# Building Community
## ~~around Tools for Automated Video Transcription~~
# for Rich Media Notebooks:
# The SpokenMedia Project

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Office of Educational Innovation and Technology

# Motivation

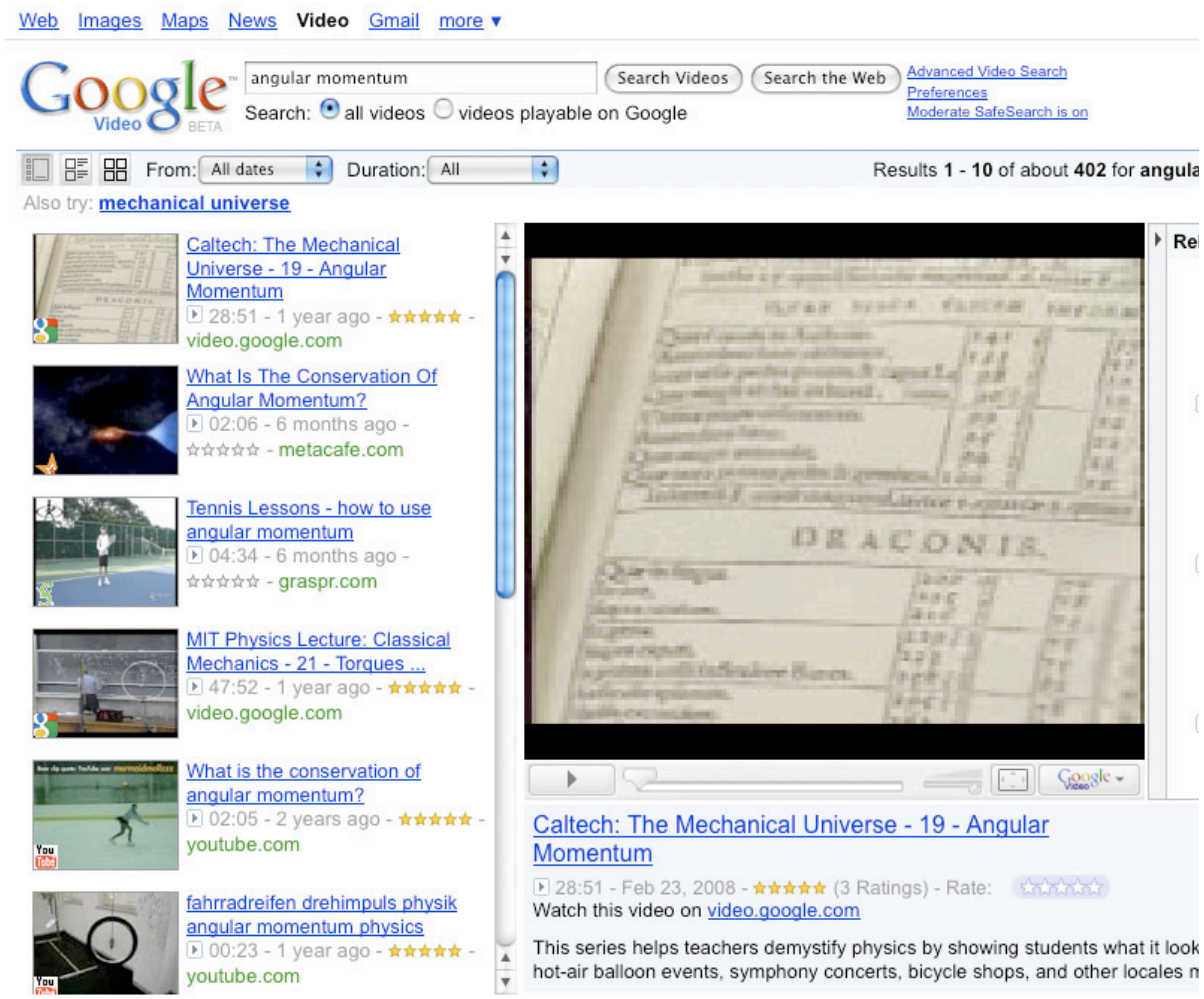
MIT OCW 8.01: Professor Lewin puts his life on the line in Lecture 11 by demonstrating his faith in the Conservation of Mechanical Energy.

