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- Document Image Processing
  - Bank checks, engineering drawings etc.
  - Analysis and compression
  - Watermarking and data hiding
- Content-Based Image Retrieval
- Video Processing and Analysis
  - Video content classification
  - Video text extraction and recognition
Introduction

- Watermarking grayscale and color images
  - Change gray level value or color of a selected group of pixels by a small amount without causing visually noticeable artifacts
- Watermarking document images
  - More difficult because document images have few gray levels or colors
- Arbitrarily changing pixel values in a document image would make the changes very noticeable
Experimental Result

William Clinton

Original (287 x 61)

Embedded with the letters “POLYTECHNIC” (91 bits)
Applications

- Document is the primary form of written communications; watermarking and data hiding techniques for document images have many important applications.
- Copy control and prevention, ownership assertion, authentication, fingerprinting or traitor tracing, steganography, media bridging, smart documents, etc.
- Bank checks, financial instruments, legal documents, driver licenses, birth certificates, digital books, engineering maps, architectural drawings, road maps, etc.
Content-Based Image/Video Retrieval

- Extract features from images or video frames
- Use extracted features for indexing and similarity computation in retrieval
- Commonly used features for images and video: color, texture and shape [Idris and Panchanathan '97][Chan, Lei, Lopresti, and Kung '97]
- Other features for video: motion, audio, and speech features
- Example CBIR systems: QBIC, MARS, FIBSSR, and others.

January 13, 1999
Sample Query Images (left) and the Target Images (right) with Their Ranks. (Lower ranks indicate higher similarity.)
Scale-space Object Boundary

$t = 0$

$t = 16$

$t = 256$

$t = 4$

$t = 64$

$t = 1024$
Sample database images

Arrowhead

Fighter Jet (top view)

Human Figure

Fighter Jet (side view)
Retrieval Results
Class A – Fighter Jets (top view)
\( S_{\text{min}} = 16, \ S_{\text{rot}} = 1024, \ \text{scope} = 5 \)
Testing Sequences

REPORT.avi

FOOTB.avi

BASEB.avi

CHANGE.avi
Figure 1. Test image “data13”

Figure 2. Illustration of a “scan line segment” (at y = 80 for test image “data13.”)

Figure 3. Gradient profile for scan line y = 80 for test image “data13.”

Figure 4. Binary text extracted from test image “data13.”