New Web tool to create educational and adaptive courses in an E-Learning platform based fusion of Web resources

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Abstract. The evolution of new communication and information technologies led to a very high rate of innovation in online education. This opens doors for several major research projects at universities, institutes and research centers, all over the world. The content of training courses and quality are two key points presented in each E-learning platform system. Our working interest registers in these two points, or the need for powerful tool to create automatic creation of course content and the source is of course the Web, which has a huge space of information available requires good and over filtering. Our new tool increase the quality of being given the wealth of Web resources, direct adaptation based fusion of Web resources to learner profiles give high performance of our new tool, and enrichment of courses directly from the Web with backup of extracted resources, ensures the reusability of E-learning platform resources. This is also important that teachers receiving full benefits, time and effort will be reduced, and they just control over resources created in databases of system.

Keywords: Web Resources, E-learning Platform, Reusability, Adaptation, Fusion, Learner Profiles.

1   Introduction

The amount of learning material on Internet has grown rapidly in recent decades. Therefore, the information consumers are challenged to choose the right things. In systems of e-learning, most approaches have led to confusion for learners. Inevitably, adaptive learning has gained much attention in this area [1], [2].

We aim through our new tool reduce the huge space of the Web, containing billions of Web pages, to a personal space and direct adaptive to learners, to increase their satisfaction and provide good training scalable to any change or update [3], but with reliable and academic resources [4]. We must find good research and precise filtering to extract the most relevant information, because we are facing a very large mass of information available on the WEB, and editors spend an indefinite time to create courses and more specifically, having a content database that will be adapted to learner profiles. And before the learner needs to cultivate, to deepen more on such field or theme of learning [5], we are obliged to produce system that uses the Web as a documentary medium, and provides techniques to custom navigation for learners.

The rest of paper is organized as following: the second part related works and learner needs to construct adaptive and personalized learning domain. In the third part, we present our new tool and approach to create educational and adaptive courses in an E-learning platform based fusion from Web resources. And finally, we terminate with discussion and conclusion.

2   Related works

To create a practical learning environment for e-users, and to a broad audience (different objectives, knowledge levels, funds or learning abilities), it is necessarily that the designers of e-learning systems thinking on adaptive learning environments and flexible with this potential need, so they must improve the performance to the learners [6], [7]. Recent works dealing with the problem of adaptation have very powerful difficulty, because such learner profile can change a lot of time in learning [7], [3].

Some researchers are in making extensions for learning content standards to improve the quality of learning process. These researchers argue that current standards do not support an adaptive system so that they must be changed to have good adaptation to learner model. Much effort has been made in the field of adaptive systems to offer a user model. In learning systems, most of these works are about learning styles of learners to gain more [8], [9], [10], [11]. Learning style is an acceptable factor of adaptation, as it reflects the characteristics of learner preferences and needs.

There are two different general approaches of learning content adaptation [12], [13], [14]. The first approach seeks to adapt learning content with special needs, and the second focuses on the provision of the most appropriate learning content to needs of learners. The first is called adaptation of content level and the second is called the link-level adaptation. Neither approach has been preferred to another in the literature. Several research projects have been targeted to lead to propose new methodology for appropriate content. Some of these studies are underway on the extension of learning content standards to improve the quality of learning process. One group argues that current standards do not support an adaptive system so they must be modified in some respects [15], [16]. In response to fact that metadata standards of learning content are somehow inadequate for some applications, group of researchers tried to replace these standards with ontologies 'Semantic Web' [17], [18], [19], [20], [21]. Ontologies modeling course and give interaction between learners and systems, such as [17], [18], [20], [21], [22]. There are some studies that have used agents in adaptive learning [3], [4].

Current generation of E-learning platform is not yet ready for commercialization [23]. In other words, current studies are so focused on quality of adaptation [2] that result in special systems designated for learning purposes and does not work with other systems. In addition, no work to date has begun the next content before the adaptation, that is, to adapt content unorganized or non-existent [24]. The new in our research (addition to last work [25]), is the fusion of several fragments of Web resources, to increase the quality of training content via adaptive, reliable, very rich and dynamic learning domain in the sense enrichment and update.

307

3   Proposed approach

We must first searching in the Web by Google API; we can with this API finding Web resources to be filtering in another processing step. In second time, we consider implementation and the use of ontology in our system. A simple idea is the extraction of concepts, slots and instances. To do this step, we need an API called Jena. This API allows reading and writing of ontology (RDF or OWL type) in Java Platform. Our domain ontology is OWL-type, which has facilitated its implementation. We keep the hierarchy of ontology after extraction of concepts to give hierarchy that preparing our Learning Domain to saving in next time all extracted segments in correspondent parts of course in new segments database 'NSDB' after fusion of sub segments. 'NSDB' database use Excel model (as in Table 1.), to do this, we used a Java Excel API; this API allows reading and writing an Excel document in Java Platform. For each part of course, we define some semantic rules 'SR' to calculate degree of relevance 'DR' and distance based semantic rules 'DBSR' of each sub segment 'SS' of one Web resource part. The semantic rules of each course part defining in table are organized vertically and for each one, we define their correspondent sub segments, these later are extracted from Web resources. After this, we start fusion process (as in Fig. 1.) for each course part in table, for example for Part 1, we choose the content stored in sub segment 1 to N and save new segment or course part in correspondent column, in the same part of course Part 1, we save result in FSS1 'Fusion of Sub Segments'.

