TutorSpace: Content-centric Platform for Enabling Blended Learning in Developing Countries

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ABSTRACT

One significant impact of the Massive Open Online Courses (MOOCs) phenomenon is that they have accelerated the widespread availability of quality education content. We refer to this content as the Open Educational Resources (OERs). It is our hypothesis that the OERs can be used to supplement classroom teaching for improved teacher efficiency and better student outcomes. We present a platform called TutorSpace which helps in curating OER content from multiple sources, integrating this content into a curricular setting in the context of what the lecturer is teaching and delivering it to students in a personalized way. A particular novelty of the TutorSpace platform is its capability for content-driven non-linear navigation of video content.

1. INTRODUCTION

The developing economies such as India, Brazil, China, etc face acute shortage of quality instructors, which is one of the primary reason for large number of unemployable graduates [2, 3]. Quality educational content (i.e. videos, slides, assignments) generated by the MOOCs can be potentially used to improve student learning and engagement in developing countries. However, instructors find it hard to use OER content directly in their course due to many reasons such as lack of context, no easy way of cross-source content aggregation, limited content search and curation capabilities of existing systems, and network bandwidth constraints. For example, *Alice* is an instructor of an Algorithms course in XYZ university and she had taught some of the basic sorting algorithms to the students of her class. She wants to find specific videos for the "heap sort" algorithm concept, which can be given as an homework to the students. As, there would be different videos available online for this concept with varying duration, difficulty level, sources, etc. Alice is likely to spend a lot of time navigating through the available videos to finally select a video which suits her class' requirement.

We present a platform called *TutorSpace* that helps in searching and curating OER content from multiple sources, allows integration this content into a curricular setting in the context of what the lecturer is teaching and helps delivering it to students in a personalized way. TutorSpace uses advance multimedia concepts to support features such as quick and efficient video navigation, identification of topic transitions in a video, adding annotations on a video, etc. For the students, TutorSpace enables self-paced and ubiquitous learning where they can see course material posted by the instructor. TutorSpace also provides capabilities for students to share their notes, video bookmarks with their peers and discuss the topic of mutual interest in discussion forums.

2. TUTORSPACE PLATFORM

The proposed TutorSpace platform [1] provides content-centric capabilities to help instructors in the course curation. It allows instructors to have a digital presence of a classroom-based course, ability to search relevant course materials, and inclusion of selected education content in the curriculum. One of the key features of TutorSpace is that it provide a lecture planning workbench where the instructor can pool content from different sources and intersperse outside content with snippets of his/her pre-created content or classroom teaching. For students, TutorSpace enables self-paced and ubiquitous learning where they can see course material posted by the instructor. It also allows students to share their notes, video bookmarks with their peers and discuss topics of mutual interest in discussion forums. Some of the primary functional components of TutorSpace are as follows:
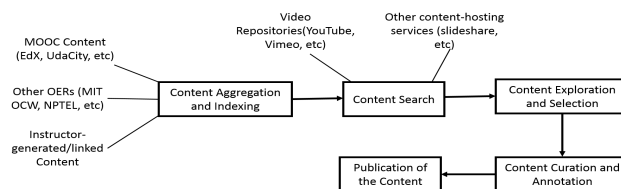

Figure 1: Step-by-step overview of instructor-led content curation and selection

2.1 Content Aggregation, Indexing & Search

TutorSpace aggregates content from different sources i.e. MOOCs (Coursera, EdX, Udacity), YouTube, etc. The content aggregation includes indexing meta-data about the course (i.e., information, syllabus), and video lecture specific meta-data (title, description, transcript of the video, duration, etc). Similarly, TutorSpace provides flexibility to the instructor to upload/link his/her own self-generated content too. Figure 2a presents a snapshot of the search dashboard in TutorSpace. Instructor can search for any concept and the system returns a set of relevant video lectures. The instructor has the flexibility to add search filters w.r.t. the source of the content (e.g., known-OER or all-YouTube) as well as other advanced filters such as duration, presentation style (e.g., slide or black-board), etc. Additionally, TutorSpace indexes meta-data about each video and further, this meta-data is presented to provide additional cues to the instructor as shown in Figure 2b. One of these cues is customized word-cloud which contain some of important concepts covered in the video (i.e., video preview). A detailed step-to-step creation process of customized word-cloud is presented in one of our earlier work [5]. These cues can help in the first-level decision making of whether to play a video or not. For example, word-cloud can help instructor in answering broad question about the video such as, "does this video contain algorithms for both linear and binary search" or "does this video explain heap sort with implementation
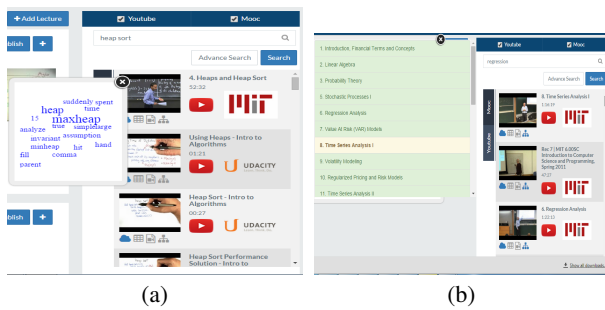
Figure 2: (a) A snapshot of content search dashboard of TutorSpace. (b) Snapshot of concept relationship for a video

in Python programming language". In low bandwidth settings, it can save significant amount of time for the instructors [5].

