

A Formal Model of Learner's Annotations Dedicated to Web Services Invocation

Anis KALBOUSSI^{a*}, Omar MAZHOUD^a, Ahmed HADJ KACEM^b & Nizar OMHENTI^a

^a*Higher Institute of Computer Science and Management, Kairouan University, ReDCAD Lab, Tunisia*

^b*Faculty of Economics and Management, Sfax University, ReDCAD Lab, Tunisia*

*kalboussianis@gmail.com

Abstract: Various models of learner's annotative activity have been proposed in E-learning domain. This models which try to conceptualize the annotations of learner are used as basis of many annotations systems. In this article, we propose a new formal model of learner's annotations dedicated to Web services invocation. This conceptual model, composed of ontology and pattern of annotation, tries to present the learner's annotative activity as a means of invocation of appropriate Web services. Therefore, from a learner's annotation we interpret a goal implicitly expressed and we try to discover and invoke a Web service which can meet the annotation's object and consequently assist the learner in his learning activities.

Keywords: E-learning, learner, annotation, annotative activity, Web service, ontology, pattern

1. Introduction

The e-Learning is an activity with high knowledge content. So the learner mobilizes varied data to realize his different activities in an effective way. Therefore, this learner is a member of the category of "knowledge worker" (Drucker, 1994) who needs to be assisted by computing tools to better manage his personal knowledge needed to carry out his activities. Among these tools, we are interested in our research works to the annotation systems existing in the Web. These annotation tools are widely used in E-learning platforms because annotation practice is omnipresent. During his reading, the learner usually uses comments, highlight, circle of sections, post-it etc., to annotate the reading resources in his learning session. Indeed, many systems have been developed to annotate digital documents such as XLibris (Marshall, Morgan, Golovchinsky and Schilit, 2001), MemoNote (Azouaou and Desmoulins, 2006), TafAnnote (Cabanac, Chevalier and Chrisment, 2007), iAnnotate (Plimmer, Samuel, Heng, Meghavi and Laura, 2010)...But the majority of annotation systems share the same features aimed primarily to: create new annotations, visualize existing annotations by considering the styles of shaping, manage the storage of annotations, search and share annotations according to multiple criteria. However, the repetition of the same features by the majority of Web annotation systems shows an under exploitation of the annotation's semantic. This is due to the fact that all the formal models of learner's annotations proposed by the researchers who develop these annotation systems superficially analyze and conceptualize the learner's annotative activity.

In this paper, we propose a new formal model of learner's annotations dedicated to Web services invocation. This conceptual model, composed of ontology and pattern of annotation, tries to present the learner's annotative activity as a means of invocation of appropriate Web services.

2. A formal model of learner's annotations dedicated to Web services invocation

We propose in this work a new annotation's formal model composed of an ontology and pattern of annotation. Thus, by the use of an annotation ontology, we store a semantic of the learner's annotative activity available to computer programs. In addition, we try to automate, on one hand the annotative activity of the annotator and on the other hand the process of deduction of the appropriate Web service to answer the annotation goal, by means of an annotation pattern.

2.1 Annotation ontology

The learner's annotative activity should be presented through a model which reflects the three aspects (physical, semantic and contextual) of the annotation necessary to exploit it as a potential source of Web service invocation. However, the existing models of annotation (Kahan and Koivunen, 2001); (Marshall, Morgan, Golovchinsky and Schilit, 2001); (Azouaou and Desmoulins, 2006) can not represent these three aspects of the annotation at the same time. They are not therefore suitable for our approach. So, any model of the state of the art is dedicated to accommodate our approach consisting in presenting the annotative activity of the learner as means to invoke appropriate Web services and consequently assist him in his learning activities. Our first objective is to model the annotation so that it can represent the three necessary aspects for our approach. The proposed model is based on ontology composed of three aspects: physical, semantic and contextual. This annotation ontology with its semantic descriptions, allow for an efficient reasoning on the attributes of the annotation and therefore a search for the most relevant Web services. Figure 1 describes the annotation ontology. We detail the semantic aspect, because it plays a key role in the invocation of Web service from an annotation.

- **Reading domain:** represents the domain in which the user reads and annotates a document.
- **Reading goal:** presents the goal of the learner in his reading activity.
- **Annotative act:** presents the action to annotate. It is the process that involves the choice of an annotation shape according to a well determined goal and to apply it to the annotated passage.
- **Annotation goal:** represents the object implicitly expressed by the annotator by chosen an annotation. This goal hides a need for Web service to meet this object expressed by the learner.
- **Service community:** Set of services offering the same feature. Every community is described by a name and an objective which represents the feature proposed by this community. Thus, for each annotation goal corresponding one or several service community that can meet this goal.
- **Effect:** is the result of Web service called from this annotation.

