The SpokenMedia Project: Toward Rich Media Notebooks for Teaching and Learning

Brandon Muramatsu
mura@mit.edu
MIT, Office of Educational Innovation and Technology

Andrew McKinney, MIT OEIT
Phillip Long and John Zornig, University of Queensland
Why are we doing this?

• More & more videos on the Web
  – Universities recording course lectures
  – Students (and universities) relying upon Web video for learning

MIT OCW 8.01: Professor Lewin puts his life on the line in Lecture 11 by demonstrating his faith in the Conservation of Mechanical Energy.
What are the challenges?

- Search
  - Volume
  - Segmented by Web, Video
  - Text title and Description

Google Search for “angular momentum”
Performed April 2009
What are the challenges?

• Interaction & Use
  – Full video vs. Segments
  – Does transcript or captioning exist?

What about Bing?

Bing Search for “angular momentum” Performed August 2009

Videos

Angular Momentum Time Pieces TENDANCE...
Dailymotion 2:11

Angular Momentum est une société...
Dailymotion 3:19

Angular Momentum 1
TENDANCE MAGAZINE TV
Dailymotion 2:19

Angular Momentum Time Pieces TENDANCE...
Dailymotion 2:09

Angular Momentum 10e ANNIVERSAIRE - 2008...
Dailymotion 2:29

Angular Momentum - Science Theater 24
YouTube 4:59

Geomeg & Physics. Angular Momentum...
YouTube 1:19

Angular Momentum Demos
YouTube 6:01

Fun with Physics - Angular Momentum

Conservation of Angular Momentum

What is the conservation of angular momentum

DEMO: Conservation of angular momentum
Why do we want these tools? MIT OpenCourseWare Lectures

• **Improve search** and retrieval
• **What do we have?**
  – Existing videos & audio, new video
  – Lecture notes, slides, etc. (descriptive text)
  – Multiple videos/audio by same lecturer (scale)
  – Diverse topics/disciplines

• **Improve** presentation and **user experience**
• Captioning for accessibility
• Facilitate translation, other uses?
What can we do today?

web.sls.csail.mit.edu/lectures/

• Spoken Lecture Browser
  – Requires Real Player 10
we're now answering the part of eight oh one which is the most difficult for students and faculty alike ... we are going to enter the domain of angular momentum and forks it's extremely non intuitive ... the good news however is that b will stay with this concept for at least four five lectures today i will introduce both fork an angular momentum ... what is angular momentum if an object has a mass m ... and it has a velocity v ... then clearly it has a momentum ... v that's very well defined your reference frame the product of m and v ... thank the 

1. Angular Momentum, Torques, Conservation of Angular Momentum, Spinning Neutron Stars, Stellar Collapse

Lecture 20, Physics I: Classical Mechanics, Physics, MIT, 1999 (Walter Lewin)
How do we do it?
Lecture Transcription

• Spoken Lecture: research project
• Speech recognition & automated transcription of lectures
• Why lectures?
  – Conversational, spontaneous, starts/stops
  – Different from broadcast news, other types of speech recognition
  – Specialized vocabularies
Spoken Lecture Project

• Processor, browser, workflow
• Prototyped with lecture & seminar video
  – MIT OCW (~300 hours, lectures)
  – MIT World (~80 hours, seminar speakers)

Supported with iCampus MIT/Microsoft Alliance funding
How Does it Work?
Lecture Transcription Workflow

Input Files
- Video/Audio
- Metadata*
- Transcript, Slides, Docs

Audio Ripper

Speaker Model*

Domain Model*

Text Processor

Speech Processor

Locally Processed -or- Cloud Service

Transcript Creation

Output Media Linked Transcript

SpokenMedia
- Search and Retrieval
- Spoken Media Player
Recognizer Accuracy ~85%

- **Accuracy**
  - Domain Model and Speaker Model
  - Internal validity measure
  - Transcripts

- **Ongoing research by Jim Glass and his team**
Transcript “Errors”

• “angular momentum and forks it’s extremely non intuitive”
  – “folks”?  
  – “torques”?  
• “introduce both fork an angular momentum”  
  – “torque”!