- More & more videos on the Web
  - Universities recording lectures
  - Cultural organizations interviewing experts

# Motivation

- Challenges
  - Volume
  - Search
  - Accessibility

Search Performed April 2009



# 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. for domain model
  - Multiple videos/audio by same lecturer for speaker model
  - Diverse topics/disciplines
- Improve presentation
- Facilitate translation -?-

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**Related Resources**

AP Physics B II (NROC)

AP Physics B I (NROC)

MIT OpenCourseWare: 7.03 Genetics, Fall 2001 (Scout) [direct link]

Physics 8A 001: Lecture 36 - Introductory Physics (Berkeley)

Physics 8A 001: Lecture 38 - Introductory Physics (Berkeley)

More Related Resources

# Video Lectures - Lecture 20

**Topics covered:** Angular momentum (a vector) is introduced. The rate of change of angular momentum is related to the torque (also a vector). In the absence of an external torque, angular momentum is conserved. Spin angular momentum (of planets, stars, neutron stars) is also discussed.

**Instructor/speaker:** Prof. Walter Lewin

**Transcript:**
(HTML)
(PDF)

**Free downloads:**
iTunes U (MP4 - 115 MB)
Internet Archive (MP4 - 115 MB)
Internet Archive (RM - 116 MB)

**Free streaming:**
VideoLectures.net

**Resources:**
Topic index

< previous lecture | video index | next lecture >


**Transcript - Lecture 20**

We're now entering the part of 8.01 which is the most difficult for students and faculty alike.

We are going to enter the domain of angular momentum and torques.

It is extremely nonintuitive.

The good news, however, is that we will stay with this concept for at least four or five lectures.

# Why do we need these tools? University of Queensland

- Lecture podcasting
- 25 years of interviews with world-class scientists, Australian Broadcasting Company

