

Bildinformationssysteme



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Introduction:

Next-generation Web Searches for Visual Content
M.S. Lew
Computer 33/11 November 2000

A Survey on: Contents Based Search in Image Databases
B. Johansson
TR LiTH-ISY-R-2215, Dept. EE, Linköping Univ., 2000

Substance:

Principles of Visual Information Retrieval
M.S. Lew (ed.)
Springer 2001

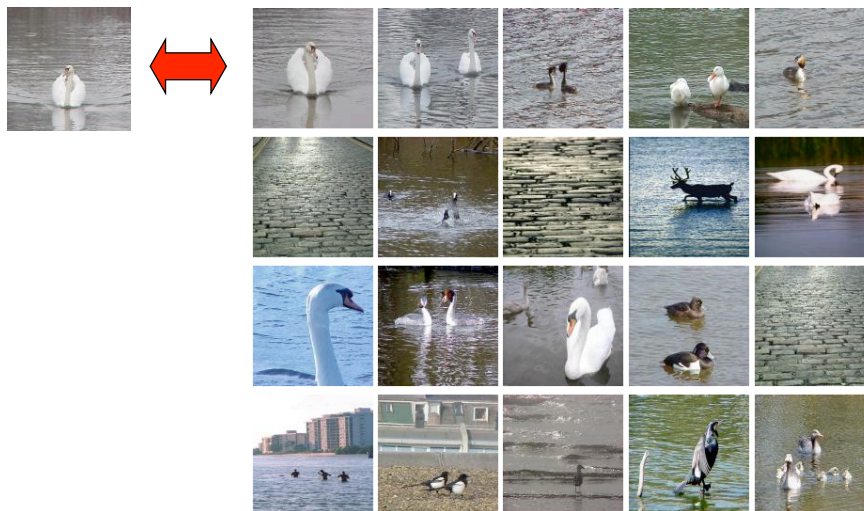
Visual Information Retrieval
A. Del Bimbo
Academic Press 1999

Image and Video Retrieval
P. Enser et al. (eds.)
Proc. Third Int. Conf. (CIVR-2004), Springer, 2004

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Examples (1)

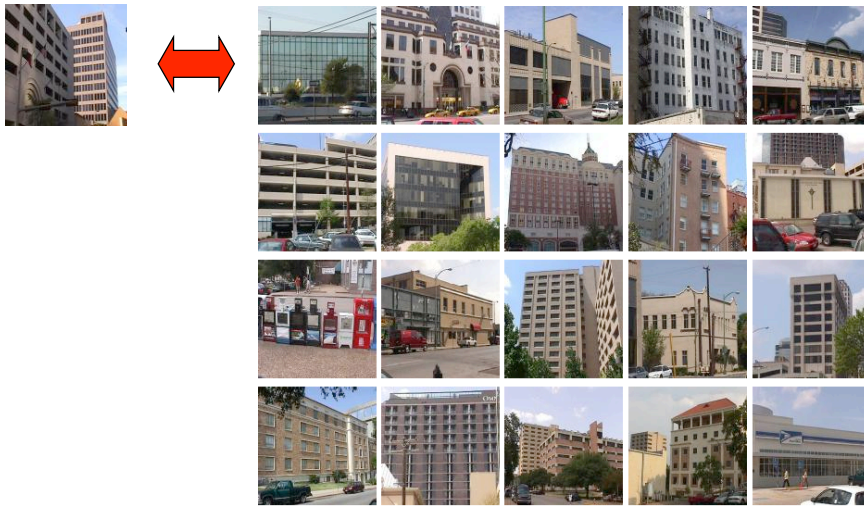
Example-based image retrieval by CIRES (Content Based Image REtrieval System)



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Examples (2)

