Introduction to Multimedia Technology (MM301)

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Lecture Rules

- Cellular phones' OFF
- No side talking
- No more than 10 min. delay

Grading policy

	Grade
Midterm	15%
Project	15%-20%
Assignments & Participations	15%-20%
Final	50%

COURSE OBJECTIVES

- **Course Description & Contents**
- This course focuses on Basic knowledge about multimedia and multimedia technology.
- Basic media such as text, image, animation, graphic, and sound.
- Current multimedia technology. Roles and uses of multimedia technology in many areas such as education, advertisement, and public relation etc.
- Image compression techniques.
- **References *Textbook:***

Fundamentals of Multimedia, Li & Drew

What is Multimedia?

- **A PC vendor view point:**

Multimedia is a PC that has sound capability , a DVD ROM drive , and perhaps the superiority of multimedia-enabled microprocessors that understand additional multimedia instructions.

- **A consumer entertainment vendor view point:**

Multimedia is an interactive cable TV with hundreds of digital channels available, or a TV-like service delivered over a high-speed Internet connection.

In our context:

“ multimedia indicates the computer technology **(multimedia computing)** for more efficient communication by using different media types”

What is Multimedia?

- **A Computer Science (CS) student view point:**

Multimedia is the applications that use multiple modalities, including text, images, drawings(graphics), animation, video, sound including speech , and interactivity.

- This Types are:
  - Text
  - Audio and speech
  - Images
  - Graphics
  - Video

History of Multimedia

1. **Newspaper**: perhaps the *first* mass communication medium, uses text, graphics, and images.

2. **Motion pictures**: conceived of in 1830's in order to observe motion too rapid for perception by the human eye.

3. **Wireless radio transmission**: Guglielmo Marconi, at Pontecchio, Italy, in 1895.

4. **Television**: the new medium for the 20th century, established video as a commonly available medium and has since changed the world of mass communications.

5. The **connection** between **computers** and ideas about **multimedia** covers what is actually only a short period:

Challenges of Multimedia Computing

- Developing a successful multimedia system is non-trivial.
  - Continuous media types such as video need
    - a lot of space to store and
    - very high bandwidth to transmit.
  - Tight timing constraints.
  - Automatically analyzing, indexing and organizing information in audio, image and video is much harder than from text.
  - **Multimedia involves many different research areas and needs more complex and more efficient algorithms and hardware platforms**.

Multimedia Applications

- Examples of Multimedia Applications include:
  - World Wide Web
  - Multimedia Authoring, e.g. Adobe/Macromedia Director
  - Hypermedia course ware
  - Video-on-demand
  - Interactive TV
  - Computer Games
  - Virtual reality
  - Digital video editing and production systems
  - Multimedia Database systems

Multimedia Applications

- **Video-on-demand(VOD)**

Video on demand or audio and video on demand(AVOD) are systems which allow users to select and watch/listen to video or audio content when they choose to.

- **Interactive TV**

(also known as ITV or iTV) is a form of media convergence, adding data services to traditional television technology. Throughout its history, these have included on demand delivery of content, as well as new uses such as online shopping, banking, and so forth.

- **Hypermedia**

Hypermedia Is not constrained to be text-based . It can include other media, e.g. Graphics, images, and especially the continuous media–sound and video.

Multimedia Applications

- **Virtual reality**

Virtual reality (VR), sometimes referred to as immersive multimedia, is a computer-simulated environment that can simulate physical presence in places in the real world or imagined worlds. Virtual reality can recreate sensory experiences, including virtual taste, sight, smell, sound, touch, etc.

Multimedia Applications

- **Video editing**

The term video editing can refer to: The process of manipulating video images.