# What can we do today?

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

- Spoken Lecture Browser
  - Requires Real Player 10

# How do we do it?
# Lecture Transcription

James Glass
glass@mit.edu

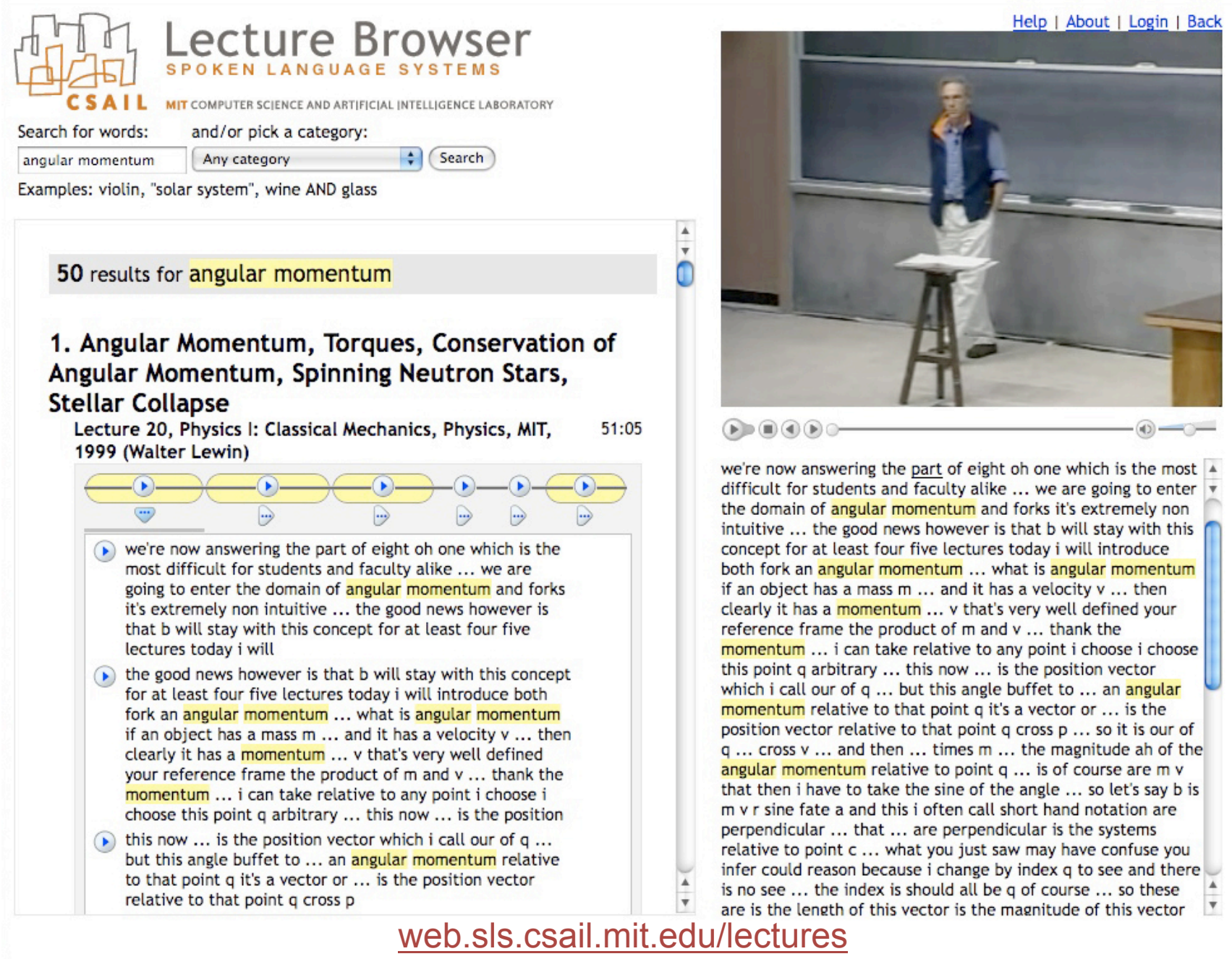

- Spoken Lecture: research project
- Speech recognition & automated transcription of lectures
- Why lectures?
  - Conversational, spontaneous, starts/stops
  - Different from broadcast news, other types of speech recognition
  - Specialized vocabularies

# Spoken Lecture Project

James Glass
glass@mit.edu


- 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

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# Lecture Browser

SPOKEN LANGUAGE SYSTEMS

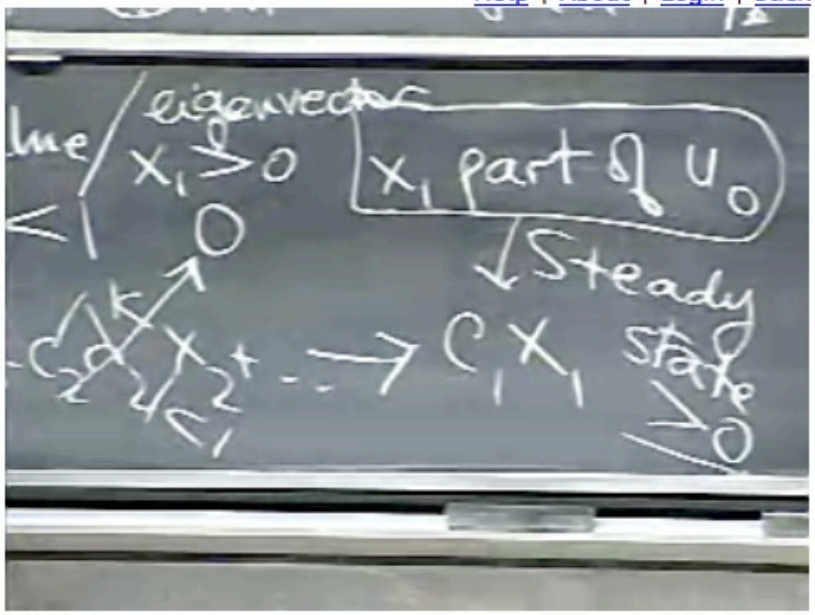
CSAIL MIT COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE LABORAT