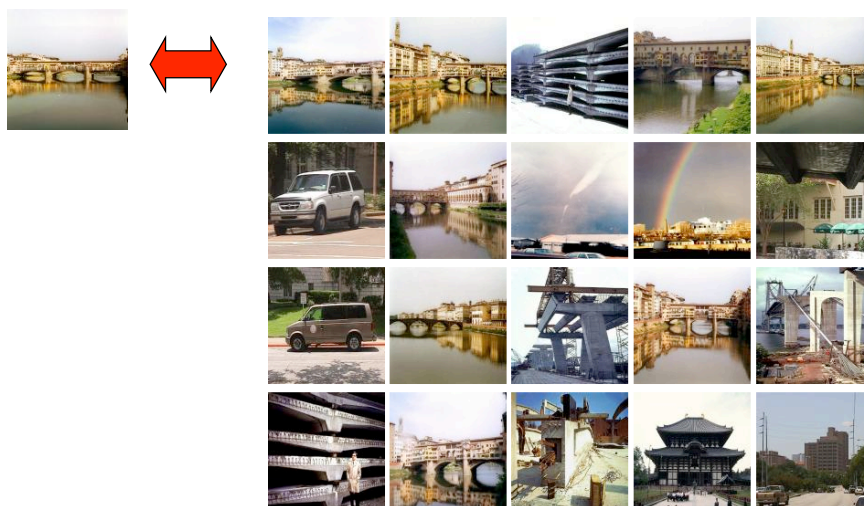
Example-based image retrieval by CIRES (Content Based Image REtrieval System)



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Examples (3)

Example-based image retrieval by CIRES (Content Based Image REtrieval System)



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Important Problem Areas of CBIR Systems

CBIR = Content-Based Image Retrieval

- **Population of image database**
 - automatic computation of primitive features
 - semi-automatic computation of semantic features
 - efficient indexing schemes
- **Query specification**
 - feature-based queries
 - example-based queries
 - browsing interfaces
 - multimodal queries

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State of the Art

The field is dominated by pragmatic approaches:

- computer support when computers are effective
- human interaction otherwise

Typical use case:

- **User specifies image query by features which have been largely precomputed for the database**
 - by primitive features from a menu
 - by interactively defined complex features
 - by an example, giving rise to a set of features
- **System responds with a potentially large number of hits from a large database**
- **User interactively selects image from retrieved image set**

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The "Semantic Gap"

CBIR suffers from the inability of the field to automatically compute "meaningful" descriptions and retrieve images by "meaningful" queries.

Example:

In order to retrieve images of "catastrophies", images must be automatically classified as depicting "catastrophies".

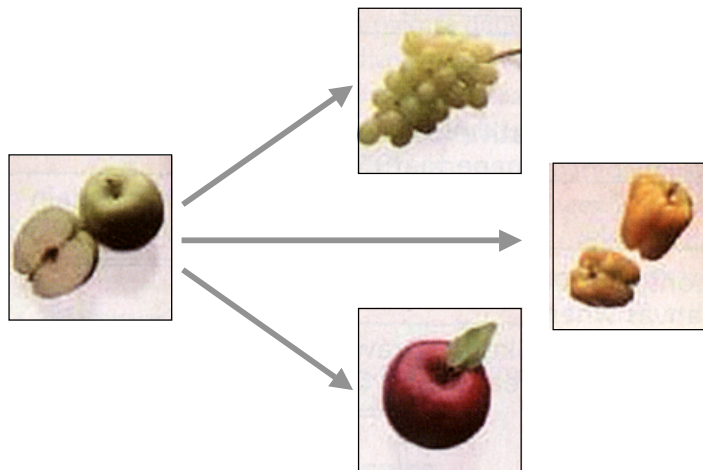
This will not possible be possible for many years!

Typically, CBIR can only select images based on superficial image characteristics, not on a deep understanding of image contents.

The challenge is to close the semantic gap!

