Improvised E - Learning with options of Searchability and Active User Participation

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Abstract - Current usage of e learning suffers from two main problems – searchability and active user participation. To overcome these challenges , the implementation of a collaborative educational e learning process is promoted here. The paper focuses on making e learning process very attractive and easy for use. The main aim is to foster a culture of participation among different user groups. Users can interact with each other while viewing a particular video , a user can also be able to search a particular portion of video ,to view only content of his interest. An algorithm for the extraction of semantic data is also presented.

Index Terms – e - lectures, video annotation, tele-teaching, collaborative learning.

1   INTRODUCTION

With the age of e-learning, some of the disadvantages of the traditional learning culture were overcome. Those include the dependence of students on teachers' methods and choice of material, a fixed curriculum and the focus on synchronous learning in groups. Researches have shown that e – lectures are playing an important role in dissemination of information, online. In the United States, 6.7 million students were enrolled in at least one online course in the Fall Semester of 2011. The data suggests that more than 32% of all higher education students were taking atleast one online course.

Nowadays even a small institute has a large database of e – lectures maintained for its students . Lecture recording systems like Tele-Task, Opencast Matterhorn, Camtasia Studio, are becoming faster and easier to use and hence the number of video lectures is growing rapidly. However this growth of e – lectures is suffering from a major issue – it is very difficult to quickly grasp the contents of a video and secondly searching through video for a specific information is also quite difficult. Because videos are a multimedia content so it is very difficult to search or index in a video.

Two main ways are possible to approach this problem. The first one is automatic metadata harvesting. For metadata extraction , images as well as audio is required from the video. Methods such as video indexing functions like automatically extracted slides provided in a timeline format, lecture structures extracted from the lecturers' slides and enhanced with direct links to the video, as well as keywords, can all serve the purpose of finding the essential information within a large set of unprioritized data.

The second approach is the introduction of Tim O'Reilly's web 2.0. An idea of online user communities was introduced where users could create content online and share that content with a group of other users. This results in active participation of all users. Also, large amounts of new metadata that are not part of the lecture video can be created by the participants. Research showed that the active involvement with the material and the exchange with other learners is important in distance learning. Hence a lecture video annotation was introduced. This will allow students to actively participate in the video lectures and make the overall experience interesting.

The main focus of the research is to identify whether digital video annotation provides added benefits and to make recommendations to which features improve learning and experiences with video annotations. Video annotations have not been previously discussed in any research or developmental work. First of all, the evaluation aims at showing that digital video annotation improves learning effectiveness when using lecture videos. Second, individual annotations are compared with annotations from learning groups. Third, several principles from the culture of participation are employed and evaluated to make a statement about their usefulness.

2 THEORETICAL BACKGROUND AND RELATED WORK

Annotations can be of various types. First of all, we can make a distinction between manual and automatic metadata generation. With the automatic approach, metadata is harvested from audio and video data from the e-lectures. Video OCR (Optical Character Recognition) and ASR (Automatic Speech Recognition) techniques are used to extract textual data from the media files. Using the manual approach, we can distinguish between many different subsets. First of all, different groups of people can annotate. Using the media service department to annotate lecture videos is very time consuming and costly. When the lecturers themselves annotate their lecture videos, this is a very time consuming and therefore mostly impracticable approach. The last approach is the annotation by the users. User annotation can also be divided into two methods. It is possible to allow free text annotation, or one can limit the annotation to a certain set of pre-defined vocabulary. Research into standard video annotation functions has been in progress for about ten years now. Video annotation functions themselves were proven to be beneficial for students by several researchers so far. The first benefit is the easier browsing of the lecture video. Because textual annotations are metadata in addition to the multimedia video, they provide a means with which to browse the video content more quickly and easily. Furthermore, other media formats such as links and images can be used in addition to textual annotations The annotation process itself is the second benefit for students. Didactically positive processes like the reflection, weighting and interpretation are included in the annotation process. Therefore, it promotes a deeper understanding of the topic being explained. Collaboration and discussions amongst the students are encouraged as a third benefit. This is the case because these time-based annotations servse as anchored discussions as opposed to forums.