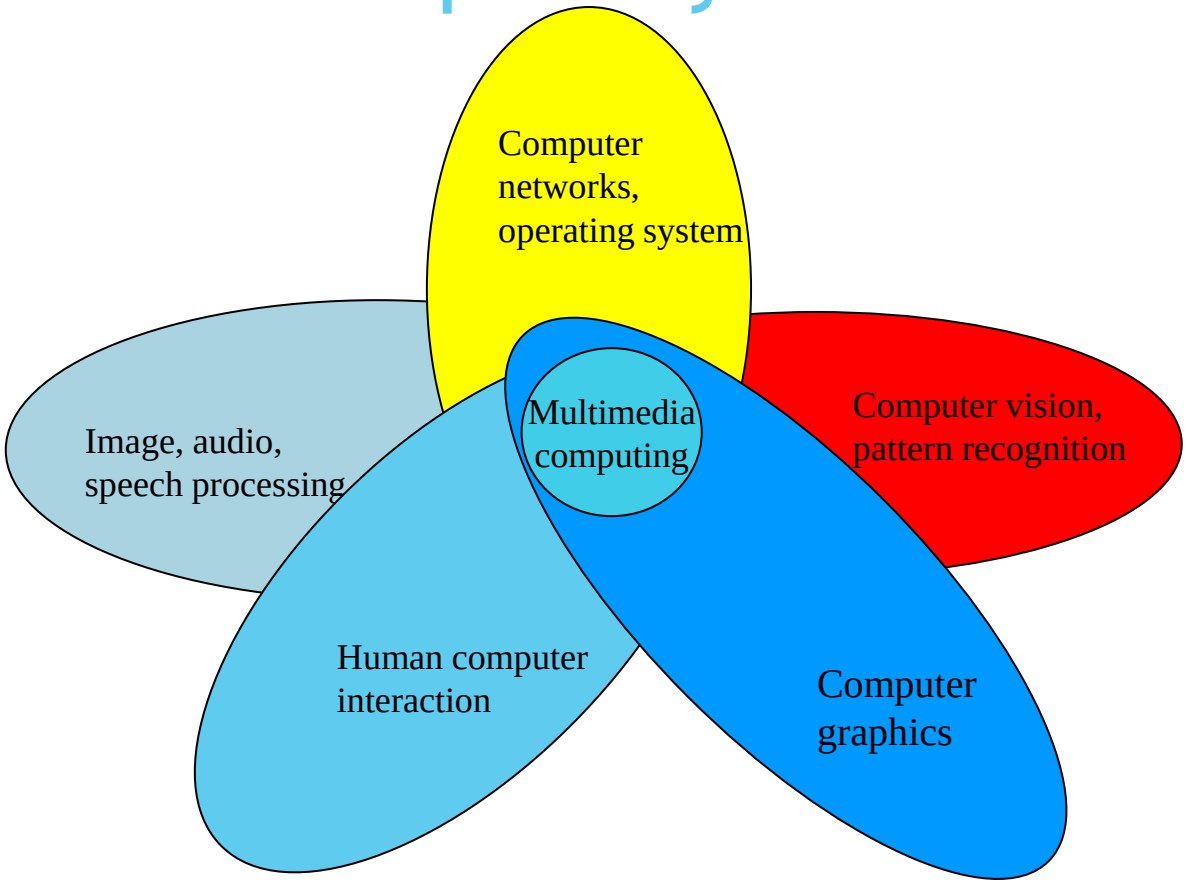
Video editing includes cutting segments (trimming),re-sequencing clips, and adding transitions and other special Effects.

- **2D and 3D**

World Wide Web

- Universal access of web resources (by everyone every where).
- **HTML**: a language for publishing Hypermedia on the World Wide Web
- **XML**: a markup language for the WWW in which the user or application can be able to define the tags
- **XSL:** basically CSS for XML.
- **SMIL**: synchronized Multimedia Integration Language, that allows for interaction among any media types and user input

Multimedia is Multidisciplinary



Multimedia System

- Multimedia involves more than simple addition of new data types.
- It integrates a wide range of symbol modes simultaneously into a coherent framework.
- The framework is usually denoted as a multimedia system.

Multimedia Systems

A Multimedia System is a system capable of processing multimedia data and applications.

- **Characteristics of a Multimedia System**
- Multimedia systems must be **computer controlled**
- Multimedia systems are **integrated**
- The information they handle must be represented **digitally**
- The **interface** to the final presentation of media is usually **interactive**

