I A M @ImageCLEF 2009

Photo Retrieval and Photo Annotation Tasks

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Photo Retrieval

Task

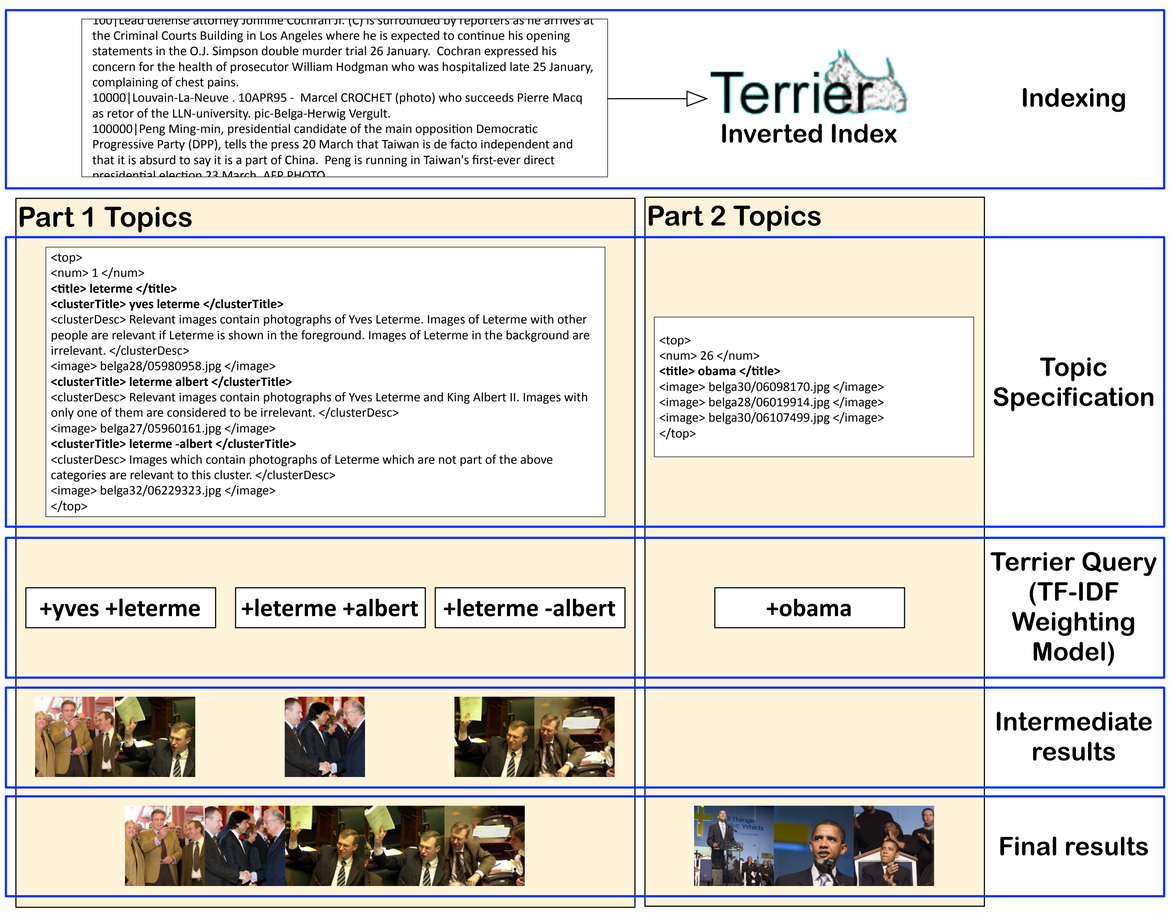
The 2009 **photo retrieval task** aimed to provide further study of the **importance of diversity** in **image search** results. Diversity in search results is often helpful to users who drive their search with **poorly specified** or **ambiguous queries**. Since the search engine cannot know precisely what the user wants, it can increase the probability of finding relevant images by presenting the complete **spectrum of representations** within the query. The task required participants to analyse methods for **increasing diversity** whilst **maintaining high relevance**.