2.2 Content Exploration and Selection

The instructors need to take a deep-dive and explore the content completely before including it in the teaching plan. Content exploration, specifically for a video, is a time-consuming task where often videos have long durations. The instructor can select any video for detailed exploration from the search results shown in Figure 2a. TutorSpace makes content exploration less time-consuming by providing techniques for non-linear navigation in a video with the help of customized word-cloud and parallel 2-D timeline as shown in Figure 3. Consider a video with the duration of nearly 60 minutes which discusses different sorting algorithms, the information provided by the customized word-cloud will include the name and time sequence of different algorithms along with other important terms discussed, which can help an instructor in getting a time-aware representation of a video [5]. Further, the customized word-cloud is interactive and instructor can click on any of keyword and its occurrences are highlighted on the 2-D timeline. The keyword occurrences represent different time instances where the keyword appears in the video. Further, mouse-hover event on any of these occurrences provide the context (i.e. an adjacent sentence) where a given keyword has been spoken. The click on any of occurrences will navigate the video to the point, where it was spoken in the video.
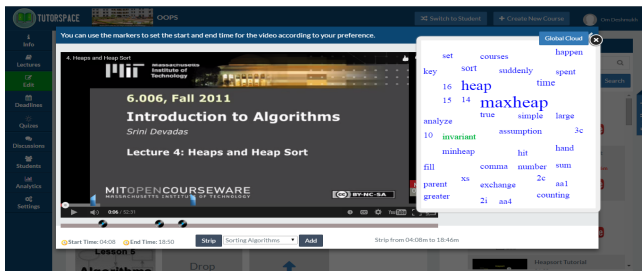

Figure 3: A snapshot of non-linear video navigation dashboard in TutorSpace with the help of customized word-cloud

Sometime, instructors may want to select a part of the content as opposed to the complete video. For example, in a 60 minute video on sorting algorithms, she may want to select only "merge sort" concept and share it with the students. TutorSpace enables partial selection of a content using its easy "video stripping" method. As shown in Figure 3, The instructor can move "start" and "end" (blue color) markers on the video timeline to highlight part of video content and click on "strip" button to select the content. After selecting the content, the instructor can drag and drop the content in their lecture plan as shown in Figure 4.
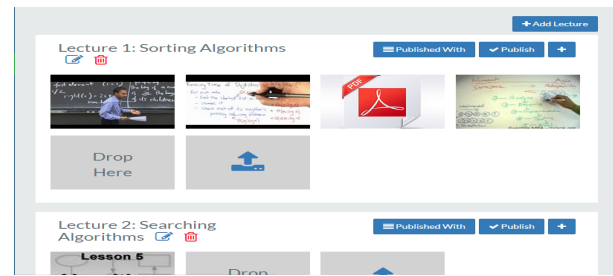

Figure 4: A snapshot of selected content (lecture plan) in TutorSpace

2.3 Other Features

TutorSpace provides a simple and user-friendly way to add notes and bookmarks on a video. After curation, the instructor can play the video and add annotations in terms of textual notes, images, external links/documents, etc with a click of a button. TutorSpace maintains detailed logs of interaction of the students with the content. It provides descriptive analytics on shared content to the instructors. The analytics include simple student-specific viewing statistics to fine-grained interaction pattern (i.e., time spent, pauses, play, etc). The instructor can use these findings to adapt the course curation strategies or to infer perceived difficulty of certain concepts. For example, if many students are spending a considerable amount of time on a specific portion of a video, it may need to be clarified during the class. Furthermore, TutorSpace provides standard learning management system (LMS) specific features such as course management, deadline creation and submission, quizzes, discussion forums, and student information management.

3. DISCUSSION

In developing countries such as India, quality of education is yet to improve substantially. We presented TutorSpace platform which can seamlessly enable integration of high-quality OER content in traditional classroom settings. TutorSpace provides rich multimedia capabilities w.r.t. content-indexing, search, non-linear navigation, and rich curation of the content. These capabilities are specifically designed to help instructor in developing countries. In our initial field-trial with the instructors, they appreciated the capabilities of the platform and provided several valuable feedback, which will be crucial for a long term acceptance of such a platform. We are in process of deploying TutorSpace to many engineering colleges in India and will be discussing our experiences in a future study.

4. REFERENCES

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