Wikis are very popular tools for digital video annotation. The academic search engine Yovisto by Sack and Waitelonis for example, is extended by a wiki. Alternatively, they allow collaborative annotation via tagging of lecture segments. Those tools are the means for further discussions about and explanations of the lecture video. They can be used by either students or lecturers. Their wiki content is not time- based, however, thus re-visiting certain points in time where a note was taken is not possible. The tagging feature, on the contrary, is time-based, but is not made for longer texts that can form a manuscript for students at the end.

Hermann and Ottmann also describe the integration of a wiki with lecture videos. Their approach is to link a specific point in time within the wiki and begin the discussion about what is taught there.

An automatic approach is to copy the content of lecture slides into a wiki and ask students to collaboratively enhance this automatic lecture script, as introduced by O'Neill.

2.1   DEFINITIONS

A digital lecture video annotation is a quadruplet consisting of the annotated text (T), the content item to which it is attached (C), the timestamp within the content item to which the annotation is added (TS), as well as the user who writes the annotation (U),

$$a = (T; C; TS; U)$$

When the annotation is shared within a group for collaborative purposes, the definition is changed as :

$$a = (T; C; TS; U; G)$$

where,

(T) – the annotated text ,
(C) - the content item,
(TS) - the timestamp within the content item
(U) - the user annotating the lecture
(G) - the group with whom the user shares his or her annotation.

3   IMPLEMENTATION

For each lecture a separate annotation is provided .The first tool is called a digital manuscript, as it supplies the functionality of writing a digital time-based lecture manuscript in a wiki-style environment while watching the lecture video.

There are two use cases for students working with e-lectures. First, students might use the lecture recording at any time after the original lecture took place. The students can use the e-lecture to either substitute the original lecture in this case, or to replay the lecture for learning and revision purposes. In order to allow the students to simultaneously watch the lecture recording and write notes on it, the manuscript interface is situated underneath the video player where the lecture is played.

Live streaming is the second use case. While the lecture is in fact taking place, the students have the option of receiving a broadcasted stream from any other location. A live streaming calendar provides access to the live stream as well as a link to the manuscript interface. The calendar also offers the students an overview of upcoming streamed events. When writing annotations in the live setting, the time is not saved as an offset, but rather an absolute time stamp is stored. The offset relative to the beginning of the lecture is calculated when the lecture is saved in the portal. Live annotations are thereby transformed into portal annotations. Students using the live annotation feature, therefore, may also benefit from the video structuring and search capabilities of the annotation feature.