Table 1. Portion of Excel Model to save Filtering Results

			DR	DBSR			DR	DBSR
Part 1	SR1	SS1	0	0	…	SSN	0	0
FSS1	SR2	SS1	0	0	…	SSN	0	0
	…	…	0	0	…	…	0	0
	SRN	…	0	0	…	…	0	0
…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…
Part N	SR1	SS1	0	0	…	SSN	0	0
FSSN	SR2	SS1	0	0	…	SSN	0	0
	…	…	0	0	…	…	0	0
	SRN	…	0	0	…	…	0	0

We obtained a comprehensive approach that meets our needs:

- The hierarchy of course is mined from ontology of domain.
- Annotations and keywords of each concept in ontology are extracted and assured calculation of degree of relevance 'DR' (1) of each segment extracted from Web resources to finding the most relevant portions.
- We calculate Distance Based Semantic Rules 'DBSR' (2) for all relevant portions to extract the most relevant sub segments.
- Finally, we order the most relevant sub segments in Excel Model to create our New Segments Database 'NSDB'.
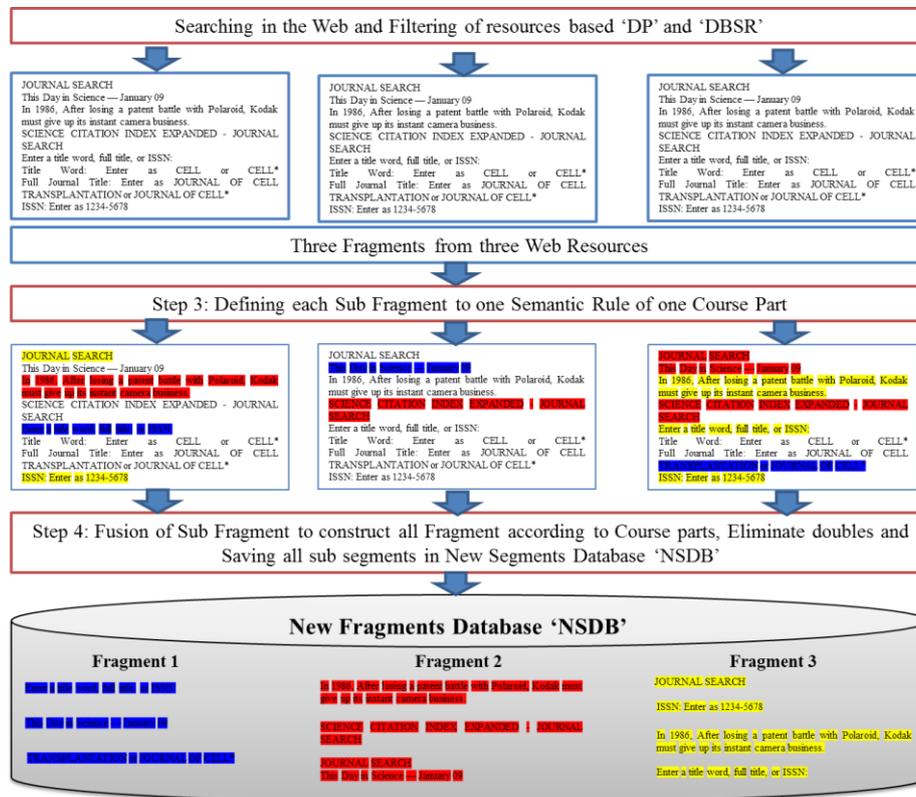
Fig. 1. Fusion process of three Web resources

3.1 Degree of Relevance 'DR'

It is a statistical result (1), based on the frequency of ontology concept (which presents a component of the course) in Web resource segment in the first part and the existence of keywords and their frequencies in the same segment in the second part. The frequency 'F' of a word in one segment is the number of times that word appears in this segment. Degree of relevance equal frequency of ontology concept in fragment, adding sum of keyword (k=0…n) frequencies of one ontology concept in one Web resource segment, multiple by correspondent keyword weight 'W'. The all is devised by total number of words in one Web resource segment.

3.2 Distance Based Semantic Rules 'DBSR'

It is a semantic result (2), based on the distance between terms in sub fragments, we must firstly extract terms from one sub fragment, and we calculate distance only between terms that defined in semantic rules. DBSR present a projection of semantic rule on sub fragment of Web resource to extract the most relevant sub segment appropriate to one sub part of course.

3.3 Fusion & Adaptation process

When processing of one document is finished, same steps were doing to other documents, but provided to relevant parts in order in Excel file for each component (column) of the course. If processing is completed, 'NSDB' database is full accomplished. After that, our 'NSDB' database present mean of adaptation based fusion process. We can adapt courses to level in learner profiles. Each level has number of course parts, and number of semantic rules. If level augments, course parts and semantic rules augment.

4 Discussion and Conclusion

Through this study developed, we succeed in building new Web tool with new adaptation approach in E-learning platform, based research and filtering of Web resources, after that, creating areas of learning with possibility of fusion of extracted resources, and the most important, adaptation of Web content to learner profiles. The world in the last years saw very rich side resources available on the Web; our method is to reduce this informational space in an adaptive educational space, personalized and mostly reusable for entire community of learners.

The study improves the quality of segments after fusion of several Web resources, and reusability of segments stored in our database gives performance in E-learning platform, and finally the augmentation of construction courses quality with enrichment by Web resources and the good methods of research and filtering implicated in our tool.

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