Multimedia Systems

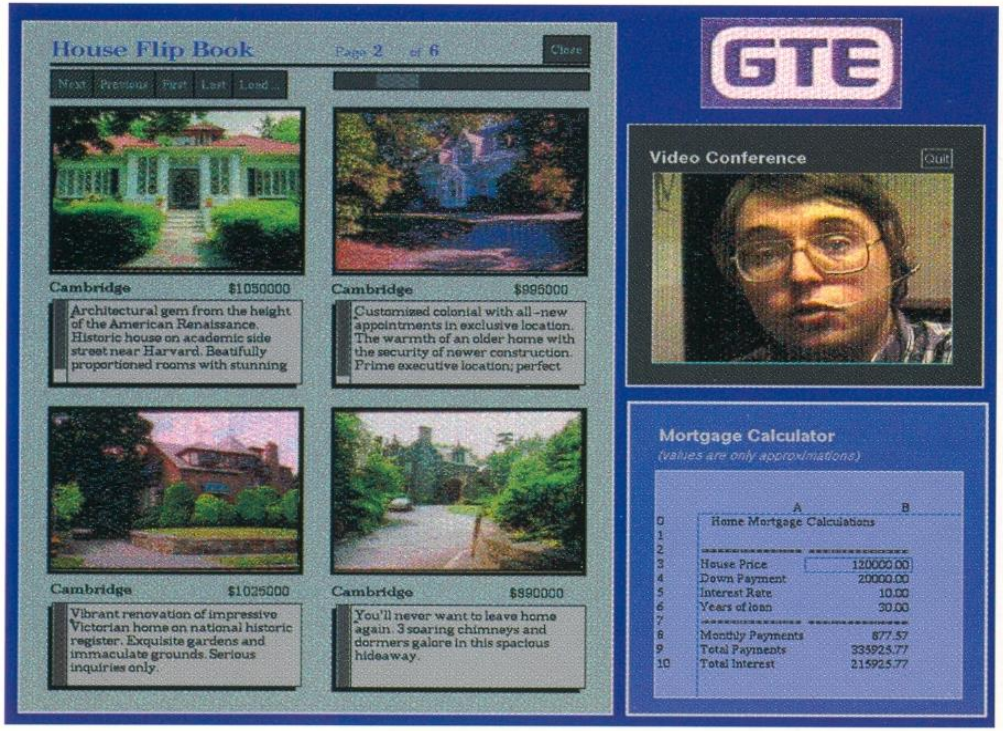
- **Video teleconferencing**
  - Also known as a video conference by a set of telecommunication technologies which allow two or more locations to communicate by simultaneous two-way video and audio transmissions

Multimedia Systems

- **Collaborative working environment**
  - A collaborative working environment (CWE) supports people, such as e-professionals, in their individual and cooperative work
  - **Examples:**
    - E-mail
    - Instant messaging
    - Application sharing
    - Video conferencing
    - Collaborative workspace, document management and version control system

