Snapshot of Research Horizons

- What we talked about
  - Compression techniques
  - Storage models and structures
  - Operating system support
  - Digital audio and video networking and communication architectures
- What we did not talk about
  - Media synchronization
  - Methodologies, tools, and software architectures for multimedia collaborative applications
  - Multimedia document architectures
  - Multimedia database management, content-based retrieval techniques
  - Hardware architectures

Today's Class

- Talk about what we didn't talk about...

Multimedia Databases

Challenges

- Traditional databases (relational, object-relational)
  - Predominantly textual and numeric data
  - Use data structures such as $B+$ trees to index data
  - Use query languages such as SQL to retrieve data
  - Use query optimization techniques to improve performance
- Limitations:
  - Unable to efficiently handle data types such as images and video
  - Traditional indexing structures and query languages are no longer adequate

Query by Image Content (QBIC)

- Key concept:
  - Find pictorial information in image/video databases based on color, shape, texture and sketches
- Issues
  - How do you index and store data?
  - How do you retrieve data?

Data Model

- QBIC supports two types of data
  - Still images that contain objects
    - Objects are portions of an image (e.g., a tree, a house)
  - Video shots containing moving objects

Handling Images

- QBIC computes and extracts various properties of an image
  - Color, texture, shape
- Images can be annotated with textual information
- QBIC also allows identifies interesting regions (objects) in the image
  - Objects can be identified manually or automatically
- Above image characteristics are stored along with a thumbnail version of the image

Handling Video

- Shot detection
  - Identify scenes within a video clips (cuts, fade,...)
- Representative frame selection
  - Choose a representative frame R from each scene
- Extract information for R as in still images
- Extract motion information

Handling Queries

- QBIC allows queries based on color, texture, shape
  - Find all images with a tree
  - Find all images with 30% red and 20% blue
  - Find all scenes with a zoom/pan
  - Find all images with a tree, 20% blue and a green textured object
- QBIC allows similarity-based query
  - User can sketch an object in freehand
  - QBIC extract features of the sketch and retrieves images that are similar
- QBIC provides a GUI for specifying queries

Multimedia Databases: Future Challenges

- Annotation and database population tools
- Feature extraction and matching methods
- Integration with text
- Extensibility and flexibility
- User interface
- Indexing and performance