ▼ ● To_explain_a_passage
 - ▼ ● a_passage_of_a_course
 - ▼ ● To_explain_graphically
 - To_explain_a_method
 - To_explain_an_algorithm
 - ▼ ● To_explain_textually
 - To_explain_a_chart
 - To_explain_a_graph
 - a_passage_of_a_question
- ▼ ● To_add_a_reference
 - Bibliographical
 - to_a_part_of_the_same_document
 - to_a_question
 - to_a_response
 - to_another_document
- ▼ ● To_connect_two_passages
 - To_connect_a_question_to_an_answer
 - To_connect_two_answers
 - To_connect_two_concepts
 - To_connect_two_ideas
 - To_connect_two_questions
- ▼ ● To_express_a_difficulty
 - of_a_course
 - of_an_exercise
 - to_answer_a_question
 - to_apply_a_theorem
 - to_deduce_a_result
 - to_interpret_a_previous_result
 - to_understand_a_concept
 - to_understand_a_passage
 - to_understand_a_question
- ▼ ● To_memorize_an_error_of_a_problem-solving
- ▼ ● To_restructure
 - To_enumerate_the_stages_of_a_problem-solving
 - ▼ ● To_restructure_an_exercise
 - a_demonstration
 - a_question
 - an_answer
 - ▼ ● To_synthesize
 - a_course
 - a_definition
 - an_idea
- ▼ ● To_support_attention
 - To_mark_a_passage_in_a_course
 - To_mark_a_question_in_an_exercise

Figure1. Ontology of learner's annotations objectives

3. Conclusion and Future Work

Our goal in this article is to clarify the semantic of the annotation produced by the learner by handling the various learning objects. The clarification of semantic learner's annotation will enable him to memorize his traces which represent his ideas, knowledge and remarks.

We developed for this, an ontology of the annotation's semantics that includes generic properties (to Add a remark, to Criticize, to Develop, to connect two passages, to support the attention...) and others rather specific which characterizes the learner and his activities (to criticize a course, to connect two questions, to develop a concept,...).

The purpose of the development of the ontology is to implement it in an annotation tool dedicated to the learner.. We implemented the first prototype version of EasyAnnotation that supports semantic learner's annotation of web pages content.

In our perspective, we will try to enrich the annotation's tool with a "domain ontology" which characterizes a particular domain of learning, and an ontology of the context which describes the context in which the learner annotates his document. In addition, to extend the annotation tool to support sharing annotation between learners.

We can also enrich the semantic annotation ontology by adding detailed classes that inherit the existing classes. This enrichment may be achieved through the monitoring of the annotations produced by the learners.

References

- [1] Noy, N.F. and D.L. McGuinness. *Ontology Development 101: A Guide to Creating Your First Ontology* (2002).
- [2] Gruber, T., R., *A Translation Approach to Portable Ontology Specifications*. Academic Press (1993).
- [3] Noy, N.F., et al., *Protégé-2000: an open-source ontology-development and knowledge-acquisition environment*. AMIA Annu Symp Proc. (2003), p. 953.
- [4] Mille, D., *Modèles et outils logiciels pour l'annotation sémantique de documents pédagogiques. Thèse.*, in *Département informatique*. Université Joseph-Fourier: Grenoble (2005), 173 pages.
- [5] Guarino, N. *Understanding, Building, and Using Ontologies : A Commentary to 'Using Explicit Ontologies in KBS Development'*. in *IJHCS* (1997).
- [6] Gruber, T.R., *Towards Principles for the Design of Ontologies Used for Knowledge Sharing*. Int'l J. Human-Computer Studies, 1995. **43**(5/6): p. 907-928.
- [7] Noy, N. and D. McGuinness, *Ontology Development 101: A Guide to Creating Your First Ontology*. Knowledge Systems Laboratory (2001).
- [8] IEEE, *IEEE Standard for Learning Object Metadata, Learning Technology Standards Committee*.
- [9] Design, I.L. *IMS Learning Design* (2005) [cited; Available from: <http://www.imsglobal.org/learningdesign/>].