Example Multimedia Systems

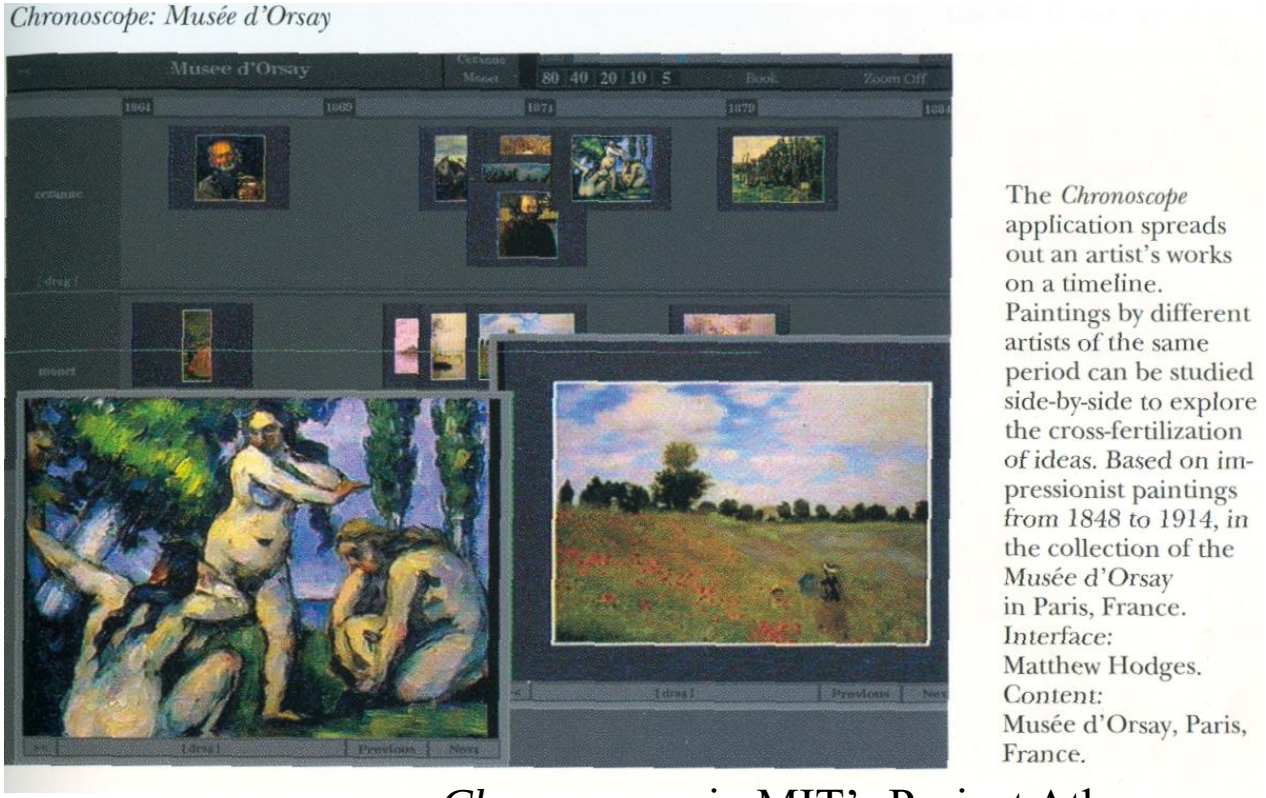
Real Estate



This prototype real estate application was developed with the AthenaMuse software at GTE Laboratories. House descriptions and color images are retrieved from a multimedia database and placed in a customized listing booklet. The client and Realtor can discuss candidate homes and financing options via desktop videoconferencing and a shared document facility.
Interface:
Russell Sasnett, at GTE Laboratories.

