Analysis and Interface for Instructional Video

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- Motivation

- Segmentation by *Media Type*

- Clustering by *Content-based Matching*

- Visualization and Indexing of segmented data

- Demo

- Future Investigations

Motivation

- Video-taped courses currently made available to students with "keyframe" index

- "Keyframe" = snapshot of video at points of substantial change every 20-25 seconds

- Typical course length: 75 min per lecture, 26 lectures per semester = 32.5 hr of video data (3.5 megaframes!) => 5000 snapshots

- Need a more compact, content-directed indexing method for keyframes

Process Overview
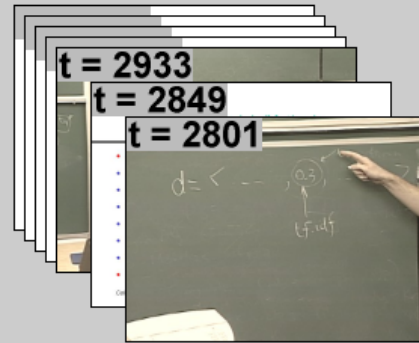
1. Video → 2. "Keyframes" → 3. Segmentation by *Media Type*
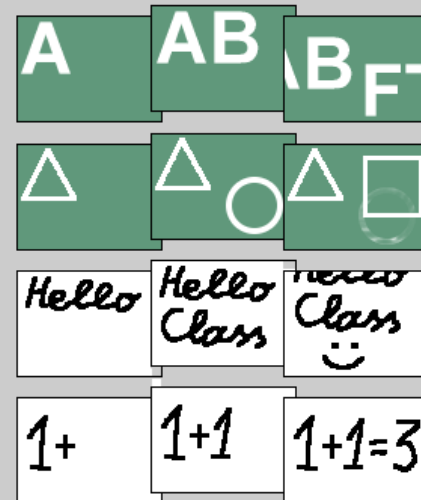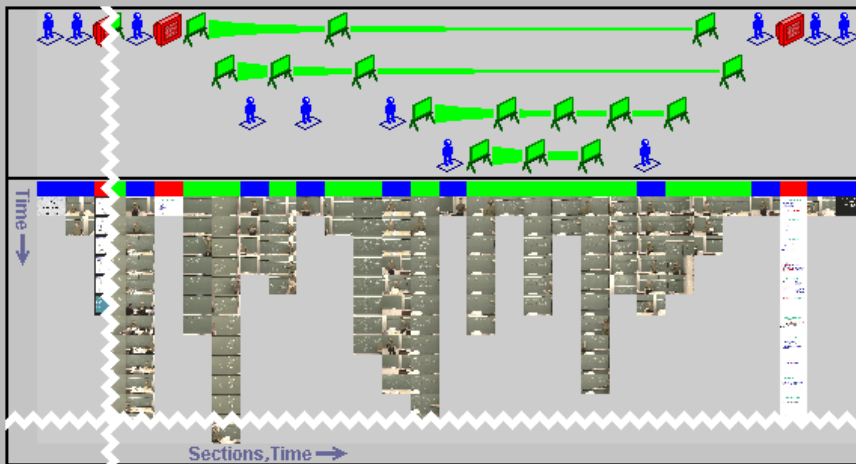
5. Visualization and Interface ← 4. Clustering by Content

Segmentation by Media Type

- Snapshots belong to six Media Types
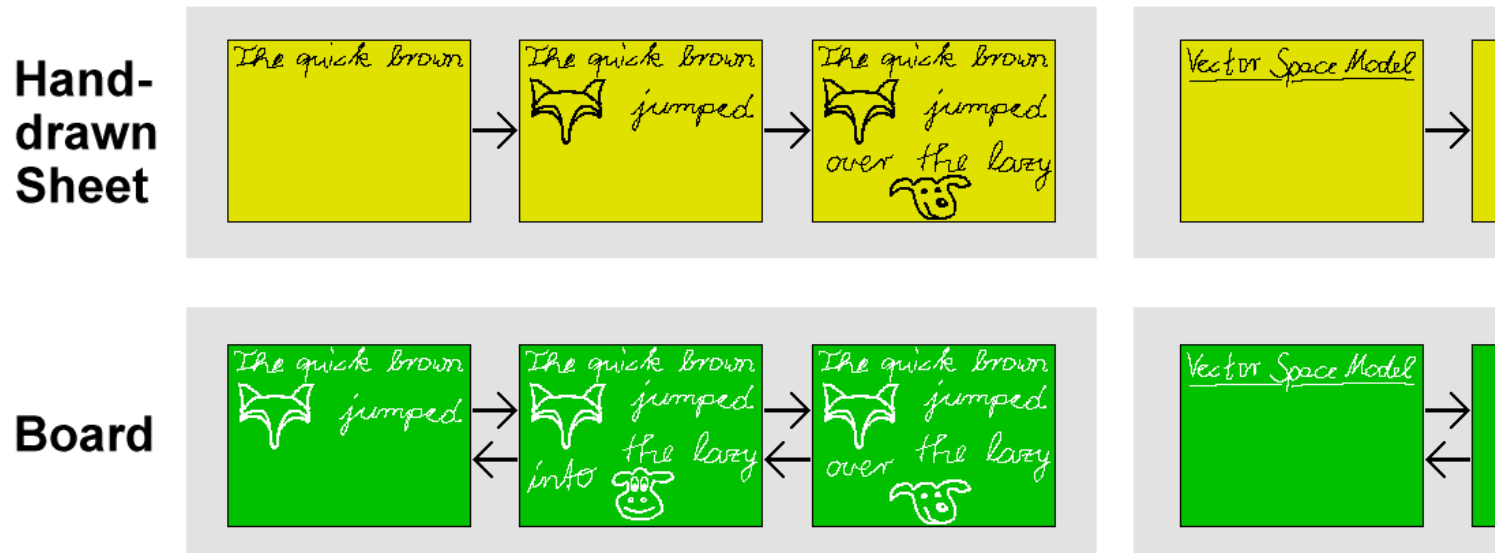- Media Type can be easily visualized