Help | About | Login | Back

Search for words: and/or pick a category:

eigenvalue | Any category | Search

Examples: violin, "solar system", wine AND glass




**23** results for eigenvalue

## 1. Markov Matrices, Fourier Series

**Lecture 24, Linear Algebra, Mathematics, MIT, 1999 (Gilbert Strang)** 51:01

this question of steady state will come up you remember we had steady state for differential equations last time when do what was the steady state what was the eigenvalue ... what was the eigenvalue in the differential equation case that led to a steady state it was lambda equals zero when what open you remember that we did an example and one

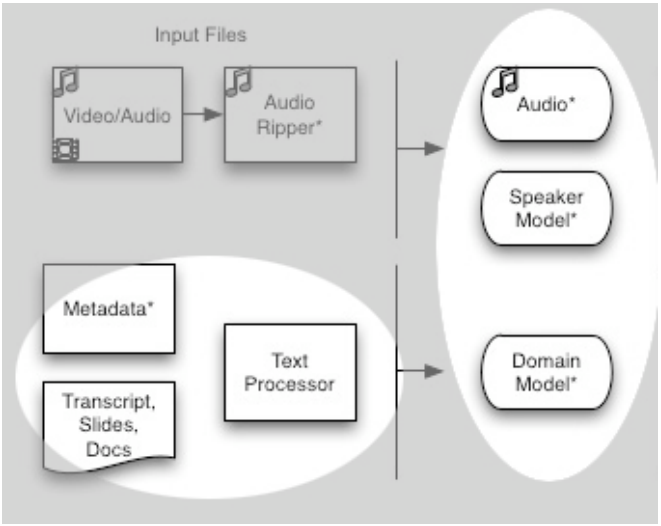
one as time went on there that thing stayed steady now what in the powers case it's not a zero eigenvalue actually with powers of a matrix a zero eigenvalue that part is going to die right away ... it's an eigenvalue of one ... that's all important so the steady state will

positive ... if the start was if the start was so opens well actually in in general i'd this might have a might have some components zero always but no negative components in that eigenvector okay can i a come to that point ... how can i look at that matrix ... so that was just an example ... how could i eat be sure how how can i see that a matrix if the columns add to zero add to one sorry if the columns add to one ... this property means that lambda equal one is an eigenvalue okay so that's this is think that through what am i saying about let me cop it a b look at a ... and if i believe that one is an eigenvalue then i should be able to subtract off one times the identity and then i would get a matrix that's what minus point nine ... minus point oh one and minus point six white took the ones away and the other parts of course sir still what they were ... and this is still point two and point seven and okay we'll we'll what's ... what's up with this matrix now i've shifted the matrix this markov matrix by one by the identity ... and what do i want to

