ImageCLEF 2004

The CLEF cross-language image retrieval campaign

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Image retrieval

- Retrieval methods
  - Using primitive features based on pixels which form the contents of an image (CBIR)
  - Using abstracted features assigned to the image (e.g. captions, metadata etc.)
  - Using a combination of both methods
- Cross-language image retrieval
  - Retrieval based on visual features is language-independent
  - Language of associated texts should have minimal affect on their usefulness for retrieval

ImageCLEF 2004 (1)

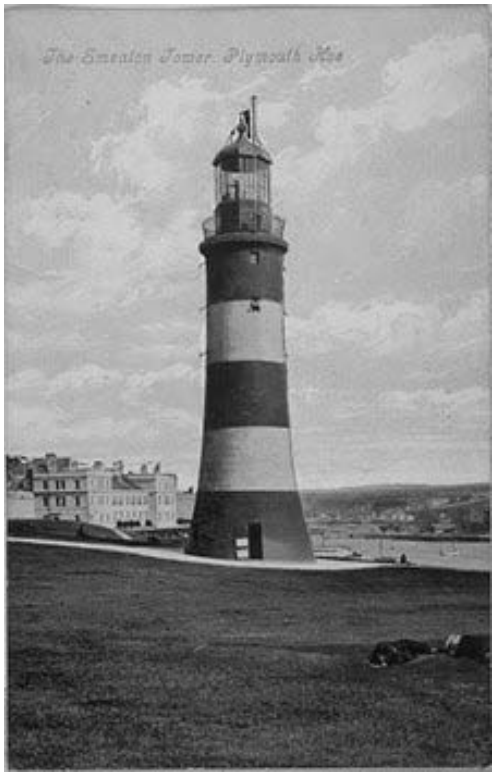
- Motivations
  - Many image collections exist with associated texts (e.g. Corbis, Getty Images)
  - Few campaigns exist for large-scale image retrieval
  - Many practical applications which could benefit from image retrieval evaluation (e.g. medical domain)
- Aims
  - To promote the evaluation of image retrieval and unite both image and text retrieval communities
  - To investigate how visual and textual features can best be combined for retrieval (e.g. QE)

ImageCLEF 2004 (2)

- ImageCLEF provides
  - Two document collections (images + texts)
  - Search tasks for each collection (topics)
  - Relevance judgments
  - Default CBIR system (GIFT/Viper)
- ~30,000 historic photographs (St. Andrews)

ImageCLEF 2004 (2)

Record ID:	JV-.044809
Short title:	The Smeaton Tower, Plymouth.
Long title:	Plymouth Hoe. The Smeaton [Lighthouse] Tower.
Location:	Devonshire, England
Description:	Red and white striped lighthouse on coastal cliff with harbour and town beyond, and substantial building on cliff terrace below.
Date:	Registered 1904
Photographer:	J Valentine & Co
Categories:	[lighthouses][beacons & lighthouses][Devon all views][Collection - J Valentine & Co]
Notes:	JV-44809 pc/mb(or possibly 44810)TECH: Coloured.



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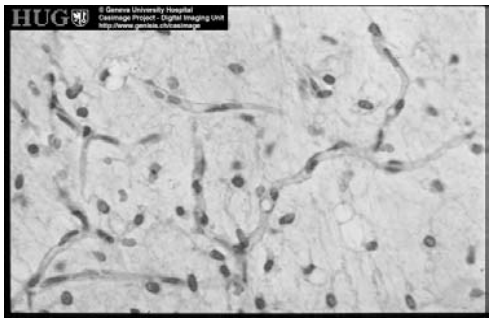
ImageCLEF 2004 (2)

<Description>
X ray: Mass effect within the soft tissues of the proximal part of the left calf, difficult to outline, seen only as it displaces the fat planes. There are no calcifications. The adjacent bone is normal.

MRI: Oval mass within the medial gastrocnemius muscle, very well delineated, slightly lobulated (axial cuts). Its structure is heterogeneous. On T1, it is slightly hyperintense compared to the adjacent muscle (red arrow). It is isointense to fat on proton density images (DP), very hyperintense on T2 and IR with some hypointense areas in its centre. After injection of contrast medium, there is marked enhancement except for the central area, which remains hypointense.

Arteriography: there is hypervascularity of the soft tissues outside the medial tibial plateau by vessels arrising mostly from the genicular arteries.
……
</Description>



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  - QBVE task: find as many relevant images as possible given an initial image

Search tasks

- St. Andrews collection – ad hoc
  - 25 topics: title, narrative and example image
  - Topic title translated into 12 languages

Search tasks

<top>

<num> Number: 2 </num>

<title> 1908 صور لروما أخذت فى أبريل </title>

</top>

<top>

Pictures of Rome taken in April 1908

- Queries modified by photographer/date
- Queries modified by location
- Queries related to specific events
- Queries related to known items
- Queries related to general topics

- Log file analysis
- Librarians
- Previous research (Armitage & Enser)