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What is a "Similar" Image? (1)



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What is a "Similar" Image? (2)



- Similarity is a multidimensional measure
- Weights of individual similarity dimensions may be context-dependent
- Constraints may be useful

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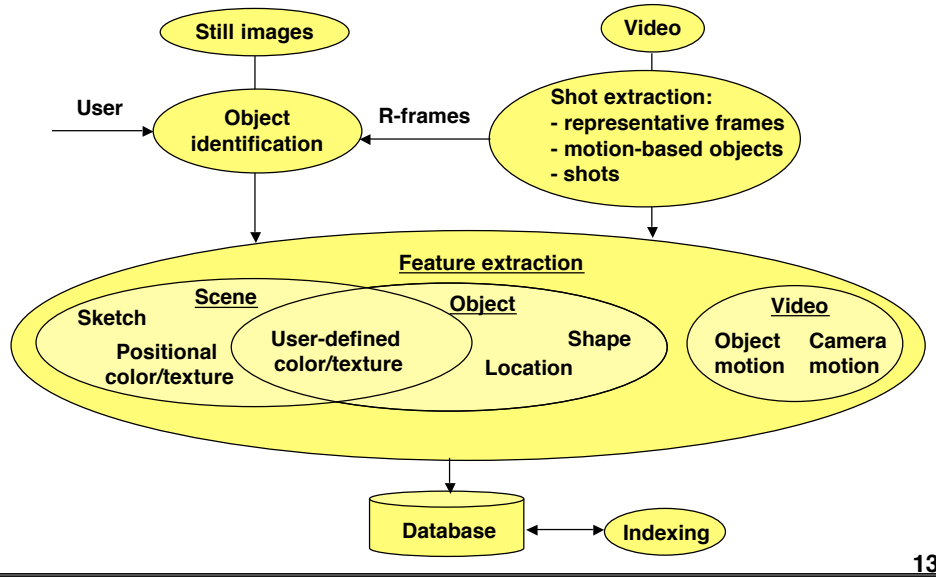
Dimensions of Similarity

Similarity by

- key words
- colour histogram
- texture
- edge orientations
- 2D-shape
- layout
- sketch
- Gabor filter bank responses
- probabilistic feature structure
- multi-scale comparison
- object categories
- high-level concepts

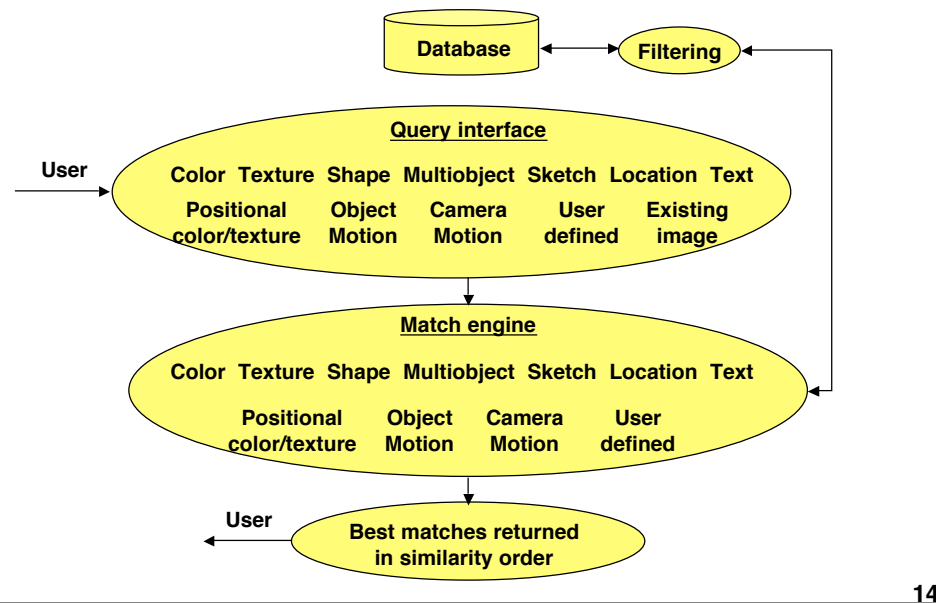
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QBIC Database Population



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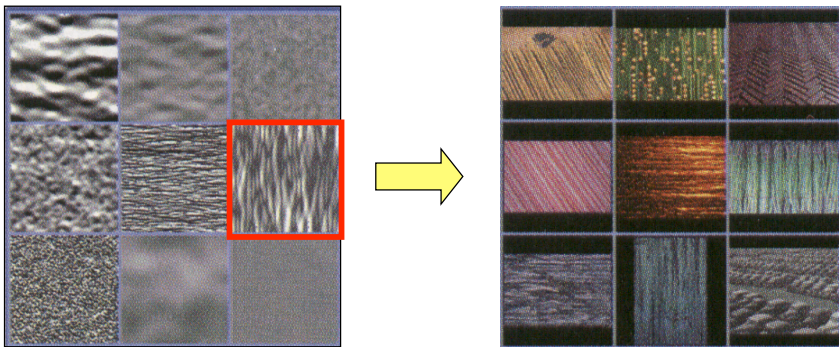
QBIC Queries



