Videolectures Ingredients that can make Analytics Effective

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

Abstract

Videolectures over the Internet started at the turn of the century and became more and more popular, until they recently obtained a wide echo in the form of Massive Open On-Line Courses (MOOCs). Although videolecture usage data have always been important, in the case of MOOCs they are vital for the success of the initiative. In the present paper, we suggest that some (already available) tools for the extraction of semantic information from the video should be used, as they may vastly improve the meaningfulness of the information extracted from videolecture analytics.

Author Keywords

Videolectures, effective analytics, semantics, MOOCs

ACM Classification Keywords

K.3.1 [**Computers and Education**]: Computer Uses in Education - Computer-managed instruction (CMI).

Introduction

The idea of massively using videos of recorded lectures for teaching goes back to the attempts to use TV as an educational medium. The TV introduced some educational programs (and later channels), but only in rare occasions they were a success. A such case was the Italian TV show "Non è mai troppo tardi" (It's never too late) which from 1960 to 1968 brought more than a million of illiterates to achieve a primary school degree (probably one of the most successful examples of TV-based distance education ever, and a sort of early MOOC –Massive Open On-line Course, even though the "line" was not the Internet). Even before that there were instructional movies – used for instance to demonstrate scientific experiments that were too complex or too lengthy to be performed in a school laboratory. Also today there are educational TV channels, like Teachers TV : a digital channel for everyone who works in schools. Teachers TV's programmes cover every subject in the curriculum, all key stages and every professional teaching role. It can be accessed on digital cable and satellite (more recently also via Internet).

In the seventies, the use of VHS cassettes allowed for the first time to attempt transforming videos into an "on demand" resource for satisfying educational needs, but again the effort had only a marginal impact on the education mainstream.

At the end of the 80's, a system that implemented a rather mechanical process of individualized instruction was patented [1]. Part of the system consisted in the ability to use some ad-hoc hardware to play movies.

Only in the nineties PCs had sufficient power and memory space to consider them as tools that can be used for reproducing videos and multimedia in general. With the millennium turn the increased network bandwidth and the power of mobile devices (laptops first, and then pads and smartphones) allowed distributing videos over the Internet, which ultimately delivered today's capability to use video instruction anywhere and at any time. Since the early experiments [3, 13] a lot of research has been done on the Internet carried videolectures field (for a review see [9, 10]).

It took then about 15 years for these videolectures to pass from the work of the pioneers to the pages of the New York Times [8]. They went progressively though a larger and larger diffusion, with a first boost given (around 2005) by the Apple iTunes-U initiative, which also allowed extracting some usage data from the logs, see e.g. [2]. Along the path, for a few years (starting again from 2005) the podcasting variant has been a fashionable approach. Only recently MOOCs finally made it into the official dictionaries: the MOOC entry in the English Wikipedia dates July 2011. A history of MOOCs in 2012, the year of the boom, is reported in a post by Audrey Watters.

MOOC Numbers

Figures such as "1.7 million students for Coursera" or "ratio students to professor 150.000:1 in Udacity" [8] are certainly impressive: however, in spite of their popularity, there is little data on MOOCs. Stories of success and failure are often anecdotal. Some statistics is available coming from MOOC platforms like Coursera, Udacity and MITx, and they are puzzling.

The first MIT MOOC (MITx - 6.002x: Circuits and Electronics.), boomed with 154,763 registrants. Only 45% however (69,221 people) looked at the first problem set, and out of them only 26,349 earned at least one point (17% of the enrolled): we can consider these as the ones who manifested a real interest, rather than just a curiosity.

The number halved by the midterm assignment (13,569 people looked at it while it was still open and 9,318 people got a passing score on the midterm - 6% of the enrolled).

In the end, after completing 14 weeks of study, 7,157 people earned the first certificate (4,6% of the enrolled, i.e. 27% of those who really manifested interest). In spite of the gigantic drop, having more than seven thousand students passing a course is a massive achievement indeed.

The numbers for Coursera's Social Network Analysis class are less encouraging. Out of the 61,285 students registered, 1303 (2%) earned a certificate, and only 107 earned "the programming (i.e. with distinction) version of the certificate" (0.17%).

