Content Based Retrieval in Multimedia Databases

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Content-Based Retrieval

Text-Based Retrieval

- Automatic annotation of image content is not achieved yet.
- Manual annotation is an arduous task.
- There are unlimited ways of annotating a picture.
- Some visual contents are difficult to describe.
How to describe visual content?

Features definition

- Color distribution
- Texture pattern
- Shape
- Objects
- Partial semantic
- Real content

Degree of difficulty

How to describe visual content?

Features representation

- Color
  - Color Histogram
  - Color Coherence Vectors
  - Correlograms
  - Spatial Chromatic Histogram
  - ...
- Texture
  - Wavelets
  - Grey-Levels Distribution
  - Gabor Filters
  - Tamura descriptors
  - ...
- Shape
  - Deformable Template
  - Invariant Moments
  - Wavelets
  - Description of boundaries
  - ...
- Other
  - Discrete Cosine Transform
  - Regions Layout/Relationship
  - ...

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Content-based similarity retrieval

The similarity problem

- The term "similarity" has different meaning for different people.
- Even the same person uses different similarity measures in different situations.

A retrieval system should be able to
- use low level and high level descriptions of visual contents automatically extracted.
- cover a wide range of users requirements.
- adaptively select the retrieval strategy that is most suited for the users needs.
The ‘Quicklook<sup>2</sup>’ system

Overview

Web-Demo at http://quicklook.itc.cnr.it

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The ‘Quicklook<sup>2</sup>’ system

Queries available

- Pictorial queries
  - Provide an example of ready-made image
  - Sketch an image with the available tool
  - Browse the database to find one or more relevant images with which to begin

- Textual queries
  - Filter the database with textual keywords
  - Search images by textual annotation similarity
  - Search images by text similarity

- Advanced queries
  - Combination of one or more of the above queries
  - Relevance feedback
Relevance Feedback
"Human-in-the-Loop"

Query Reformulation

Features Weights

Pictorial Textual

SIMILARITY EVALUATION

Database

Ranked Results

Example
Results Presentation

“Virtual Museum”

The result can be presented in a navigable 3D-like virtual environment

- Different environments
- Different frames to choose from
- Image’s canvas sizeable
- Image are shown in linked rooms

‘Quicklook’

Other issues

- “Long-Term” Learning
- Database Organization
  - Indexing Structures
- Meta-data Exploitation
  - Hidden annotations
- Integration of other media
  - Video Data
  - 3D Objects Data
Database Organization
Clustering

- Can be used to:
  - Improve retrieval efficiency
  - Provide an overview of database content

Hidden Annotation
Segmentation based on semantic content

THESAURUS DEFINITION

MATCHING /DECISION RULE

Vegetation, Water, Sky
Hidden Annotation
High level categorization

Image Classification
- Close-up
- Text
- Graphic
- Outdoor
- Indoor

Video Indexing
Segmentation: shots detection

Cuts / Fades Detection

KeyFrames
Video Indexing
Abstraction: summarization

Key Frame Levels

Structure Levels
- Video
- Scenes
- Shots
- Frames

3D Objects

- Challenges
  - 3D Pre-processing
  - Features to use in indexing 3D objects
    - 2D Features
    - 3D Features
    - Invariants
  - Interface to use to submit a query
    - 2D Projections View
    - 3D Examples
  - Matching 2D and 3D data
Multimedia Databases
Applications

- Art gallery, museum.
- Photographic archives (journalism).
- Textile databases.
- Trademarks databases.
- E-commerce catalogues.
- Web-searches.
- Medical image databases.
- Facial databases (security, law enforcement).
- Engineering design databases.
- Geographic databases.
- Satellite image databases.
‘QuickLook²’ Scheme