3.1   Models and Processes

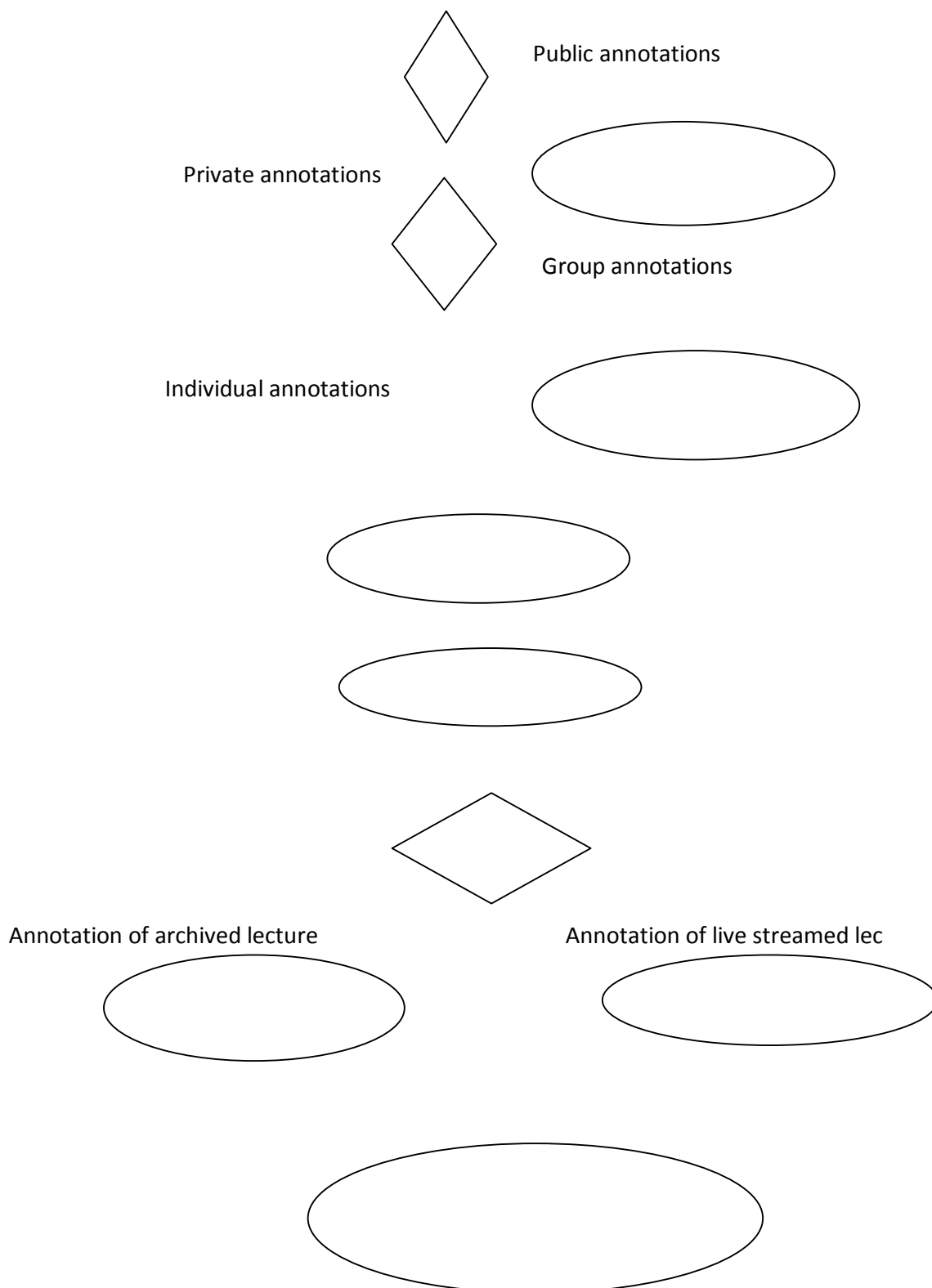Several use cases for annotation process can be distinguished. Those include:
Private and Public annotation
 Individual and Group annotation
 Live and on demand annotation

The different use cases are all incorporated into one interface so that the user may choose between the different options at once.

Public annotations

Private annotations

Group annotations

Individual annotations

Annotation of archived lecture

Annotation of live streamed lec

3.2   User Interface

It was found out that the ease and speed of the annotation interface is crucial for its success. Formatting options are also desired. In order to make the annotation process faster, therefore, a marker was implemented that allows students to set a bookmark at one specific time within the video with one click. Pre-defined default captions, such as important, exam and revise are available. Students can use these as a very rapid input, but they can also define individual markers. The manuscript feature with limited WYSIWYG functionality was implemented in order to provide more formatting options.

Whereas the marker creation interface only consists of a listing of the captions connected to a differently colored marker icon, the manuscript creation interface includes a text edit field that is transformed into a javascript field in order to include formatting options. The public option as well as the group selection are also included in the interface. The viewing interfaces are situated underneath the marker and manuscript creation interfaces. As additional features, both of them include links to the editing interfaces at the back end (edit, delete, etc.) and links to directly jump into the video at the specific point in time when the annotation was created - the timestamp for the manuscript and the marker on the timeline for the marker function. The manuscript interface additionally includes a screenshot option that saves a small version of the current slide within the annotation. This allows students to also store visual hints along with their textual annotations that should help them to retrieve the desired information more easily at the end. Furthermore, an icon that triggers a pdf export is added. This allows the students to use their manuscripts also for offline learning.

3.3 Culture of Participation

The digital manuscript function for groups supports creating a user group where all members may annotate the video at any point in time. Ultimately, it should allow all group members to see and edit each other's notes. In order to incorporate a culture of participation in this learning scenario, five issues have to be tackled:

_ fostering group awareness
_ incorporating rewards from the group
_ creating scenarios to support problem-solving
and online discussion
_ engaging more students as coordinators and collaborators
_ involving students as meta-designers

First of all, it must be ensured that the authors of the contributions are obvious when a group of people are working on the same annotation. Since four different states for the annotations are possible - private, visible in the group, public and not linked to the group, as well as public and visible in the group - a rights managements system makes sure that private annotations cannot be seen by group members, that only publicly available annotations can be viewed by users outside the group, and that only members of the group are actually able to change annotations within the group. This rights management, as well as the group awareness functions, have been implemented and are available via the web interface.