MOOC questions and challenges

The statistics raise several questions. The most compelling one is probably "why aren't a large number of students finishing the course?". This question may be difficult to find a response to, but responses to other inquiries can be obtained by monitoring the users' behaviour, and gathering statistics and analytics. Examples of such queries are e.g. the following ones:

- Where do the students come from?
- Which videos are most popular, and which ones attract little interest?
- Are students actually watching the videos on the assigned dates?
- Are viewers watching all the way through?
- At what point in the lecture, if any, do viewers stop watching?
- Are there any portions of the videos that are being watched repeatedly?
- Are the students watching the videos by the assigned deadlines?
- Do the videos generating active user engagement?
- Do students edit, share, download the material?

The interpretation of the statistics may however be not easy. Knowing that the sequence on lecture N at time between t1 and t2 is often reviewed is not by itself a meaningful cue. What is there? To know, we need to view ourselves the fragment. When the potentially interesting sections or points are many, this may be a very time-consuming task. The problem arises by the lack of semantic information.

Some help may come from a low-granularity structure of the material. For instance, if "lectures" are broken into small pieces (20 minutes) as in the case of Kahn Academy, or even less (10 minutes fragments, like in certain Coursera cases), it is likely that each unit has a well-defined semantics. Instead, if a lecture is recorded in class, and hence follows time constraints which are dictated by logistics rather than by content, things are much more difficult.

In these cases, substantial help may come from certain ingredients that we claim to be important ingredients of the videolectures:

- multiple (parallel) cognitive channels,
- semantic marking,
- transcripts,
- annotations

Videolecture enhancements that may (also) help analytics

The ingredients we mentioned are not really new, as some people have been using them for years in the context of videolectures as tools for improving the user experience. For instance, semantic annotation has been used for facilitating lecture navigation (see e.g. [11]), and transcripts have helped searching a videolecture (see later). However, in the light of analytics they assume a new dimension. Let us briefly examine them.

The first component we mentioned is multiple cognitive channels. Typically on-line lectures in MOOCs focus on at exactly two channels: they are either video + audio, slides + audio (the so called webcasts), or computer screen + audio (as e.g. in the case of the Kahn Academy). There are even lectures bases on audio alone (podcast), even though they were mostly used before the success of the MOOC term.

In contrast, even the snubbed frontal lectures in class are based on a richer paradigm. The teacher uses the blackboard, PowerPoint slides, may project his/her computer screen, and at the same time students see gestures and facial expressions. It is quite possible to reproduce such environment even in on-line lectures. A variety of authoring systems allow using in parallel (at least) two visual channels (e.g. slides + video), making the on-line lecture richer. While Moreno and Mayer [7] suggested that the presence of multiple cognitive channel brings a negative "split attention" effect, Glowalla [6], a German instruction psychologist, reported that lectures showing a video and slides favour learners show better concentration, while the audio + slide version is perceived as more boring. Data obtained by other investigators [4] confirm the better efficacy brought by the presence of video as an additional cognitive channels. We believe MOOCS should adopt such a rich communication paradigm, and not rely on the poorer paradigm based on a single video channel (+ audio).

This choice would help introducing the second ingredient: semantic marking. Having e.g. slides transitions makes it very easy to associate metadata to specific portions of a video. When a teacher presents a slide, what is s/he talking about? Most likely, we find the answer in the slide title. If slide transition timing, and slide content, are captured while recording the video, it becomes extremely easy to tag the video with semantic annotation. Questions like the ones we have mentioned, e.g. "Are there any portions of the videos that are being watched repeatedly?" may have now a significantly more interesting answer than "at time nn:nn": the answer might rather be something like "the fragment discussing third Kepler law". The power of analytics suddenly is vastly increased, exactly because of the availability of semantic metadata. And the important point is that such metadata – which are a resource which is notoriously difficult and costly to obtain, are automatically generated!

On the same line, availability of (synchronized) audio transcripts allows associating meaningful information to the timeline. A few years ago, we [5] successfully experimented using Automatic Speech Recognition tools to enrich videos with synchronized transcripts that allowed students to perform searches into on-line videolectures. This technique would of course also allow mapping any data coming from analytics on the content without the need of visual inspection of video fragments. Natural language processing (NLP) tools could be used to extract additional semantic information from a specific video fragment.