web.sls.csail.mit.edu/lectures

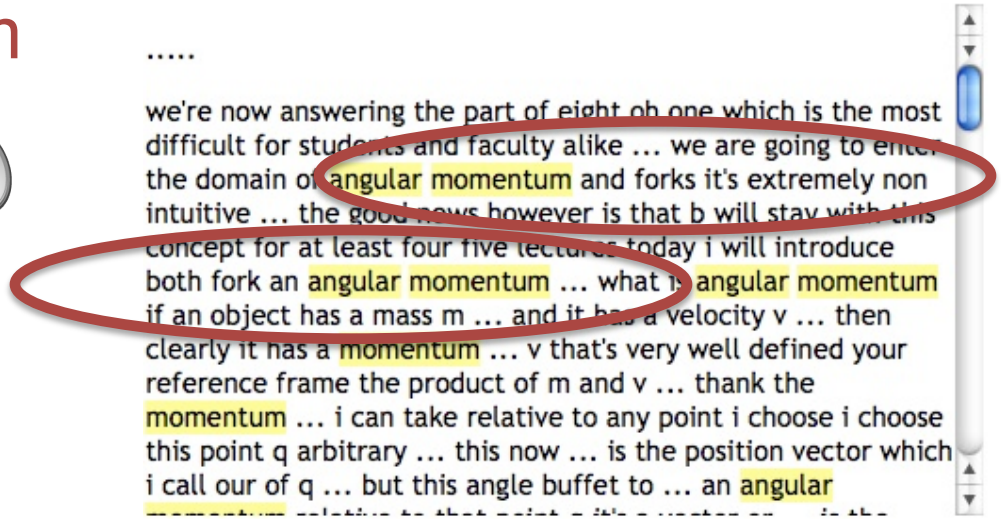
# Current Challenges: Accuracy

- Accuracy
  - Domain Model and Speaker Model
- Transcripts

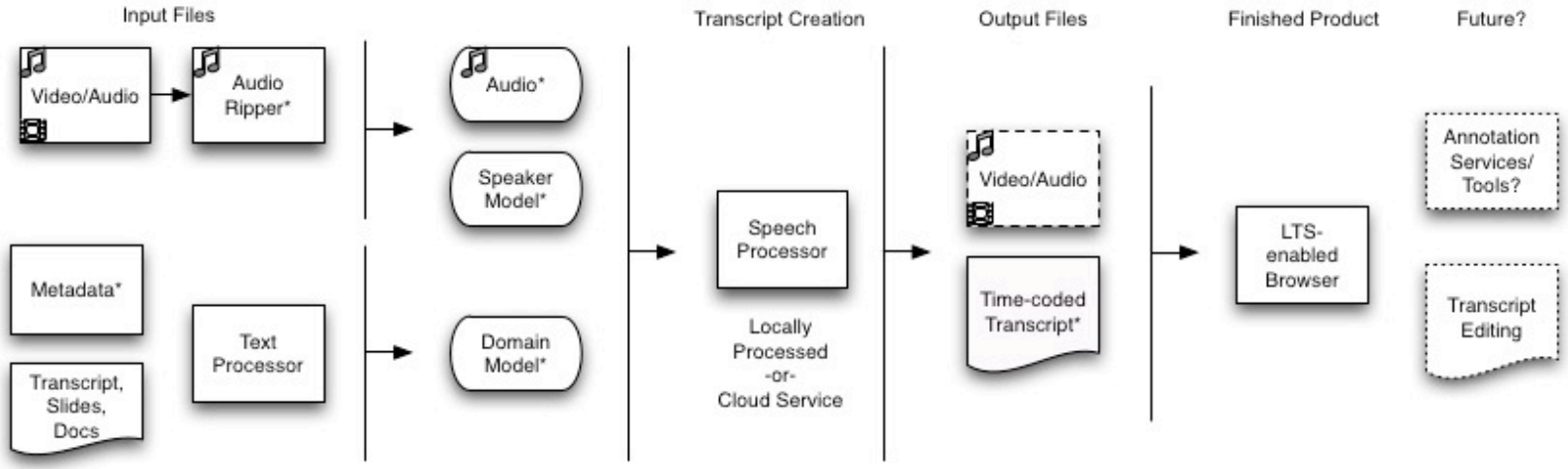


# Transcript “Errors”

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



# How Does it Work?
# Lecture Transcription Workflow




More Info: Domain Model  Speaker Model

# That's what we have today…

- Features
  - Search
  - Segmentation of video
  - Concept chunking
  - Bouncing Ball Follow Along
  - Randomized Access
- Challenges
  - Accuracy ~mid-80%
  - Errors