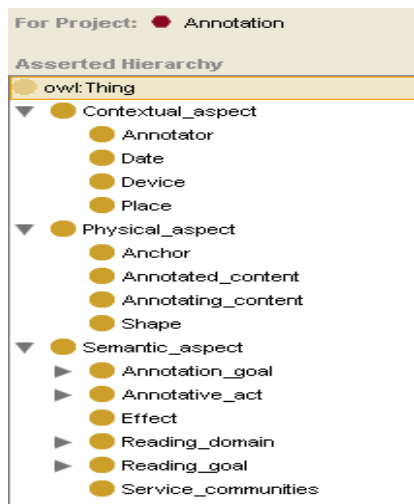


Figure 1. The annotation ontology

Pattern name			
Problem to be solved	Physical aspect	Anchor	
		Shape	
		Annotating content	
Pattern context	Contextual aspect	Annotator	Name
			Role
			Age
			Native language
		Date	
		Place	
		Device	
Proposed solution	Semantic aspect	Annotation goal	
		Service communities	Name
			Goal
		Effect	

Table 1: The annotation pattern

2.2 Annotation pattern

The annotator repeats the same tasks during the creation of an annotation: the selection of the anchor, the choice of the shape and the explicitation of the various attributes of this annotation. Consequently, when it is a question of annotating a wide collection of documents, the annotative activity becomes heavy for the annotator. On the other hand the process of search and invocation of Web services satisfying an annotation goal requires a learning phase from the annotation system to automate this process during the later annotation sessions of the annotator. So, to automate, on one hand the annotative activity of the annotator and on the other hand the process of deduction of the appropriate Web service to answer the annotation goal, we propose to use a pattern of annotation.

The proposed pattern allows to deduct the annotation goal from its shape and then based on this object the system interprets the appropriate Web service which assists the learner to achieve the goal of his annotation. The pattern is represented by an ontology that refers to the elements of the annotation ontology. Indeed, the annotation pattern represents a conceptual solution (the semantic of the annotation) to a problem (find this semantic for a given annotation shape in a given context). Our annotation pattern (see table 1) is composed of four elements:

- (1). **Pattern name:** the name of the pattern should express the semantic of the annotation.
- (2). **Problem:** describes the problem to be solved by our annotation pattern. It represents the choice of an annotation shape.
- (3). **Context:** the context in our case is a set of information that characterizes the annotation session of the learner. This information allows us to infer the semantic of the annotation.
- (4). **Solution:** it is to find some attributes of the semantic aspect of the annotation such as the annotation goal and the service communities.

2.3 Case study

To better explain our approach of assistance of learner's annotative activity by Web services, we present a scenario in which a learner in *E-learning* domain consults a course. The reading goal of the learner is *to understand* this consulted course. The first made annotation consists in *to translate a passage*. Based on our new approach, we consult the annotation ontology and interpret the goal of this annotation. For example, we offer to the learner the choice to invoke an *online translator* presented as a Web service to meet the goal of this annotation. If the learner confirms this choice, a search query of Web service, to satisfy this goal, will be built and sent to a directory of Web services. So we specify at the search query, the keyword "translator" which is the name of the desired Web service. The search result returned as a list of Web services. Finally, the annotation system must choose itself the most relevant Web service to the learner. So, in that case appears the need to the learner's profile helping to choose the target language of the translation. The information such as the native language seems decisive. This information can be extracted from the annotation ontology via the class "annotator / Native language". Thereafter, during the invocation of the selected Web service, the annotation system must automatically supply the passage to be translated without recourse to the learner. This information can be extracted from the annotation ontology via the class "Annotated content".

3. Conclusion

The main objective of our research is to propose a new approach of exploiting the annotative activity as a means of Web services invocation. We have proposed an annotation conceptual model composed of ontology and pattern of annotation. Thus, by the use of ontology, we stored a semantic of the learner's annotations. In addition, we tried to automate the annotative activity of the learner and the process of invocation of the appropriate Web service to answer the annotation goal, by means of an annotation pattern. In future work, we will try to develop a prototype of an annotation system based on the proposed model to experience our new approach of assistance of the learner by Web services.

References

- Azouaou, F., Desmoulins, C. (2006). A Flexible and Extensible Architecture For Context-Aware Annotation in E-Learning. In: *the 6th IEEE International Conference on Advanced Learning Technologies*, 5-7 July 2006, Kerkrade, The Netherlands. IEEE Computer Society.
- Cabanac, G., Chevalier, M., Chrisment, C. (2010). A Social Validation of Collaborative Annotations on Digital Documents. In: *Journal of the American Society for Information Science and Technology*, 61 (2) 271-287.
- Drucker, P. (1994) "The age of social transformation." *The atlantic Monthly*. 274. pp.53-80. 1994.
- Kahan, J., Koivunen, M-R. (2001). Annotea: An Open RDF Infrastructure for Shared Web Annotations. In: *WWW 01 Proceedings of the 10th international conference on World Wide Web*.
- Marshall, C., Morgan, P., Golovchinsky, G., Shilt B. (2001). Designing e-Books for Legal Research. In : *Actes de ACM/IEEE joint conference on Digital libraries*, Roanoke (USA), ACM Press, pp 41-48.

Plimmer, B., Samuel, H., Heng, C., Meghavi, D., Laura, L. (2010). iAnnotate: exploring multi-user ink annotation in web browsers. In: *AUIC '10 the Eleventh Australasian Conference on User Interface*, Australia.