Research Question

Can we use content-based image features to increase image search result diversity?

Baseline Text-based Indexing and Retrieval

Our baseline retrieval system uses Terrier as the underlying platform. The queries from the two parts of the task were handled differently. Terrier was configured to just use standard TF-IDF weighting for the retrieval. Two term-processing pipelines were tested; one with Porter stemming, and another without.



Re-ranking results using visual features

Using visual features extracted from the images, we developed an iterative technique for re-ranking the images based on the idea of maximising the distance between the currently ranked images and the remaining images. This has the effect of forcing highly dissimilar (or diverse) images to the top of the list, and images that are near-duplicates of highly ranked images to the bottom.

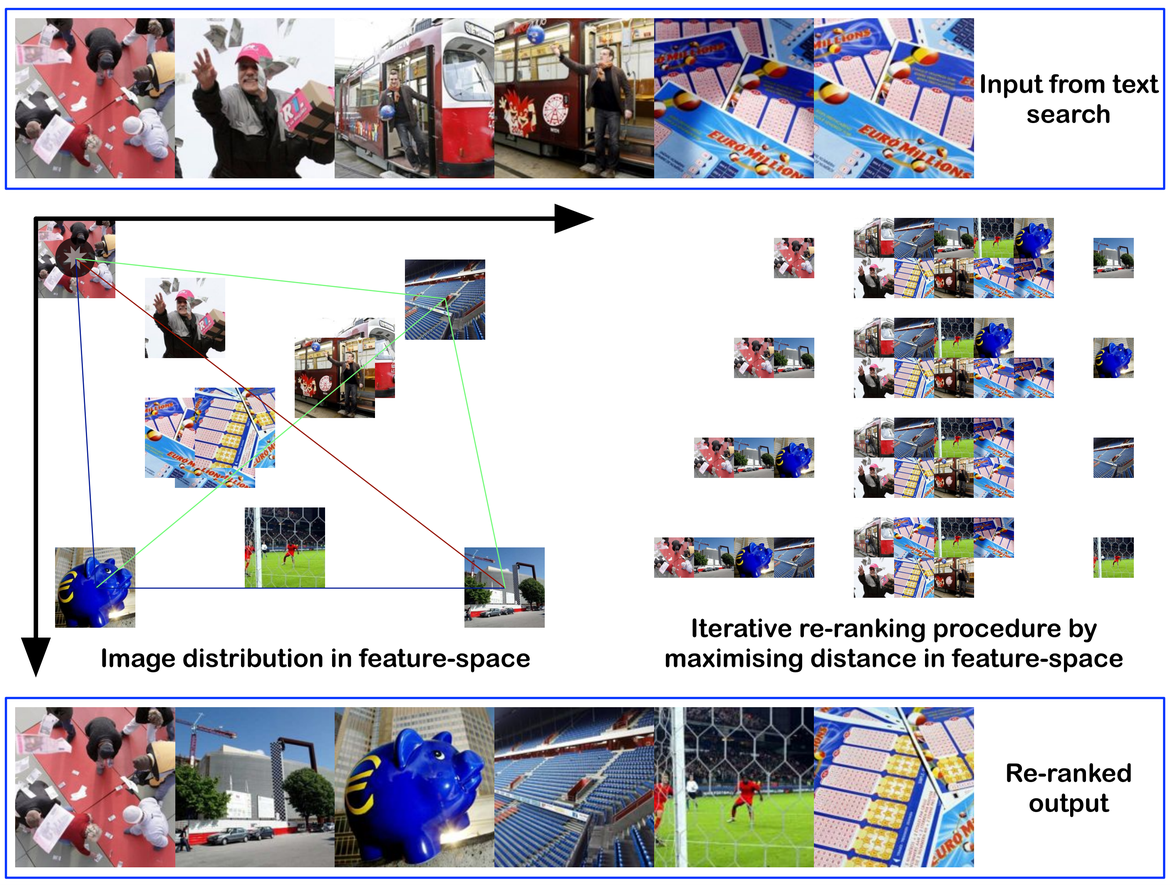


Image Features

We used a **bag-of-visual-terms** feature morphology for both the retrieval and annotation tasks. For the **retrieval task**, we used a multi-scale **difference-of-Gaussian** peak detector for region detection, coupled with the **SIFT** local descriptor and a **3125** term vocabulary. For the **annotation task** we combined **MSER** and **doG** detectors with **SIFT** and **Colour-SIFT** features, using **3125** term vocabularies for each detector/feature combination.