Finally, we mention in passing that the possibility for students to annotate video lectures would be a yet additional, precious source of information. Again, this would be a case of a feature that was originally designed to achieve a particular goal (such as e.g. to grow a community sense around a set of videolectures), and that would acquire an additional value in the context of usage analysis that is typical for analytics tools. This would be true for the extra information that NLP tools could mine from the notes, but in addition to that, data regarding annotation would per se be an extra source that could be mined (e.g. to find correlations with the difficulty or interest of a particular video portion).

Conclusion

MOOCs may be just an ephemeral fashion, or might revolutionize the future landscape of higher education: only time will tell. In this short paper we advocated the need for them to embrace a richer cognitive paradigm, and to be enriched by metadata associated with video fragments. The availability of such metadata, which should be automatically extracted, provides important hints that they make the information extracted by videolecture analytics much more significant.

References

[1] A. Louis Abrahamson, Frederick F. Hantline, Milton G. Fabert, Michael J. Robson, Robert J. Knapp. (1989). “Electronic classroom system enabling interactive self-paced learning”, US Patent 5002491.

[2] A. Defranceschi, M. Ronchetti. (2011). "Video-lectures in a traditional mathematics course on iTunes U: usage analysis" in Proceedings of EDMEDIA 2011 - World Conference on Educational Multimedia, Hypermedia and Telecommunications 2011, Chesapeake, VA: AACE, 2011, p. 720-727.

[3] M.H. Hayes. (1998) Some approaches to Internet distance learning with streaming media, Second IEEE Workshop on Multimedia Signal Processing, Redondo Beach, CA, USA (1998).

[4] A. Fey. (2002) Audio vs. Video: Hilft Sehen beim Lernen? Vergleich zwischen einer audio-visuellen und auditiven virtuellen Vorlesungen. Lernforschung, 30. Jhg (4):331–338 (in German)

[5] A. Fogarolli, G. Riccardi, M. Ronchetti. (2007). “NEEDLE: Searching information in a collection of video-lectures” in Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications ED-MEDIA 2007, Norfolk (Va): AACE, 2007, p. 1450-1459.

[6] U. Glowalla. (2004). Utility and Usability von E-Learning am Beispiel von Lecture-on-demand Anwendungen. In Entwerfen und Gestalten, 2004 (in German).

[7] R. Moreno, & R. E. Mayer. (2000). A Learner-Centred Approach to Multimedia Explanations: Deriving Instructional Design Principles from Cognitive Theory, Interactive Multimedia Electronic Journal of Computer-Enhanced Learning (2).

[8] L. Pappano. (2012). “The year of the MOOC”, The New York Times, Nov 2, 2012 http://www.nytimes.com/2012/11/04/education/edlife/massive-open-online-courses-are-multiplying-at-a-rapid-pace.html?pagewanted=all&_r=0

[9] M. Ronchetti. (2011). "Perspectives of the Application of Video Streaming to Education" in Ce Zhu, Yuenan Li, Xiamu Niu (a cura di), Streaming Media Architectures, Techniques, and Applications: Recent Advances, Hershey PA, USA: Information Science Reference, IGI Global, 2011, p. 411-428.

[10] M. Ronchetti. (2011). "Video-Lectures over Internet: The Impact on Education" in G. Magoulas (a

cura di), E-Infrastructures and Technologies for Lifelong Learning: Next Generation Environments, New York: IGI Global, 2011, p. 253-270.

[11] M. Ronchetti. (2012). "LODE: Interactive demonstration of an open source system for authoring video-lectures" in Interactive Collaborative Learning (ICL), 2012 15th International Conference on, Los Alamitos, USA: Computer society Press of the IEEE, 2012, p. 1-5.

[12] D. McKinney., J.L. Dyck, & E.S. Luber. (2009). iTunes University and the classroom: Can podcast replace Professors? Computer & Education 52, 617-623.

[13] F. Tobagi. (1995) Distance learning with digital video. Multimedia, IEEE vol. 2 (1) pp. 90 – 93.