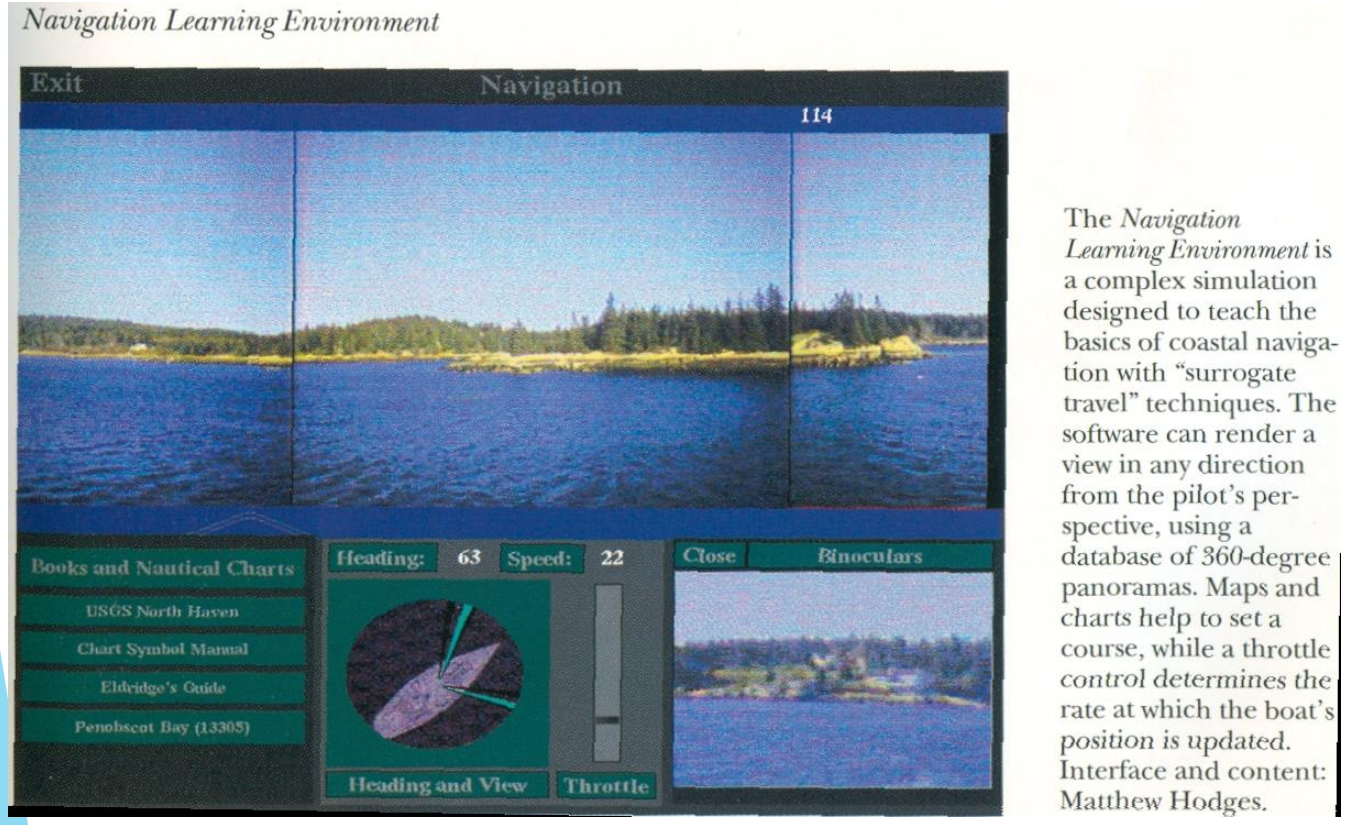
Real Estate in MIT's Project Athena

Example Multimedia Systems



Chronoscope in MIT's Project Athena

Example Multimedia Systems



Navigation Learning Environment in MIT's Project Athena

Multimedia Computing

- Multimedia systems involve some basic enabling techniques:
  - Multimedia data representation and compression.
  - Multimedia data processing and analysis.
  - Transmitting multimedia data through communication networks.
  - Multimedia database, indexing and retrieval.

Data Compression

Raw image takes about 6M bytes
(without header information)

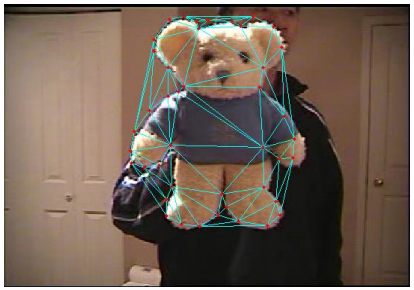
24k bytes with jpeg, Q=50

Media Processing and Analysis

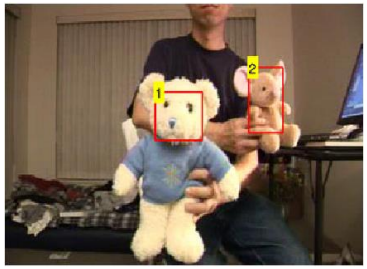
- In applications such as digital library, automatic data analysis has to be done to extract semantic meanings from audios, images and videos.
- Based on media processing methods such as
  - object tracking (face, eyes),
  - object recognition,
  - gesture recognition, etc.,

we can build more effective human computer interfaces.

Tracking Object by Image Matching



Multiple Object Tracking



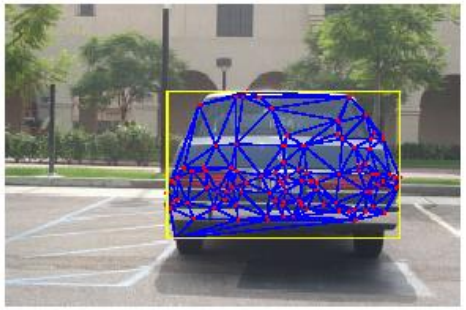
Toys

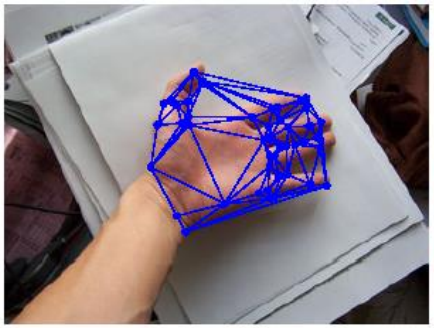
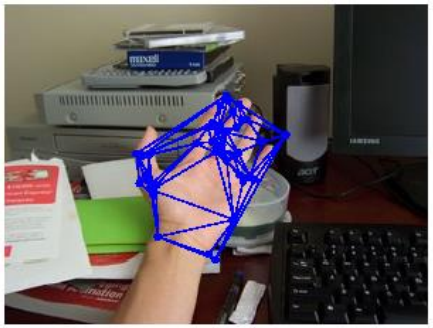
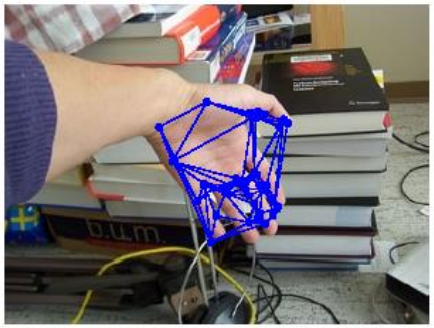
Squash