On the one hand, rewards from the group can be supported by tracking the contributions. If a version control system is utilized, the group members are more aware that their contribution is being judged, because their inputs are countable and publicly visible.

Also, notifications about the latest contributions should be offered. On the other hand, counting all contributions in a statistic that is visible to all group members will allow for control of individual group member participation in terms of both quality and quantity. Awarding an extra status boost for well performing group members, as well as a voting system to select the best group members are further options for how group reward can be implemented. Voting can also be implemented on the annotation level in order to enable quick and easy low-level feedback. Those last-mentioned triggers for group reward are part of a research field that has recently opened up. These mechanisms are also of benefit to the teacher as well in terms of grading the students. If participation is defined as part of the learning target the statistics may be used for student evaluation. A second form of assistance for grading is textual group feedback.

Problem solving and online discussion can also be incorporated into an open and flexible annotation system. As Reinhart et al explained, the teacher may plant some seeds, so to speak, to trigger these processes. One scenario includes the teacher asking questions within the lecture. It is the students' task, then, to discuss these questions and document their discussion within the digital annotation. Second, students might even post questions when annotating a live lecture. At the end of the session, the questions are answered in a pre-defined time slot.

Different methods to engage more students as coordinators and collaborators can be imagined. For example, students should be encouraged to form their own groups and collaboratively write a manuscript that they can use for learning and further discussion. However, the teacher could also create a learning group. One possible use case is a seminar in which students present different topics in a talk. Those presentations would need to be recorded. In the tele teaching environment, the annotation interface could be used by the fellow learners for discussion and questions.

The annotation environment itself is the means with which to give learners the freedom to act as meta-designers. When it is designed in a freer and more open manner, the user has the opportunity to adapt the environment according to his or her needs and use it in a way that works well for his or her context and learning style. More precisely, besides simple textual annotations it should be possible to include files as well as structure and design. A wiki like environment would fulfill those needs. One obvious scenario from the students' perspective is the utilization of the annotation environment as a tool for the collaborative creation of a lecture manuscript. This manuscript can serve as a means of exam preparation, as a summary of the topic, and also as a later point of entry for further research and learning.

5   CONCLUSION AND FUTURE WORK

In this paper, we have introduced a collaborative video annotation function and illustrated several user studies and questionnaires we conducted to test this function. From the students' feedback, it is obvious that this kind of participative feature is desirable in a distance learning setting. Students favour the manuscript feature that allows them to have searchable notes with a timestamp that enables them to jump into the video at the desired points for revision. Also the learning effectiveness when watching e-lectures showed a tendency to be higher when students used the manuscript function in addition to watching the video. Nevertheless, a further need for modifications to the functions has been revealed.

First, we plan to make a number of improvements to the manuscript and marker functions. Primarily usability adjustments to the user interface have to be made. All functionalities need to be on one screen, making scrolling obsolete. The viewing area might therefore be placed beside the input area. Furthermore, the marker function should be enhanced by providing shortcut keys for important pre-defined system markers. The formula editor is an enhancement for the manuscript feature. Because several students also said that the exact time when the annotation is entered is usually too late, we plan to utilize the automatic segmentation function and always assign the annotations to the time span of the matching segment.

Further challenges in connection with the development of the annotation feature include knowledge management issues. The aim is to make the annotations easily searchable, and other existing metadata reusable in the annotation context, and also to reuse the annotations themselves as well as allow the students to keep their data. The search can be enabled by including the user-generated data within the search index. Reusing existing metadata might involve, for example, the feature that the text from the automatically created lecture structure (data retrieved from the slides by OCR techniques) can easily be copied into the manuscript. Allowing the students to also store their data outside the portal is possible by having several export functions. We started by implementing a PDF export, but other data like csv or standard text are options for further development.

When it comes to reusing the annotations themselves, the extraction of further semantic metadata is the next step. A quick overview of this possibility was demonstrated in this article. Further evaluation and details of the implementation remain to be presented.

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