Expanding Horizons and Envisioning the Future of Analytics on Video-Based Learning

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WAVe 2013 workshop at LAK'13, April 8, 2013, Leuven, Belgium.

Abstract
This paper describes the potential and promising value of analytics on the emerging area of video-based learning. In particular, we describe the contributions presented at the International Workshop on Analytics on Video-based Learning (WAVe 2013) and envision the future of this research area. WAVe presents the current state-of-the-art in the design, development and evaluation of video-based learning systems. WAVe 2013 emphasized the importance and benefits of analytics for video-based learning to support learners and instructors with the appropriate resources for improving the use of video-based learning systems. The long term goal of WAVe is to develop a critical discussion about the next generation of analytics employed in video learning tools, the form of these analytics and the way they can be analyzed in order to help us to better understand and improve the value of video-based learning. In this volume, we have included the 6 submissions and the 2 keynote presentations that were featured at the workshop.

Author Keywords
Analytics, Video-based Learning, Video-lectures, Interaction Design, MOOCs

ACM Classification Keywords
K.3.1 [**Computers and Education**]: Computer Uses in Education - Computer-Managed instruction (CMI).

Introduction

With the widespread adoption of video-based learning systems such as Khan Academy and edX, new research in the area of Learning Analytics has emerged. Even new for-profit companies, such as Coursera and Udacity, have started offering forms of instruction that are primarily video-based. To date, universities across the globe (Stanford, Oxford, MIT and some 800 other schools) offer video lectures on topics from Algebra to Zoology.

The use of video for learning has become widely employed in the past years [5]. Many universities and digital libraries have incorporated video into their instructional materials. Massive Online Open Courses (MOOCs) are becoming an increasingly important part of education. For instance, students can access academic content via digital libraries, discuss with tutors by email and attend courses from their home. In order to support video learning, various technological tools have been developed, such as Matterhorn and Centra. These tools and others like them provide an easy way for a learner who has missed a lecture to catch up, but also enable other, especially slow learners, to review difficult concepts.

Many instructors in higher education are implementing video lectures in a variety of ways, such as broadcasting lectures in real time, augmenting recordings of in-class lectures with face-to-face meetings for review purposes, and delivering lecture recordings before class to "flip the classroom" and provide hands-on activities during class time. Other uses include showing videos that demonstrate course topics and providing supplementary video learning materials for self-study.

Millions of learners enjoy video streaming from different platforms (e.g., YouTube) on a diverse number of devices (TV, desktop, smart phone, tablets) and thus create records of billions of simple interactions. This amount of learning activity might be converted via analytics into useful information [4] for the benefit of all video learners. As the number of learners watching videos on Web-based systems increases, more and more interactions have the potential to be gathered. Capturing, sharing and analyzing these interactions (datasets) can clearly provide scholars and educators with valuable information [11]. In addition, the combination of learner profiles with content metadata provide opportunities for adding value to learning analytics conducted on data from video based learning activities.

To explore the future of video-based technologies for teaching and learning, we aim to build a research community around this topical area, to brainstorm about what the next generation of video-based learning tools might look like, what kind of data can be collected, and how these data can help us to better understand and improve the value of video-based learning.

Existing empirical research (e.g. [5, 7, 9]) has begun to identify the educational advantages and disadvantages of video-based learning. However, there still remain many essential unexplored aspects of video-based learning and the related challenges and opportunities;

such as, how to use all the data obtained from the learner, how to combine data from different sources, and so on. WAVe aims to support this research endeavor through an analytics approach to video-based learning. In particular, the objective of this workshop was to bring together researchers, designers, teachers, practitioners and policy makers who are interested in how to do research on the use of any form of video technology for supporting learning. This workshop provided an opportunity for these individuals to come together, discuss current and future research directions, and build a community of people interested in this area.

By taking into account learners' interactions and many other data—such as students' demographic characteristics of gender, ethnicity, English-language skills, prior background knowledge, their success rate in each section, their emotional states, the speed at which they submit their answers, which video lectures seemed to help which students best in which sections, etc. — new avenues for research in the intersection of video-based learning and analytics are now possible.

Objectives

The workshop was structured be an interactive, engaging experience that motivated participants to get involved and engage in fruitful discussions on the topic of Video-Based Learning and the potential benefits of Analytics. To do so, it combined several activities. First, highly recognized keynote speakers opened the workshop. Then the workshop organizers gave the participants the opportunity to be engaged into creative and motivating discussions about the key issues related to analytics on video-based learning.