Lab

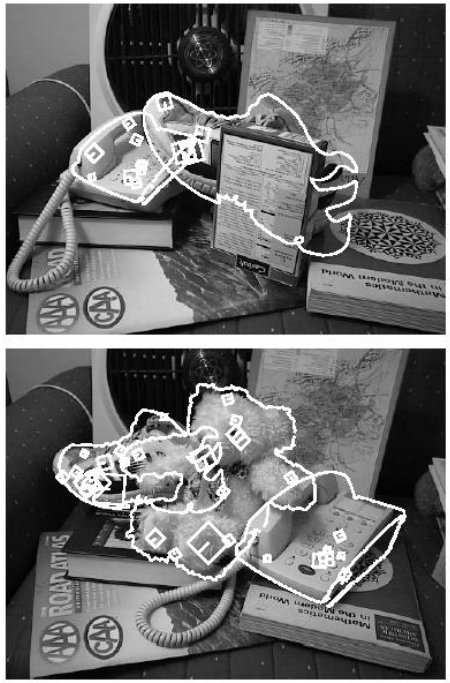
Double Squash

Finding Objects in Clutter



Object Recognition



David G. Lowe, **"Object recognition from local scale-invariant features,"** ICCV99.

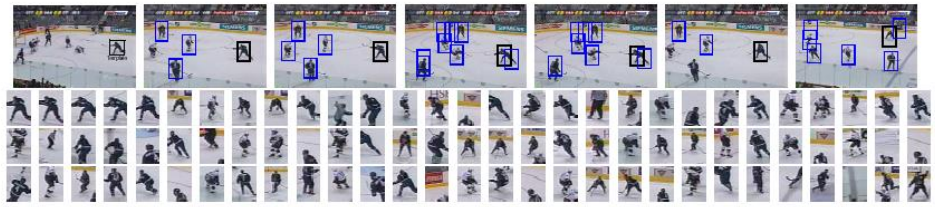
Posture Detection in Images

(a) Top 23 matches for figure skating posture 1. The first image is the exemplar.

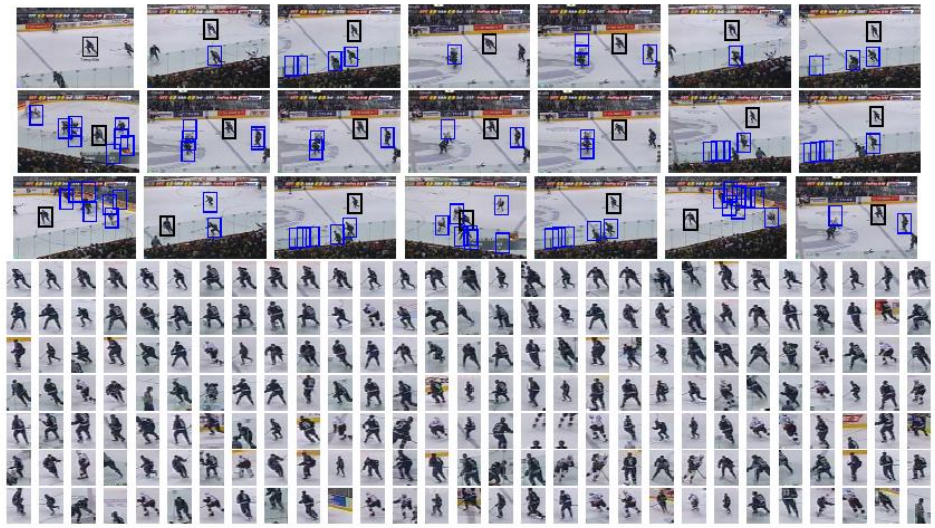
(b) Top 23 matches for figure skating posture 2. The first image is the exemplar.

(c) Top 23 matches for figure skating posture 3. The first image is the exemplar.