we’re now answering the part of eight oh one which is the most difficult for students and faculty alike ... we are going to enter the domain of angular momentum and forks it's extremely non intuitive ... the good news however is that b will stay with this concept for at least four five lectures today i will introduce both fork an angular momentum ... what is angular momentum if an object has a mass m ... and it has a velocity v ... then clearly it has a momentum ... v that's very well defined your reference frame the product of m and v ... thank the momentum ... i can take relative to any point i choose i choose this point q arbitrary ... this now ... is the position vector which i call our of q ... but this angle buffet to ... an angular momentum relative to that point p it's a vector which is the
That’s what we have today…

• Features
  – **Search** and playback
  – Segmentation of video (concept chunking)
  – Bouncing Ball follow along
  – Randomized access

• Challenges
  – Accuracy ~85%
  – Transcript errors
Where are we heading?

• Transition to a lecture transcription service

• Toward Rich Media Notebooks to improve the user experience via Web 2.0 video interaction methods
Transition: Research to Production
A Lecture Transcription Service

• Prototype transcript production service
  – At MIT, University of Queensland
  – Automate processes
  – Integrate with media production workflows

• Engage with content (video) producers to test
  – UC Berkeley, Harvard, etc.
  – Opencast Matterhorn
A Lecture Transcription Service?

Caveats

• Lecture-style content (technology optimized)
• Approximately 85% accuracy (probably not a full accessibility solution)
• Other languages? (not sure)
• Processing hosted at MIT (current thinking)
  – So will submit jobs via MIT-run service
  – Contribute audio extract, models, transcript for further research
Toward Rich Media Notebooks Improving the User Experience

• Upgrade playback (Flash, H.264 encoding)
• Innovative interfaces
  – Bookmarking and annotation
  – Clip creation and authoring
• Social Editing (improve transcripts)
• Concept and semantic searching
  – Semi-automated creation of concept vocabularies
Alternate Representations

• Microsoft Project Tuva: Enhanced Video Player
  – research.microsoft.com/apps/tools/tuva/
• MIT OCW Highlights for High School
• Look Listen Learn
  – Alternate view of MIT OCW video
  – www.looklistenlearn.info/math/mit/
• Google Audio Indexing
  – labs.google.com/gaudi
  – U.S. political coverage (2008 Elections, CSPAN)
Richard Feynman: The Messenger Series: The Great Conservation Principles

The explanation is, that angular momentum appears in two forms:

research.microsoft.com/apps/tools/tuva/
MIT OCW
Highlights for High School

Lecture 20 - 8.01, Physics I

Choose your topic below for Lecture 20:

> Angular Momentum (0:00)
> Conservation of Angular Momentum (8:18)
> Ice Skaters' Delight (17:36)
> Stellar Equilibrium and Remnants (25:34)
> Stellar Observation (35:32)
> Supernova Images (40:54)

Now playing:
Angular Momentum

Total Differential \( f(x, y, z) \)

\[
df = f_x \, dx + f_y \, dy + f_z \, dz
\]

\[
df = \frac{\partial f}{\partial x} \, dx + \frac{\partial f}{\partial y} \, dy + \frac{\partial f}{\partial z} \, dz
\]

Important: \( df \) is NOT \( \Delta f \)

Can do:

1. Encode how changes in \( x, y, z \) affect \( f \)

2. Placeholder for small variations \( \Delta x, \Delta y, \Delta z \) to get approx formula

\[
\Delta f \approx f_x \Delta x + f_y \Delta y + f_z \Delta z
\]
How We Can Turn Our Economy Around

...I rise today to talk about America economy and we're Americans are out right now we've seen a...

...the that way we can turn this American economy around next quarter we...

...about where they're going to go in this economy and we can we know...

...we need to get people to invest in the economy and you do that fight...

http://labs.google.com/gaudi?q=economy&longid=62275349661560701
Thanks!

oeit.mit.edu/spokenmedia

Brandon Muramatsu
mura@mit.edu
MIT, Office of Educational Innovation and Technology

Andrew McKinney, MIT OEIT
Phillip Long and John Zornig, University of Queensland