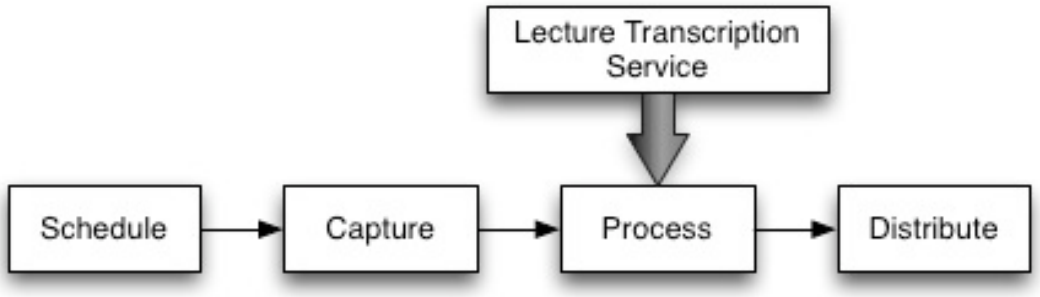
# Where do we go next?

- 99.9% Accuracy? For accessibility
- Bookmarks and state
- Crowd-sourced modification
- AI on front end, user speaks terms s/he wants to find
- On commercial videos, from libraries
- Video Note (from Cornell), students highlight video for other students, with ratings (of content)
- Collections of resources (affective/personal meaning layer)
- Multiple speakers/conversations within a single audio? (In studio=good, journalism interviews on street=very challenging)
- Packaging for offline searches of content (interesting thought about human subjects)
- Binaries for self-installation
- Share APIs

# How else might this be used?

- Ethnographic research
- Video Repository with funds for transcription, best application of resources
- Clinical Feedback

# Transition: Towards a Lecture Transcription Service




- Develop a prototype **production** service
  - MIT, University of Queensland
  - Engage external partners (hosted service?, community?)

# A Lecture Transcription Service?

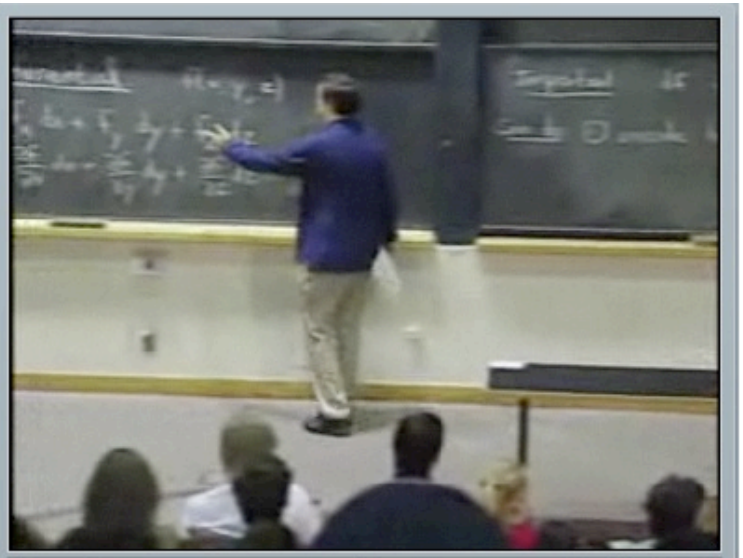
- Lecture-style content (technology optimized)
- Approximately 80% accuracy
- Probably NOT full accessibility solution
- Other languages? (not sure)
- Browser open-sourced (expected)
- Processing hosted/limited to MIT (current thinking)
  - So will submit jobs via MIT-run service
  - Audio extract, domain models and transcripts available donated for further research

# Future Directions

- Social Editing
- Bookmarking and annotation
  - Timestamp
  - Rich media linking (to other videos, pencasts, websites, etc.)
- Concept and semantic searching
  - Semi-automated creation of concept vocabularies
- Discussion threads

# Alternate Representations

- Look Listen Learn
  - www.looklistenlearn.info/math/mit/
- Alternate UI, Google Audio Indexing
  - labs.google.com/gaudi
  - U.S. political coverage (2008 elections, CSPAN)



It's a relation between x, y, z, and f.