Dealing with Multiple Objects

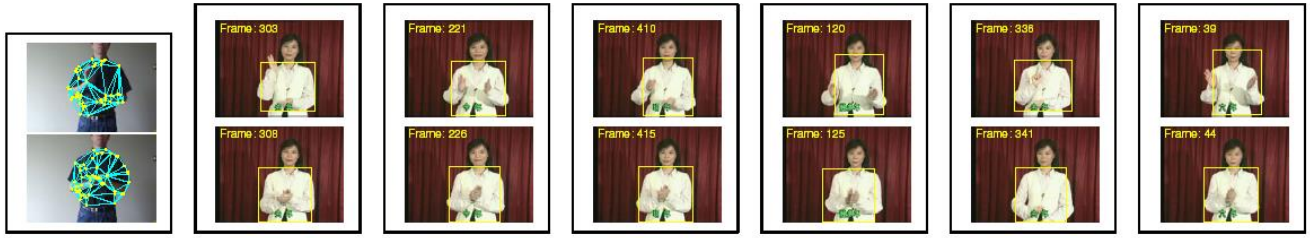


(a) Locating shooting posture in video with exemplar 1



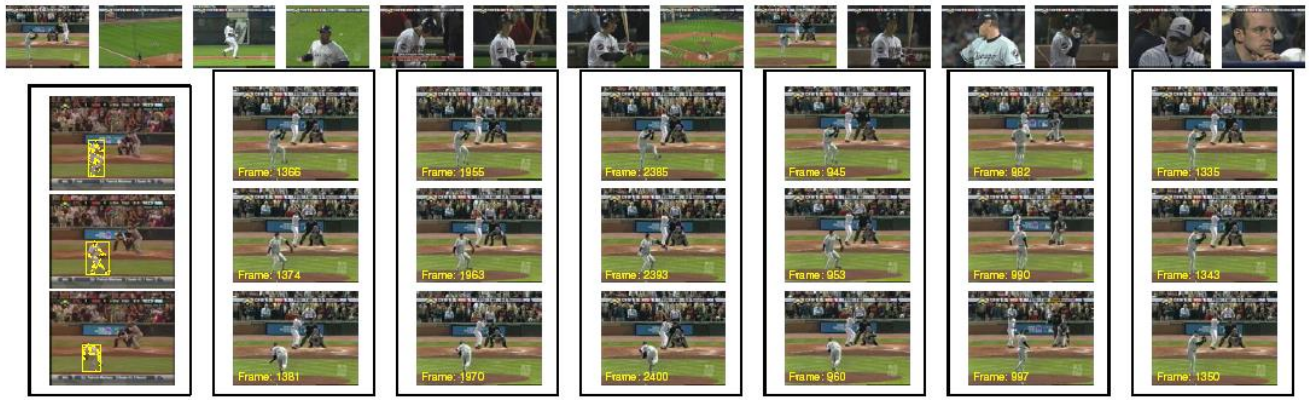
(b) Locating postures in video with exemplar 2

Action Detection



(a) Templates (b) Cost:43.9 (c) Cost:45.5 (d) Cost:46.0 (e) Cost:46.2 (f) Cost:46.4 (g) Cost:46.5

Sign language gesture detection



(a) Templates (b) Cost:29.29 (c) Cost:29.68 (d) Cost:29.91 (e) Cost:30.11 (f) Cost:30.17 (g) Cost:30.19