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- St. Andrews collection – ad hoc
  - 25 topics: title, narrative and example image
  - Topic title translated into 12 languages
- St. Andrews collection – interactive
  - 16 example images (target search)
  - Require 8 users (follows iCLEF methodology)
  - Aim: experiment with methods of query refinement

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  - 25 topics: title, narrative and example image
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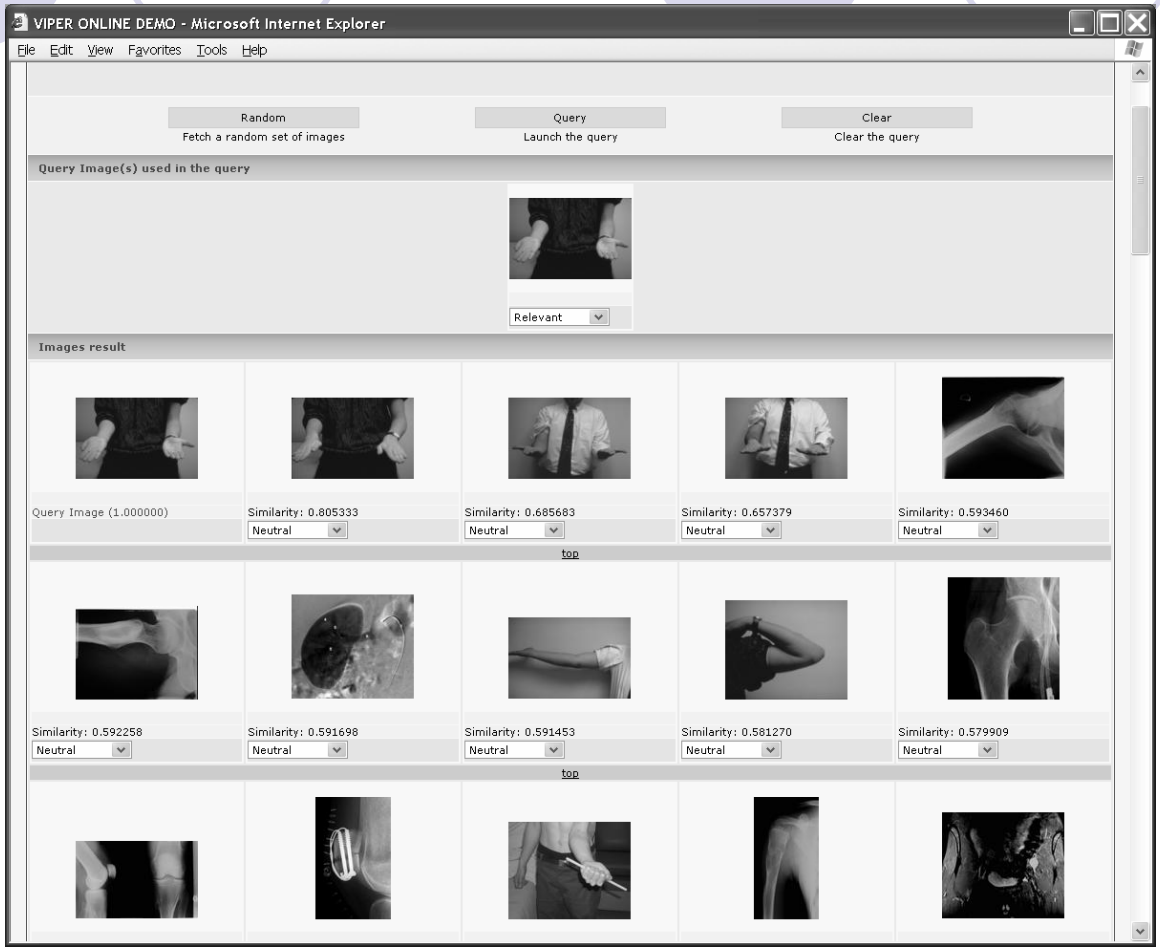
- St. Andrews collection – interactive
  - 16 example images (target search)
  - Require 8 users (follows iCLEF methodology)
  - Aim: experiment with methods of query refinement
- CasImage collection
  - Find visually similar images: *modality (e.g. MRI, x-ray) and anatomic region (e.g. chest, arm)*
  - ~2,100 medical case notes in English and French
  - 26 example images selected by a radiographer

Medical task - example



http://viper.unige.ch/~muellerh/demoCLEFmed/index.php

ImageCLEF 2004 – participation

Group	Country	Med	Ad hoc	Interactive
National Taiwan U.	Taiwan		✓	
I-Shou U.	Taiwan	✓	✓	✓
U. Sheffield	UK		✓	
Dublin City U.	UK		✓	
Imperial College	UK	✓		
U. Montreal	Canada		✓	
U. Oregon	USA	✓		
State U. New York	USA		✓	
Michigan State U.	USA		✓	✓
U. Alicante	Spain	✓	✓	
Daedalus	Spain		✓	
UNED	Spain	✓	✓	
U. Hospital Geneva	Switzerland	✓		
Dept. Med. Informatics, Aachen	Germany	✓	✓	
Dept. CS, Aachen	Germany	✓		
U. Tilberg	Netherlands	✓		
CWI	Netherlands	✓		
Commissariat Energie Automique	France	✓	✓	
TOTAL		**11 (43)**	**12 (190)**	**2**