Green	Board
Blue	Podium/ Instructor
Red	Computer
Yellow	Hand-drawn Sheets
Orange	Printed Media (Illustrations)
Cyan	Class

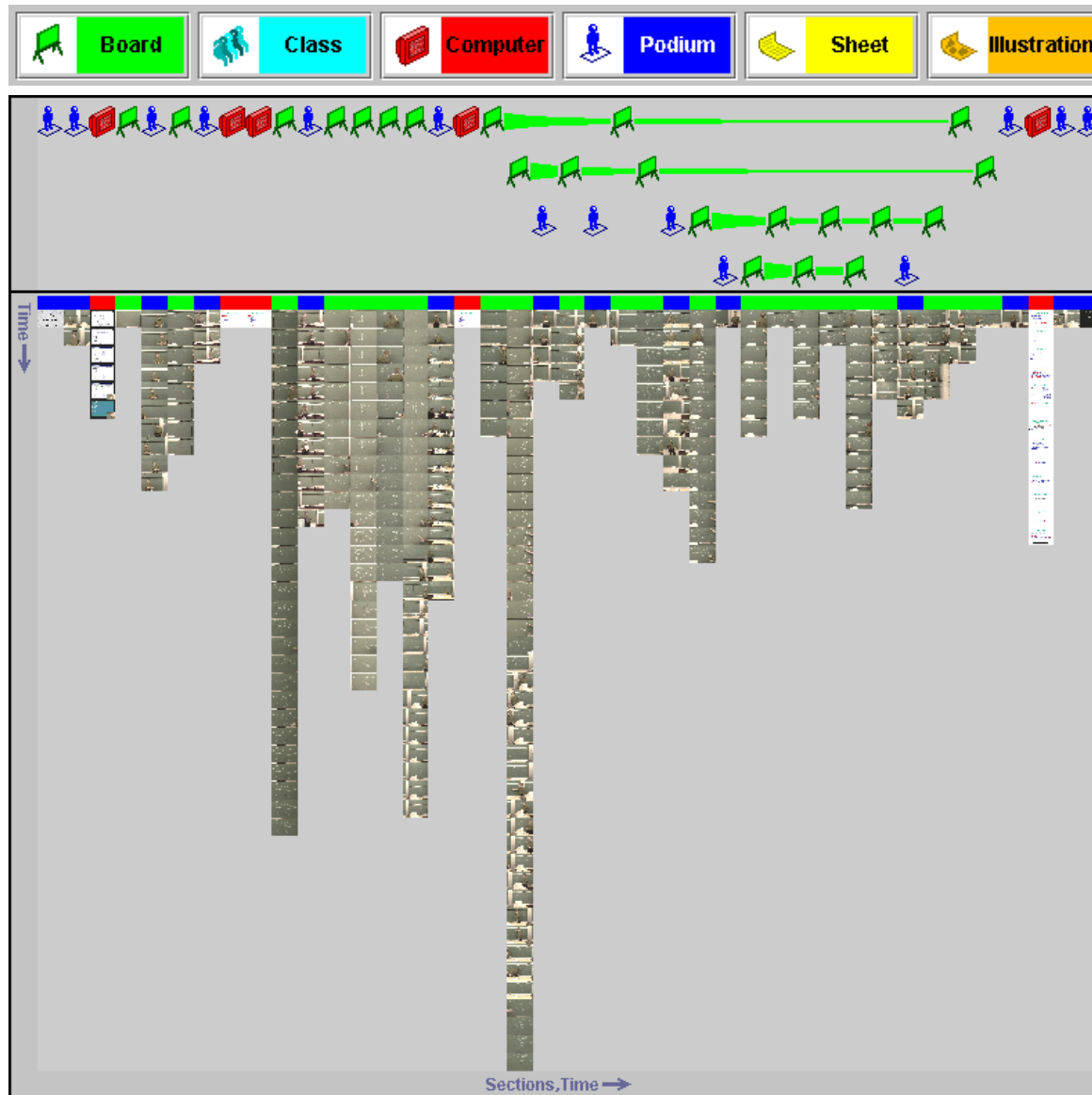(see paper for decision tree classifier)

