Visual Computing

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Outline

- Content-based Image Retrieval
  - Motivation and Goal
  - Problem Statement
  - Current and Future Projects
- Data Mining Projects
Motivation & Goal

The growth of digital imaging

Digital Image Collections & Applications

- Satellite Image Archives
  - Military
  - Geographical
- Computerized Tomography
  - Medical
- Images on the Web
  - E-commerce
  - Entertainment
  - Educational
Motivation & Goal (cont.)

The need for data management

- Exploration Modalities
  - Browsing
    - Interactive
    - By Subject
    - Navigation & Summarization
  - Retrieval
    - By Image Example
    - By Keyword
    - By Features & Sketches

- Humans tend to use semantic concepts when querying and browsing multimedia databases.
Motivation & Goal (cont.)

External sources of information about images:
- Captions
- Transcripts
- Close Captioning
- Verbal description

Text from:
- Manual Indexing

Internal sources of information:
- High-level features:
  - Keywords

Learned visual Concept: ‘sunset’

Automatic or semi-automatic generation of keywords for images from their visual content

High-level features:
- Learned visual Concept: ‘sunset’

Low-level features:
- Color
- Shape
- Texture
Problem Statement

Image retrieval systems that permit image searching based on features automatically extracted from the images’ own visual content are called content-based image retrieval (CBIR) systems.

- **visual features** (primitive or low-level image features)

  Domain-specific features:
  - fingerprints, human faces

  **General features**:
  - **color**, texture, shape

**Drawback:** lack of expressive power
Problem Statement

Image Database

Mountains and waterfalls

Feature Extraction

Histogram

Semantic Gap

Meaning: Sunset

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Current and Future Projects

Color and Shape-based Image Retrieval
Current and Future Projects

Color Patterns and Synobins
**Color Patterns and Synobins**

Bins representing different colors but when similarly used across the image database can be considered as synonymous with each other and the pattern that they define is the analogous of a concept from text retrieval.

<table>
<thead>
<tr>
<th>Same root/color used in different contexts</th>
<th>Doctor, Doctorate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor, Physician</td>
<td></td>
</tr>
</tbody>
</table>

Bins representing different colors but when similarly used across the image database can be considered as synonymous with each other and the pattern that they define is the analogous of a concept from text retrieval.
Future Projects

Narrative Description of Images

Face Recognition Applications
# Data Mining Projects

- **Using Data Mining for Target Marketing Efforts**

**Kansei Engineering:** Mappings from image car characteristics to customer feelings/preferences

<table>
<thead>
<tr>
<th>Vehicle Attributes</th>
<th>Anticipated Feelings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adventurous</td>
<td>Accomplished</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Acknowledged</td>
</tr>
<tr>
<td>Athletic</td>
<td>Anonymous</td>
</tr>
<tr>
<td>Long Lasting/Enduring Style</td>
<td>Confident/Competent</td>
</tr>
<tr>
<td>Exclusive</td>
<td>Cutting-edge</td>
</tr>
<tr>
<td>Family oriented</td>
<td>Free to do anything</td>
</tr>
<tr>
<td>Fast</td>
<td>In-control</td>
</tr>
<tr>
<td>Luxurious</td>
<td>Mainstream</td>
</tr>
<tr>
<td>Modern</td>
<td>Mentally/Physically Engaged</td>
</tr>
<tr>
<td>Muscular/Well-defined</td>
<td>Rewarded</td>
</tr>
<tr>
<td>Nostalgic</td>
<td>Sporty</td>
</tr>
<tr>
<td>Powerful</td>
<td>Tough</td>
</tr>
<tr>
<td>Sleek and Sexy</td>
<td></td>
</tr>
<tr>
<td>Sophisticated</td>
<td></td>
</tr>
<tr>
<td>Sporty</td>
<td></td>
</tr>
<tr>
<td>Tough</td>
<td></td>
</tr>
</tbody>
</table>

**Target Customer Emotional Benefits**

**Personality Profile**
- Tough
- Free to do anything
- In Control
- Confident

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Data Mining Projects

- Using Data Mining for Medical Applications
  - Prediction of high costly patients in the future for medical insurance company
  - Prediction of patients’ readability for certain surgeries

- Using Data Mining for Stock Market and Investment
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THE END!