ImageCLEF 2004 – participation

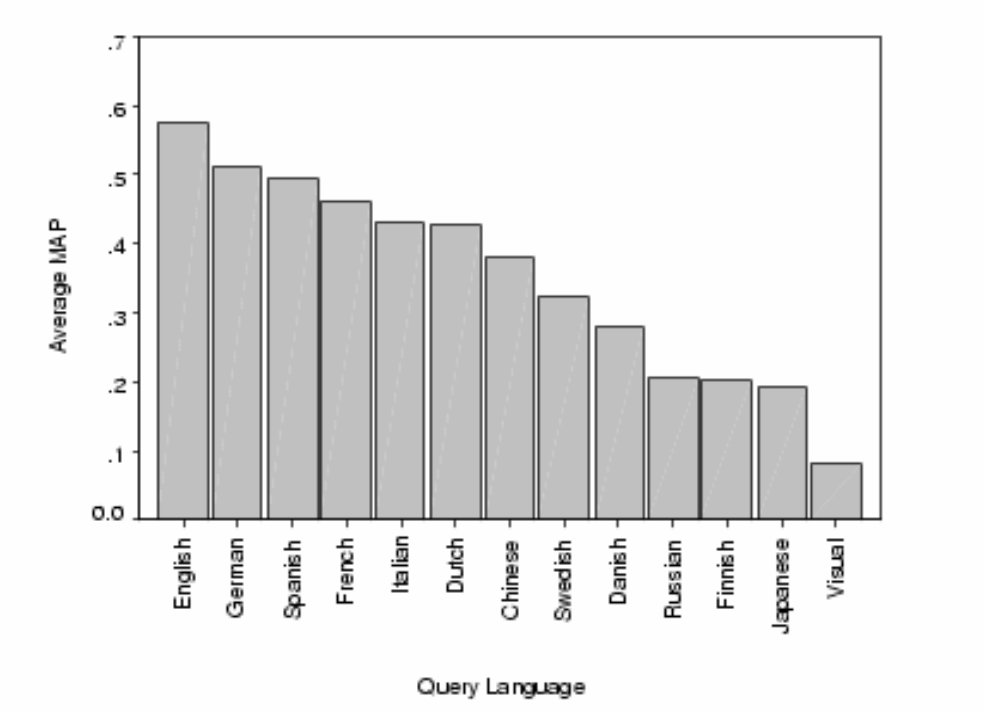
Task	Query dimension	#Runs	%Runs
Ad hoc	Manual	1	1%
	Automatic	189	99%
	With RF	135	71%
	Visual only	6	3%
	Text only	106	56%
	Text + Visual	**78**	**41%**
	Title + Narrative	5	3%
Medical	Manual	9	21%
	Automatic	34	79%
	With RF	13	30%
	Visual only	29	67%
	Text + Visual	**14**	**33%**

ImageCLEF 2004 – participation

Task	Language	#Participants	#Runs
Ad hoc	Spanish	6	41
	English (mono)	9	29
	French	6	23
	German	5	20
	Italian	5	20
	Dutch	3	20
	Chinese	5	18
	Japanese	2	4
	Russian	2	4
	Swedish	2	2
	Finnish	2	2
	Danish	1	1
	Visual only	*2*	*6*

Main results – ad hoc/interactive

- Based on top 5 results averaged across all languages:
  - MAP with QE = 0.4155; without = 0.2805 (t=3.255, p=0.002)
  - MAP text+visual = 0.4508; text only = 0.3787 (t=-2.007, p=0.052)



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  - MAP text+visual = 0.4508; text only = 0.3787 (t=-2.007, p=0.052)
- On average visual retrieval plays marginal role – semantics and background knowledge more important
- Visual retrieval shows improvements for “visual” queries (e.g. “pictures of war memorials in the shape of a cross”)
- Trend: methods of creating structured searches based on caption fields (e.g. identifying named entities)
- Interactive:
  - Visual attributes (e.g. colour) enables users to find required images quicker than without

Main results – medical

- Based on the average across all automatic and manual runs
  - MAP with RF = 0.2678; without = 0.2444 (t=0.859, p=0.397)
  - MAP text+visual = 0.2652; visual only = 0.2586 (t=-0.195, p=0.847)
- State U. New York achieved highest MAP (auto) = 0.3488
- U. Hospital Geneva achieved highest MAP (manual) = 0.4214
- Significant improvements in retrieval effectiveness for individual systems using text+visual and RF
- Main research: visual retrieval (feature extraction and parameter optimisation)

Conclusions

- We have continued to address practical applications of cross-language image retrieval
- ImageCLEF was successful in attracting groups from text, medical and image retrieval
- High participation shows a need for this kind of evaluation
  - Currently there are very few evaluation campaigns for image retrieval
- Promising research in combining text and image retrieval methods (incl. CLIR)
- Henning will discuss future areas of research