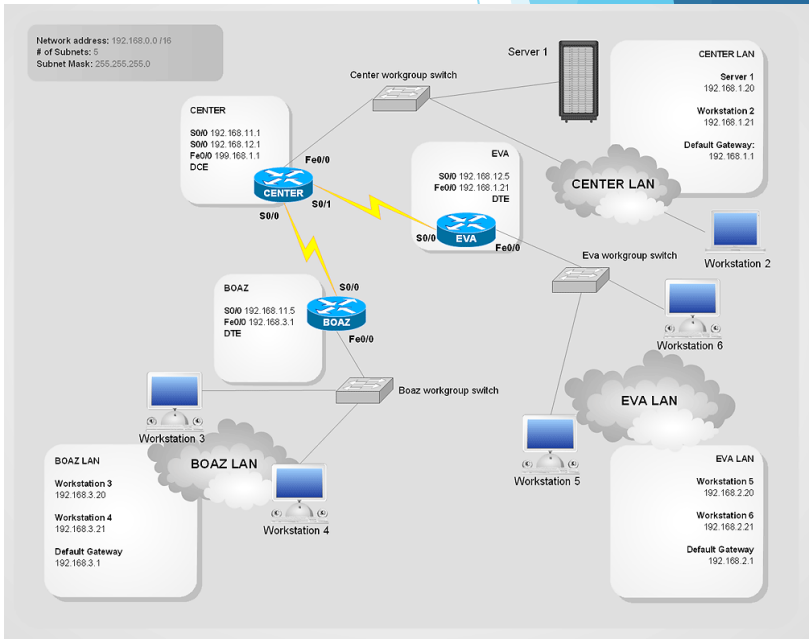
Detecting actions in baseball sequence

Finding Action Clusters in Image Database

Finding Action Clusters (con't)

Media Delivery

- Transmitting multimedia data across the network is another topic in multimedia computing.
- There are different issues when we transmit video and audio through packet network.
  - Quality of service.
  - Synchronization.
  - Error and congestion control.
  - Session setup and book keeping.



Multimedia Database and Indexing

- Multimedia database has to deal with large media files.
- Multimedia data needs new data structures, indexing and searching methods.
- Content based multimedia retrieval is still an ongoing research topic.

Overview of Multimedia Software Tools

1. Music Sequencing and Notation
2. Digital Audio
3. Graphics and Image Editing
4. Video Editing
5. Animation
6. Multimedia Authoring

Digital audio

- **Cool Edit:**
  - A very powerful and popular digital audio toolkit, including digital signal processing effects
- **Sound Forge:**
  - a sophisticated PC-based program for editing audio WAV files.
- **Pro Tools:**
  - a high-end integrated audio production and editing environment

Music Sequencing and Notation and Digital audio

- **Cakewalk**: now called Pro Audio.
  - Recording and editing audio; burning and ripping CD's; cleaning and converting albums to CD or MP3.
  - It is also possible to insert WAV files and Windows MCI commands (for animation and video) into music tracks
- **Cubase:** another sequencing/editing program, with capabilities similar to those of Cakewalk. Used by star producers and musicians for composing, recording, mixing and editing music
- **Adop Soundedit:** mature program for creating audio for multimedia projects and the web that integrates well with other Macromedia products such as Flash and Director.

Graphics and Image Editing

- **Adobe Illustrator:**
  - A powerful publishing tool from Adobe. Uses vector graphics; graphics can be exported to Web.
- **Adobe Photoshop:**
  - The standard in a graphics, image processing and manipulation tool.
- **Adobe Freehand:**
  - A text and web graphics editing tool that supports many bitmap formats such as GIF, PNG, and JPEG.

Video Editing

- **Adobe Premiere:**
  - A simple video editing tool i.e., putting video clips into any order
- **Adobe After Effects:**
  - a powerful video editing tool that enables users to add and change existing movies. Can add many effects: lighting, shadows, motion blurring; layers.
- **Final Cut Pro:**
  - A video editing tool by Apple; Macintosh only.

Animation

- **Multimedia APIs:**
  - **Java3D:** API used by Java to construct and render 3D graphics
  - **DirectX :** Windows API that supports video, images, audio and 3-D animation
  - **OpenGL:** The highly portable, most popular 3-D API.

Rendering Tools

- **3D Studio Max:** Rendering tool that includes a number of very high-end professional tools for character animation, game development, and visual effects production.
- **Softimage XSI:** A powerful modeling, animation, and rendering package used for animation and special e effects in films and games.
- **Maya:**
- **Render Man:**
- **GIF Animation Packages:** A simpler approach to animation, allows very quick development of effective small animations for the web.

Multimedia Authoring

- **Adobe Flash:** allows users to create interactive movies
- **Adobe Director:** uses a movie to create interactive presentations
- **Authorware:** A well-supported authoring product based on the Iconic/Flow-control metaphor.
- **Quest:** similar to Authorware in many ways, uses a type
- of flowcharting metaphor.

Useful Resources

- Journals
  - IEEE Multimedia
  - IEEE Transaction on Multimedia
  - IEEE Transaction on Image Processing
  - IEEE Transaction on Pattern Recognition and Machine Intelligence
- Conferences
  - ACM Multimedia
  - International Conference on Multimedia and Expo (ICME)
  - IEEE Computer Vision and Pattern Recognition (CVPR)
  - International Conference on Computer Vision (ICCV)

Thanks