RESEARCH TALK

Jaspal Subhlok

University of Houston
Research Directions (if any)

- Something Interesting
  - Else let industry take care of it

- Something Useful

- Something Fundable
  - Graduate students expect stipends to do research!

- Something I know something about
  - *Or nobody knows anything about*
Research Areas

- Parallel and Distributed Systems
  
  **Volpex**: Reliable execution when failure/errors are routine (MTBF in minutes) [with Dr. Gabriel]
  
  - Very large scale systems (1000s of nodes)
  - Volunteer computing – 100s of ordinary PCs distributed around the world solving scientific problems

- Educational Technologies
  
  - Indexed Captioned Searchable (ICS) Videos
Background

- Video medium is ubiquitous and growing for coursework
  - MOOCs, iTunes U, MIT Courseware, UH…
  - Supplement or replace lectures
- Key shortcoming of video format is the inability to quickly access content of interest
  - Loud and clear in surveys and interviews
  - Students wants answers to questions for review, not watch an hour long video
ICS Videos in a Nutshell

- Custom video player that allows quick access to video content of interest
  - **Indexing:** Video divided into logical segments with clickable index points
  - **Search:** Keyword search in video
  - **Captioning:** Scrolling captions for audio.
ICS Videos in a Nutshell

Computer Science - Introduction to Computing - COSC 1300 Lecture 21

- [Image of a computer desktop with various icons and a video player]

- Transcript:
  
  0:05 Okay so I need 3 more volunteers for today to give your powerpoint.
  
  0:10 presentation. Let's see you are Shannon, are you Shannon?
  
  0:38 Jasmine, okay so you're in the third. Jasmine Scott.
  
  0:57 What's your name now? Your last name is?
  
  1:35 okay I got 2. I need one more. We'll go with these two okay. First one is going to be Jasmine Scott here.
  
  2:38 So Jasmine is going to talk to us about TranSwitch: Engines for Global Connectivity. Hello everybody I'm Jasmine. The company I chose was TranSwitch.
  
  2:56 Basically its a company, they make integrated circuits and intellectual property solutions.

Department of Computer Science
User types a keyword -- all segments of the video that match are presented

Challenges:

- Recognize text on video frame: OCR enhanced with custom image transformations for text recognition
- Semantic search?
Automatic Indexing

The video is presented as a series of clickable segments, each with a visual index frame.

Challenges:
- Identify *Topic Changes*, beyond scene changes. Based on recognition and analysis of text patterns.
- Combined with semantic and audio input?

Department of Computer Science
Video player supports captions:

- Semi-automatic caption generation employing speech recognition (YouTube)
- ICS Caption Editor for correcting captions manually
  - “Crowdsourcing” option
<table>
<thead>
<tr>
<th>Section No.</th>
<th>Start Time (mm:ss)</th>
<th>Caption Text</th>
<th>Save my Changes</th>
<th>Status</th>
<th>Review Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit Section 1</td>
<td>0:05</td>
<td>Let's talk about floating point today. We have seen the ways of representing numbers in binary so far.</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0:13</td>
<td>the largest we've gotten with the unsigned integers we preferred edited by Rucha</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0:18</td>
<td>two to the n minus one ending number in bits you have represent and with sign integer the two complement we have negative two to the n minus one</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0:26</td>
<td>two to the n minus one minus one because one less positive number than the negative number. So the question you might</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0:37</td>
<td>represents a very large numbers or even decimal number, rational number like pi or the natural number e. The way we do this</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0:50</td>
<td>to go back and look at scientific notation base tenth</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0:56</td>
<td>things to note the number before the decimal point were call the mentissa</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:04</td>
<td>the radix or the base that you're in so we're are talking about base 2 that would be 2 and an exponent number</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:15</td>
<td>multiple ways to represent this number, of course, like we have point 1 and ten to the negative ten. However, to make sense you want to have stuffs in normalized form</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:27</td>
<td>based ten that just means you have one number before the decimal point and that is also true with binary</td>
<td>Save</td>
<td>Mark as Complete</td>
<td></td>
</tr>
</tbody>
</table>
Diverse Research Challenges

- Enhancing text from video frames by enhancing OCR accurately [Image processing]
- Identifying Index Points [Text processing, Machine Learning]
- User Interface Design
- Learning Methodologies [Education, Psychology]
  - Measurement of Enhancement of Learning
  - Inverted Classrooms
Deployment and Experience

- Widely used at University of Houston in the Departments of Biology, Chemistry, Computer Science, Geology, Mathematics

Estimate ~10,000 student users in past 3 years in ~70 courses in 6 STEM fields at UH

~3000 participated in surveys
Reasons For Using Videos

- Preview a Lecture
- Review concepts not heard in class
- Review concepts not understood in class
- Review before Test or Quiz
- Hear a missed lecture

PERCENTAGE OF STUDENTS
### Student Evaluation of Videos

<table>
<thead>
<tr>
<th>Evaluation Item</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture videos help clarify material that was not clear in class.</td>
<td>5.45</td>
</tr>
<tr>
<td>Lecture videos are useful for reviewing.</td>
<td>5.63</td>
</tr>
<tr>
<td>Having access to video lectures for this class is important to me.</td>
<td>5.61</td>
</tr>
<tr>
<td>The lecture videos helped me to study for quizzes or tests.</td>
<td>5.51</td>
</tr>
</tbody>
</table>

Scale: 1 = Disagree Strongly, 6 = Agree Strongly
Videos as a Resource

The textbook and other reading sources.
Notes you take during lecture and reading.
Professor's lecture notes.
The lecture videos.

Percent of Students

Very important
Somewhat important
Slightly important
Not at all important
The index points separated a lecture into logical segments.

The index points were appropriately placed in the video timeline.

The placement of index images on the screen made the index easy to use.

The indexing was helpful.
The search tool made it easy to navigate the video.
The search tool appeared to find the matching parts of the video.
The purpose of the search tool for finding video segments was clear.
I found the search tool easy to use.
Project Team

CS Faculty: Zhigang Deng, Olin Johnson, Shishir Shah, J. Subhlok

Students: Tayfun Tuna, Varun Varghese, Rucha Borgaonkar, Mahima Joshi
X-Students: J. Li, C. Yun, G. Bhatt, T. Tuna. A. Verma, R. Kushalnagar

NSMIT Staff: S. Baez-Franteschi, Pradeep Krishnan, Andrea Arias

Assessment: Lecia Barker (UT Austin), Yumei Liu, Erin Hodges (UH)

Deployment, usage and assessment
UH Computer Science, UH Geosciences, UH Biology and Biochemistry
UH Downtown  (Richard Alo), Texas School for the Deaf  (David Coco)

icsvideos.cs.uh.edu
jaspal@uh.edu

Many small and large projects for BS, MS or PhD students!
Contact Info

- ICS Videos System  
  www.icsvideos.uh.edu
- Username: student
- Password: icsstudent
- More details/papers about the project  
  www.icsvideos.cs.uh.edu
- Contact email: icsvideoscontact@gmail.com