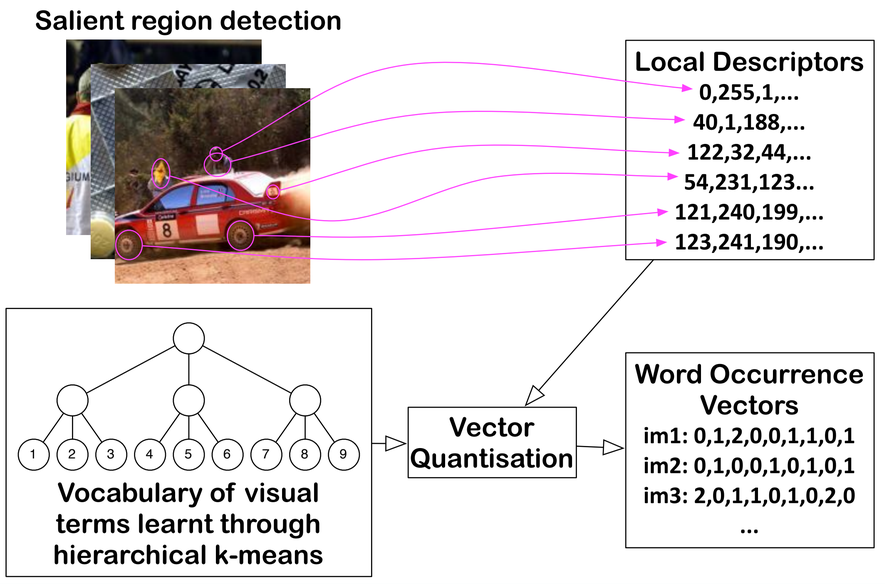


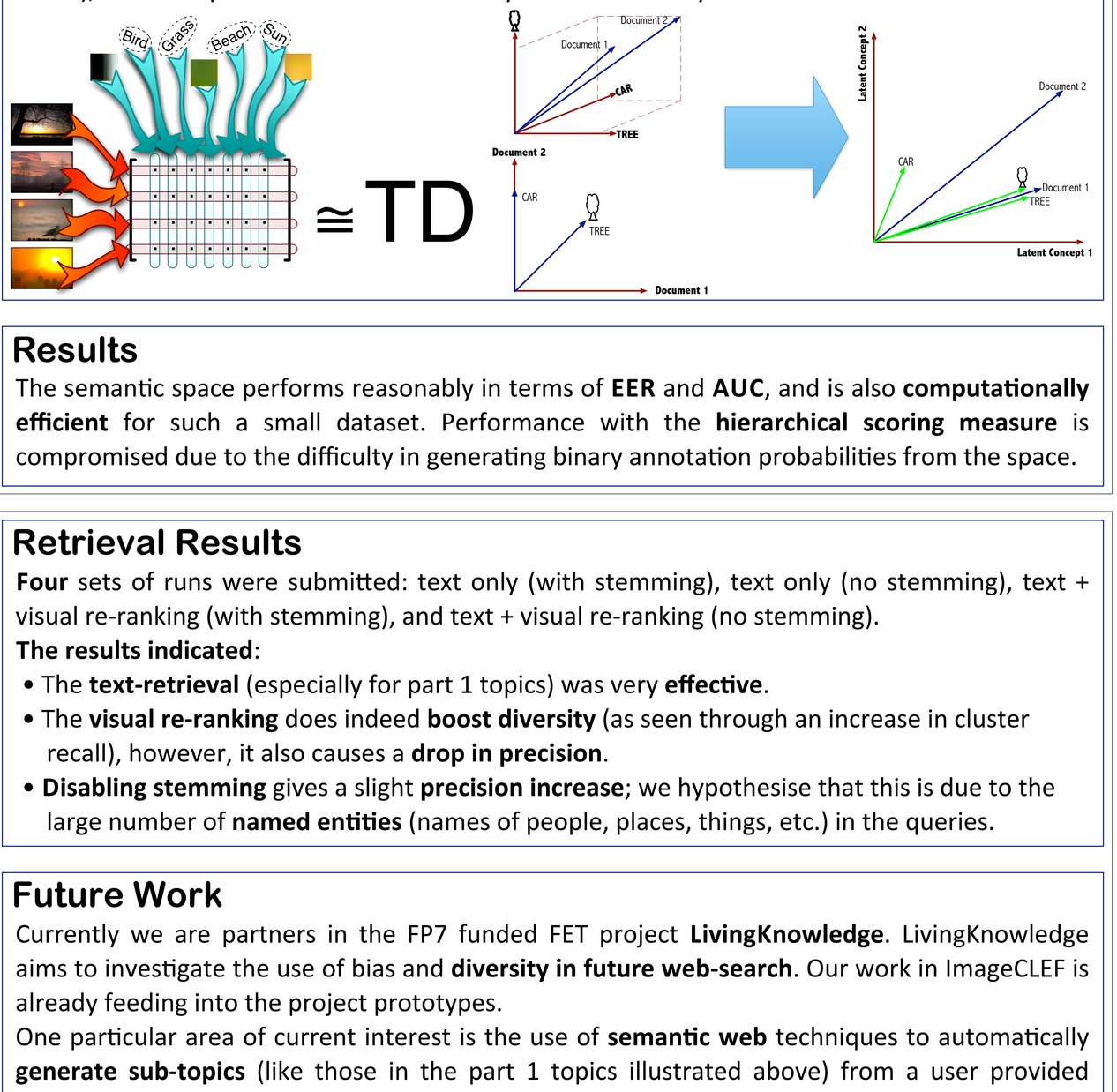
Photo Annotation Task

Task

The 2009 **photo annotation task** aimed to investigate whether the use of a small ontology or hierarchy could be used to improve annotation performance. The task was to annotate **13000 images** with **53 concepts** from the provided hierarchy. **5000 annotated images** were provided for **training**.

Technique

We used an **auto-annotation** tool that we had previously developed. The tool uses a matrix factorisation of a multi-lingual (visual-terms and keywords) term-document matrix to build a **semantic space**. Un-annotated images can be projected into this space (based on their visual-terms), and their placement is such that they occur "**near**" keywords that describe their content.



Results

The semantic space performs reasonably in terms of **EER** and **AUC**, and is also **computationally efficient** for such a small dataset. Performance with the **hierarchical scoring measure** is compromised due to the difficulty in generating binary annotation probabilities from the space.

Retrieval Results

Four sets of runs were submitted: text only (with stemming), text only (no stemming), text + visual re-ranking (with stemming), and text + visual re-ranking (no stemming).

The results indicated:

- The **text-retrieval** (especially for part 1 topics) was very **effective**.
- The **visual re-ranking** does indeed **boost diversity** (as seen through an increase in cluster recall), however, it also causes a **drop in precision**.
- **Disabling stemming** gives a slight **precision increase**; we hypothesise that this is due to the large number of **named entities** (names of people, places, things, etc.) in the queries.

Future Work

Currently we are partners in the FP7 funded FET project **LivingKnowledge**. LivingKnowledge aims to investigate the use of bias and **diversity in future web-search**. Our work in ImageCLEF is already feeding into the project prototypes.

One particular area of current interest is the use of **semantic web** techniques to automatically **generate sub-topics** (like those in the part 1 topics illustrated above) from a user provided **query**.

With respect to our **visual re-ranking** algorithm, the next stage is to **improve** it so that it incorporates information from the original ranking provided by the text search in order to attempt to **reduce the precision loss**.

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