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Formal Description and Automatic Generation of Learning Spaces based on Ontologies

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Abstract

A good virtual Learning Space (LS) should convey pertinent learning information to the visitors at the most adequate time and locations to favor their knowledge acquisition.

Considering the consolidation of the internet and the improvement of the interaction, searching, and learning mechanisms, we propose a generic architecture, called CaVa, to create virtual Learning Spaces building up on cultural institution documents. More precisely, our proposal is to automatically create ontology-based virtual learning environments.

Thus, to impart relevant learning materials to the virtual LS, we propose the use of ontologies to represent the key concepts and semantic relations in an user- and machine-understandable format. These concepts together with the data (extracted from the real documents) stored in a digital storage format (XML datasets, relational databases, etc.) are displayed in an ontology-based learning space that enables the visitors to use the available features and tools to learn about a specific domain.

According to the approach here discussed, each desired virtual LS must be specified rigorously through a domain specific language (DSL) that was designed and implemented.

To validate the proposed architecture, three case studies will be used as instances of CaVa architecture.

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1. Introduction

With the popularization of the Internet, its use in information access became common anywhere, to anyone and in many computing devices, such as smartphones, tablets, personal computers, etc. Moreover, many ways to store data in digital format emerged. These storage formats help to improve the accessibility to the information originally kept in physical documents belonging to museums, libraries or similar institutions. This storage is held in repositories of

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digital objects. Therefore, having information associated with digital objects on the Internet, they can be distributed and viewed through sites which possess features for viewing, interacting and navigate over them.

The popularity of Internet, making information accessible to everyone, anywhere, at every moment created the opportunity to evolve traditional exhibition spaces, as reading and show rooms, to virtual spaces on the web in order to enable new learning approaches.

Traditional Learning Spaces (LS) are physical locations, normally within schools and universities, exposing objects with information (whether material or immaterial things), arranging them in order to convey a message to the LS visitor[1,2]. LS host groups of people (usually students) debating about a specific subject and someone (usually a professor) who leads the debate, organizing behaviors through formal methods of education, to impart knowledge to the group.

However, most people's knowledge is not acquired in formal methods of education (as learning in a classroom, for example), but during their leisure time outside the classroom, using their laptop, smartphone or any device to socialize with other people, as well as snack bars at breakfast, travelling on a train, and also visits to museums, libraries and the like[3]. Therefore, any physical space that features knowledge sharing can be considered a learning space.

In short, the previously cited features allow a range of people (not only students) to use these learning spaces to generate and acquire knowledge. Thus, the term e-Learning should not be applied in this context to avoid misunderstandings, because it is usually used to describe LS just for students enrolled in distance education, which is not our purpose in this work. Virtual Learning Spaces, like virtual classrooms, virtual seminars, virtual museums, improve learning experience by supporting learning at leisure time, i.e., at flexible locations and time.

To build these virtual Learning Spaces, data about the desired domain should be stored in a way that later can be processed and displayed to the learner in the best possible way.

The focus of the work here reported is to build virtual Learning Spaces adapted to Cultural Heritage (CH) domain.

According to UNESCO, the legacy of physical artifacts (tangible[1]) and intangible[2] attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations are called Cultural Heritage[4]. Cultural Heritage is not limited to material manifestations, such as monuments and objects that have been preserved over time. This notion also encompasses living expressions and the traditions that countless groups and communities worldwide have inherited from their ancestors and transmit to their descendants, in most cases orally[5]. We understand culture as what we live, encompassing the daily life, traditions, attitudes, and norms of the society. Culture changes according to ones experiences, i.e., what each person learns. The heritage, is a patrimony that does not change, because it is what we inherit, i.e., what come from the past (wealth of the past).

Concerning this project, we are working with intangible CH objects with the goal of creating virtual Learning Spaces to disseminate knowledge.

The project proposal aims at automating the creation of web-based virtual Learning Spaces using an ontology and a Domain Specific Language (DSL). The ontology will serve two purposes: first, give semantics to the digital object repository; and second, describe the information that must be displayed. The DSL should allow a detailed description of the desired space. So the specific goals of this project are to create a formalism (DSL) to describe rigorously Learning Spaces taking into account the domain ontology; and develop a mechanism to generate automatically the virtual LS from its formal specification. It is a challenging idea, different from all similar projects found in the literature.

Aiming at validating the proposed architecture, three real case studies – (1) Emigration Documents belonging to *Fafe's Archive*; (2) Collection of life stories of the *Museum of the Person*; and (3) The prosopographical repository of the *Fasti Eclesiae Portugaliae* project – will be used. These real scenarios are actually relevant as they promote the digital preservation of our Cultural Heritage, contributing to human welfare. As said above, it opens many possibilities of disseminating the knowledge preserved.

Namely, it is not another project in the area of eLearning (actually we are not concerned with the topic involved in distance education targeted to closed sets of students enrolled in some course) also it is not a new approach in the area of creating digital versions of traditional museums.

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[1] http://www.unesco.org/new/en/cairo/culture/tangible-cultural-heritage/
[2] http://www.unesco.org/culture/ich/index.php?lg=en&pg=00022#art2