MSc Project — Image Retrieval Using Natural Language and Content-Based Techniques

Kate Byrne

September 21, 2003
Agenda

- The Task — what was the aim of the project?
- The Tools — combining and comparing methods
- Demo — CANTRIP in operation
- Evaluation — summary of results
Aim of the Project: Image Retrieval

show me pictures of X

NMRS images
NMRS database
Variety of Approaches

Start with physical image content or with text descriptions?

- NMRS images
- NMRS database

- colour, shape, texture, semantics
- range of text-based techniques: IR, IE, QA, database tools
Text-based Methods 1

- IR — inverted indexes with TF-IDF weighting, as in Web search engines
  - \[ TF-IDF \text{ weight} = \text{term frequency} \times \text{inverse document frequency} \]
  - high TF-IDF weight ⇒ several times in each document, but rarely in the corpus as a whole ⇒ word occurs in “clumps”
  - such words are good for discriminating between different documents

- IE — extracting structure from data, eg by finding Named Entities
  - people, places, organisations, dates, numeric amounts
  - domain-specific phrases like “unenclosed settlement” or “cruck-framed”
Text-based Methods 2

• QA — question answering tools, eg query expansion
  – find preferred or related terms from thesaurus
  – user asks for “greenhouse”, system also searches for “glasshouse” and “botanic garden”
  – sometimes helpful, sometimes not

• Database tools — structured queries against fields, with SQL
  – distinguish between type of site and name of site etc
  – use inverted indexes on individual text fields in database
Combining and Evaluating

TF-IDF + NER

CBIR + text-based IR

relational structure + unstructured text
Implementation

Six versions of CANTRIP, to test different approaches
Demo time...
## Results

<table>
<thead>
<tr>
<th>Method</th>
<th>Time</th>
<th>Precision</th>
<th>Recall</th>
<th>score_K</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>NER+</td>
<td>5.77</td>
<td>66.88%</td>
<td>100.00%</td>
<td>100.25</td>
<td>52.28%</td>
</tr>
<tr>
<td>fulltext</td>
<td>1.96</td>
<td>48.13%</td>
<td>100.00%</td>
<td>72.69</td>
<td>40.30%</td>
</tr>
<tr>
<td>search engine</td>
<td>3.17</td>
<td>29.38%</td>
<td>75.00%</td>
<td>48.63</td>
<td>29.84%</td>
</tr>
<tr>
<td>baseline</td>
<td>1.63</td>
<td>37.50%</td>
<td>62.50%</td>
<td>40.13</td>
<td>26.14%</td>
</tr>
<tr>
<td>NER</td>
<td>5.00</td>
<td>31.56%</td>
<td>75.00%</td>
<td>39.06</td>
<td>25.68%</td>
</tr>
<tr>
<td>CBIR</td>
<td>7.98</td>
<td>60.28%</td>
<td>36.11%</td>
<td>23.63</td>
<td>18.97%</td>
</tr>
</tbody>
</table>