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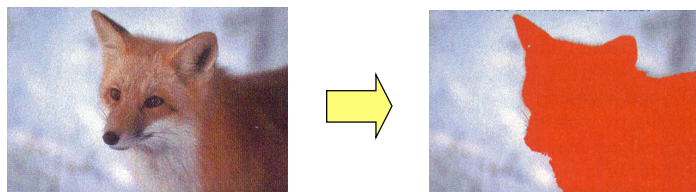
Retrieval by Texture

Retrieval by user-specified texture example (left) results in hits on the right



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QBIC Shape Definition



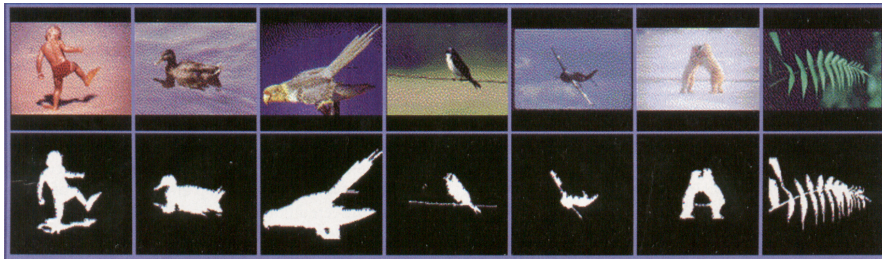
QBIC provides various tools for interactive shape definition:

- polygon outliner
- rectangular outliner
- ellipse outliner
- paintbrush
- eraser
- object translation
- flood fill
- line drawing
- snake outliner

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Automatic Object Extraction

Top row: Original images
Bottom row: Automatically extracted objects using foreground/background model and central location heuristic



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Separation into Motion Layers

In image sequences, objects with different motion characteristics may be separated into distinct "motion layers".

- Camera-motion induced optical flow
- Object-motion induced optical flow

Example:

Camera motion allows to separate foreground object from background



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Retrieval by Keywords

"lake"
and
"sunset"



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Applications of Contents-based Image Retrieval (CBIR) Systems

- Art galleries and museum arrangements
- Architectural and engineering design
- Interior design
- Remote sensing, management of earth resources
- Geographic information systems (GIS)
- Scientific database management
- Weather forecasting
- Fabric and fashion design
- Trademark and copyright database management
- Law enforcement, criminal investigation
- Picture archiving and communication systems

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Historical Images (1)

Finding a view of Wernher von Braun

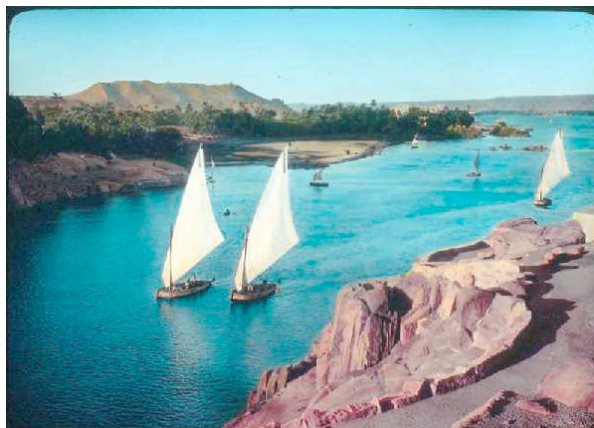
(Wernher von Braun
greet an enthusiastic
crowd at the Gulf
South State Fair in
Picayune, Miss., in
October 1963.)



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Historical Images (2)

Assuan on 25.12.1826, view from Katarakt-Hotel
(hand-coloured)



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