Informal Learning at the Workplace via Adaptive Video

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Abstract Learning at the workplace is to a large extent informal. Trainees often need consultations with more experienced colleagues who can answer their questions or demonstrate certain practice. This process is usually very time consuming for the more knowledgeable ones, who often need to repeat their explanations for various trainees. There is a high potential to make this process more efficient by means of technology, especially by using the power of multimedia. In this paper, we present a vision and work in progress for enhancing informal learning at the workplace by using video annotation and video adaptation techniques. This is part of the research and development in the Learning Layers project.

Keywords: Informal Learning, Workplace Learning, Video Annotation, Adaptive Video.

1 Introduction

The project Learning Layers aims to research the role of information technologies in informal learning at the workplace. The project has selected two very challenging application areas, the construction industry and the healthcare sector. Informal learning has traditionally played an important role in these sectors, but both have been hesitant to embrace learning technologies for different reasons. The emerging technologies are a key enabler to refocus efforts on informal learning, but few companies have taken these technologies up in a systematic way to include them into their learning strategy. The project is discovering whether technology can scale up the interactions in informal learning at the workplace.

Discussions with stakeholders revealed various requirements which can be solved by using multimedia in workplace scenarios. For instance, in the construction area young employees often ask their more experienced colleagues for advice and explanations. Moreover, when new techniques emerge (e.g. new devices/practice are introduced) people usually need assistance to understand how they function. In such situations an expert shares his knowledge with the peers, in order to boost the adoption of the new practice. However, if the process becomes repetitive, the resulting way of training is not very efficient. As such, a reasonable use of technology saves a lot of time and money.

In such workplace scenarios, mobile video recording and annotation make the training process efficient, maintaining in the same time important principles of education like engagement, demonstration and authenticity. Video is an intuitive and simple way to share an experience, as it captures many aspects of learning episodes. But because the information contained in the video is not explicit, a key feature for the easy identification of relevant parts of a video can be made by means of semantic annotations. These provide the basis for adaptation of the video according to the situational needs, selecting the relevant parts of it and presenting them in a suitable way. Thus, our solution considers mobile video recording and Web-based collaborative annotation of the resulting content. We explore if the collaboratively generated semantic annotations can represent a motivational aspect, by allowing learners to communicate and clarify issues among themselves. Furthermore, we explore if adaptive video presentations, based on the semantic annotations can further improve the efficiency of the informal learning.

2 Video Annotation

Domain knowledge of experts is often informal and ill-structured. This implies a danger of wrong representation and oversimplification when transformed into a linear form. However, for specific domains such as construction and healthcare an optimal balance between usability and the descriptive power of annotations has to be achieved. This is mainly because the vocabulary established in such working communities is of great importance for structuring and retrieving relevant information. If we consider videos as a medium of knowledge representation, further issues like segmentation and direct access to relevant parts have also to be addressed. A challenge is to provide an opportunity to easily select the scenes that are relevant in a particular context and to present them accordingly to learners. Semantic video annotation has been successfully used to categorize videos using metadata, both at a low (video frames) and abstract (semantics) levels. Development of new mechanisms to support individual and collaborative learning with videos or multimedia on the Web has been identified as an important direction of research [1].

SeViAnno is a semantic video annotation tool developed in the context of a cultural heritage scenario [2]. The tool enables plain text annotations, as well as several types of semantic annotations, i.e. *Place, Object, Agent, Concept, and Event* which are attached to specific video time points or video segments. Along with the annotation services, cloud upload, video transcoding and streaming and the use of shared media repositories are also supported for providing rich multimedia interaction capabilities. All these services are used from the various user clients, providing a flexible, extensible and modular approach to cope with video annotation use cases.

An improved widget-based prototype, which uses the customization and near real-time capabilities provided by the ROLE SDK[1] - SeViAnno 2.0[2] was further developed using the mentioned infrastructure. Apart from the collaborative features offered by the Web widget technologies, SeViAnno 2.0 also makes use of responsive

[1] http://sourceforge.net/projects/role-project/files/role-m10-sdk/
[2] http://role-sandbox.eu/spaces/sevianno2

learning spaces, targeting to be a tool for communities of practice [3]. As such, community members can join a shared space and collaborate on one or more videos. SeViAnno 2.0 contains several types of widgets used for different purposes: a video list widget, a video player widget, an annotation widget, a map (Google Maps API) widget, and a grid view widget for displaying the semantic annotations. As previously mentioned the semantic annotations can be added taking into account video time points and time interval information. The annotation services provide also the methods for searching videos or annotations. The metadata is stored using the MPEG-7[3] standard, which specifies a multimedia content description interface.

In the two Web versions, users can select a specific video and annotate it using the specified annotation types (i.e. plain text/keywords, semantic types). While the video is playing, the semantic annotations corresponding to the current video player position are being highlighted. Moreover, users can jump to a certain video position using the existing annotations (e.g. clicking on an annotation). The community awareness is given by the underlying ROLE space, consisting of a list with the members registered in a space (with presence information) and a multi-user chat.

In the Learning Layers project we have learned that an important requirement in the construction industry is the extreme limitation of available annotation vocabulary. Therefore a mobile version, called "Ach so!"[4], was developed in order to support informal learning in construction scenarios. Due to workplace constraints, Ach so! supports only simple text annotations, making it a usable tool for construction workers which work and need or capture information on-site. Nevertheless, such annotations can be further collaboratively developed into a more formal representation that may provide a better basis for useful end user services.

By using and further developing the semantic video annotation application, our approach supports communities of practice, especially regarding two main directions: 1. Support the user collaboration and seamless annotation capabilities across multiple platforms and devices (e.g. mobile, Web); 2. Make use of the mobile-Web interplay in order to collect contextual metadata, to further support both context detection and adaptation based on the gathered data by offering interplay of meaningful video fragments according to the needs of specific learners.

3 Adaptive Video Presentation

Our aim is to benefit from the annotated videos and provide an opportunity to adapt them according to the current situational demands. This should be based on the current preferences specified by a set of terms to extract just those parts of one or more videos that are relevant for these terms. In this way several long videos can be transferred into one relatively shorter, which may address the current learning goal and situational demands. Our adaptation approach is an incipient work. It is based on the FOSP method [4] that has been applied in the eQ system [5], which considers emotional intelligence in personalized adaptation. This acronym stands for Filter, Order, Select, Present. In the first step just the relevant components (segments) are

[3] http://mpeg.chiariglione.org/standards/mpeg-7
[4] https://play.google.com/store/apps/details?id=fi.aalto.legroup.achso

taken into account. In the second step these components are ordered according to certain rules. The third step includes selecting one of alternative representations of the component (e.g. the preferred media), in order to avoid redundancy. In the last step a suitable presentation strategy is chosen, e.g. how many components should be presented in parallel and how to arrange them on the end user device. These 4 basic operations are defined by functions specifying relations between various sets of attributes (metadata) from the domain, learner, and context models. For instance the weight of a component depends on its annotations and the current preferences of the learner. The order of the selected components may reflect certain logic or pattern. From alternative representation of an Object or Event the most suitable one is chosen, depending on the criteria. Various constraints can be considered, like the weight of the components or the total length of the adaptive video. In this way different adaptation strategies can be specified by different functions operating over the same data. One strategy can order the chosen components chronologically, another one according to their relevancy for the current context. Moreover, a strategy can limit the length of the adapted video too.

4 Conclusions

In this paper, we describe an informal learning approach based on collaborative video annotation, aiming to facilitate informal learning at the workplace. We intend to collect various types of annotations and use them to provide direct access to the relevant parts of them, which depend on the current context and situational demands.

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