Clustering by Content Matching

- Snapshot content evolves slowly
- Hand-drawn slides grow monotonically
- Blackboard panels varies dynamically

(see paper for content pixel filters, pan and zoom detectors, global match consistency heuristics)

Interface and Visualization

Interface and Visualization: Index

- Through analysis: temporal topic model
- Through user study: perception is topologic
- So: Topological View with relative time scale, each topic represented by media icon, interrupted topics reunited by tapered lines
- Verified: users quickly identify key concepts!
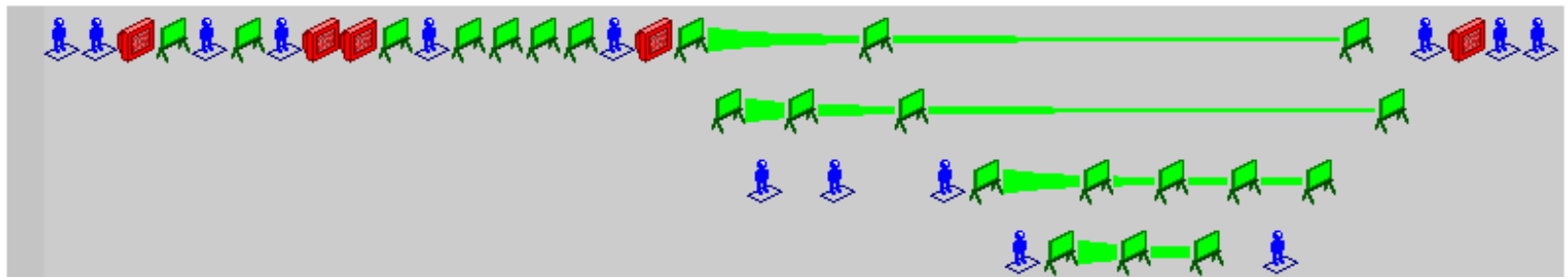
Interface and Visualization: Details

- Through user study: need content in context
- So: Key Frame View with full index of key frames, organized by *Media Type* and *Topic*
- Verified: users quickly access full-size images and the video!
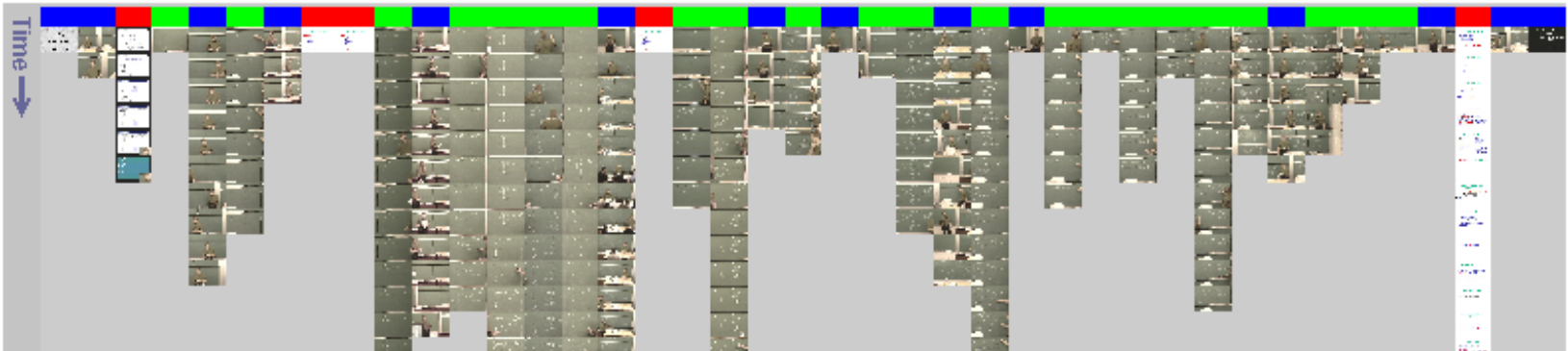
Demo

- First semantic clustering of extended collection of videos
- 17 videos
- 40 hours of lecture
- 4479 keyframes
- 334 content-matched topics

Future Investigations

- Indexing over all videos in a course and all courses in a semester

- Automatic textual annotations for topics

- More robust segmentation and faster content matching

- User studies: patterns of retrieval -> automatic content queuing