One of our main objectives was to bring together researchers who are interested on Learning Analytics and their application on video-based learning. Specifically, WAVe aimed to provide an environment where participants had opportunities to: develop their research skills; increase their knowledge base; collaborate with others in their own and complementary research areas; and discuss their own work. In particular, guiding questions and themes included:

- What might next generation of analytics enhanced video learning tools look like?
- What kind of data can be collected from video-based learning tools?
- How these data can help us to better understand and improve the value of video-based learning?

Contributions

The contributions of WAVe covered several topics, such as visualization techniques, video learning tools description, empirical examinations and best practices descriptions. In addition to the workshop proceedings (which are freely accessible from CEUR-WS), the presentations of WAVe are available via videolectures.net[1].

In particular, Brooks et al., [1] present information visualization techniques for video-lectures capture systems. With the principal goal to better understand how students use these systems, and what visualizations make for useful learning analytics. Brooks et al., applied three different methods to viewership

[1] http://videolectures.net/wave2013_leuven/

data aimed at understanding student re-watching behavior, temporal patterns for a single course, and how usage can be compared between groups of students.

Ronchetti [8] describes the current state of MOOCs and indicates that some already available tools can be better used for the extraction of semantic information from the videos. To this end, he proposes that we can improve the sensemaking of the information extracted from videos.

Ilioudi et al., [6] empirically examine the effects of video presentation styles in supporting the teaching of mathematics in secondary education. Using three different groups of students (2 with videos and one with traditional book reading), they indicate a significant difference on students attitude and that learning effects show up only after the second week. The difference on learning effect demonstrates that Talking Head video-style was more effective than the traditional book reading for complex topics.

Canessa et al., [2] introduce new prototype applications for automated recording of lectures using mobile devices. These applications were developed based on the experiences gained by the ICTP Science Dissemination Unit (SDU) in Trieste, Italy with its open source "Enhance your Audience" (EyA) recording system[2]. ICTP has more than 10 thousands hours of automated educational recordings in the fields of physics and mathematics.

Viel et al., [12] give an overview of a system which allows capturing a lecture to generate multi-video learning object composed of synchronized videos, audio, images and context information. In addition, they present how a group of students interacted with a learning object captured from a problem solving lecture and give ideas of how navigation facilities and visualization tools can assist us to include more contextual information during the presentation.

Chorianopoulos and Giannakos [4] present an open-source video learning analytics system. The system captures learners' interactions with the video player (e.g, pause, replay, forward) and at the same time it collects information about their performance (e.g., cognitive tests) and/or attitudes (e.g., surveys). The tool is a freely available open source project[3] for anyone to use and improve it.

Conclusions and the Way Ahead

The role of analytics on helping individuals to make sense of the learning procedures has drawn the interest of many scholars and practitioners in the last years. Analytics have proven their ability to help us to understand (make sense) many complex learning phenomena in the past [11].

However, comparing with research on text and discourse analytics, the research on video analytics is still on embryotic stage. Video analytics have an enormous potential, especially given what is currently happening around the explosion of MOOCs. As most of the MOOCs are using videos as their primary content delivery mechanism, research on MOOCs will heavily

[2] wwww.openeya.org

[3] https://code.google.com/p/socialskip/

influence video-based learning research. So we believe that the topic of WAVe is very timely with great potential. This potential will grow as MOOC platforms, like Coursera and Edx make their data publicly available to the research community.

Although research on video based learning has been increased in the last years [5, 10], a number of questions remain regarding the use and design of videos for learning [3]. In particular, little research has been conducted on the functionalities and the characteristics of learning videos. Characteristics like quality of visuals used, cognitive load, engagement and tone of voice, pace, length, and segmentation need to be examined in more detail in order to improve the effectiveness of video as learning medium [7].

With respect to the viewing patterns of learners, some interesting preliminary work was noted [7] including when and where students watch learning videos as well as how they view materials (e.g., in small chunks). Future research can focus on a more detailed analysis of viewing patterns and its impact on learning outcomes. For example, students who skip or re-watch segment may integrate less knowledge than students who view videos more systematically. To this end, sophisticated video analytic systems (e.g., [4]) can be used and help us to make sense and improve how students learn with the assistance of videos.

Acknowledgements

We would like to thank Dr. George Siemens and Dr. David Geerts for accepting our invitation to give keynote presentations, the workshop Program Committee members for contributing to the success of WAVe and the workshop chairs for their constructive comments and their helpful assistance throughout the workshop. Finally, we would like to thank http://videolectures.net/ for recording and editing the presentations of WAVe and the ERCIM "Alain Bensoussan" Fellowship programme for the financial support.

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