13 English

English

Lecture 11. Differentials

- MIT
- Differentials
  - Single variable differentials
  - Total differential
  - Chain Rule
  - Example
- Applications of chain rule
  - Product and quotient formulas
  - Chain rule with more variables
  - Example: polar coordinates

## 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 $\Delta f \approx f_x\,\Delta x + f_y\,\Delta y + f_z\,\Delta z$

# Thanks!

# Visit: oeit.mit.edu/spokenmedia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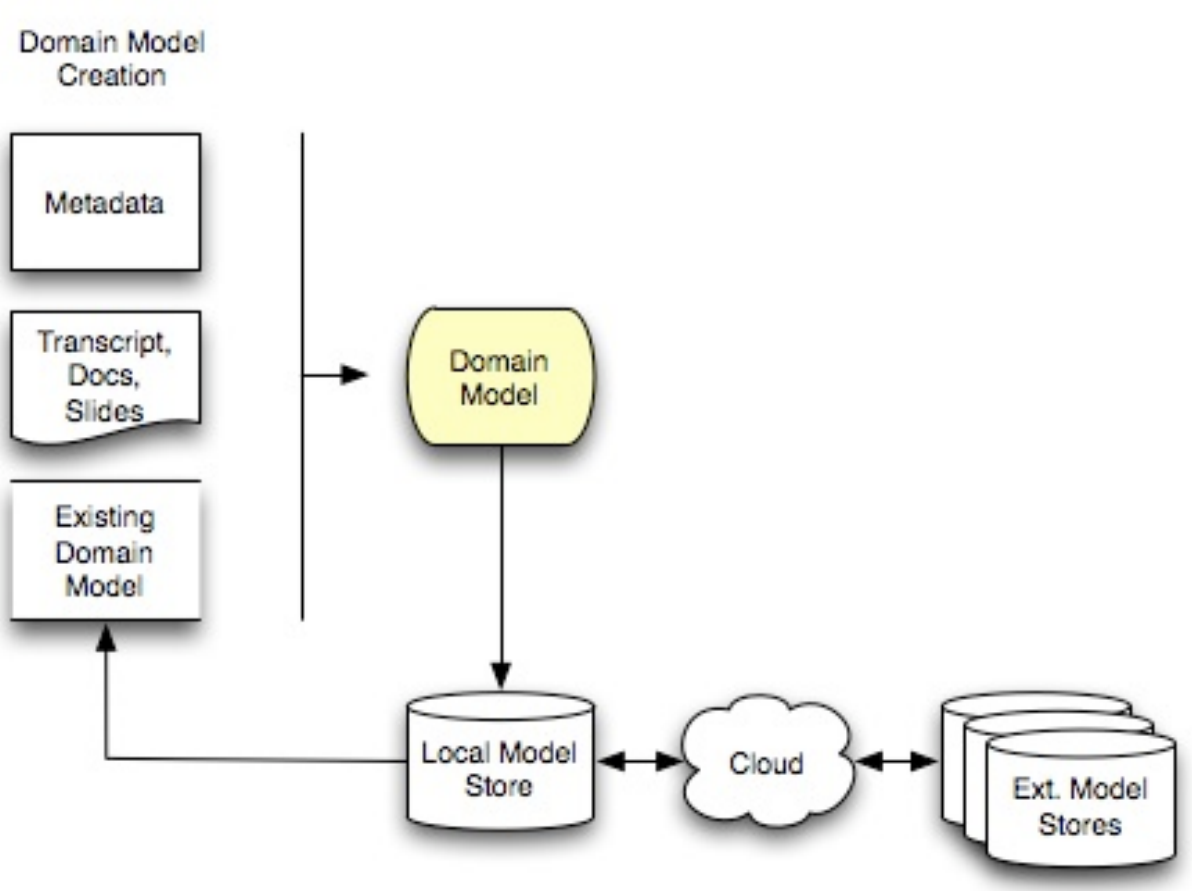
# Backup Slides

# Lecture Transcription Service: Distributed Domain Model



# Lecture Transcription Service: Distributed Speaker Model