



Guest Editorial

Developments in hardware, storage, connectivity, and sensor technology have introduced large image repositories into daily life. It has been estimated that at the time of writing one quarter of all cameras is a digital one for professionals and families. Apart from substitution of existing use, digital cameras evoke new patterns of use. Digital recording and the Internet meet to create solutions in surveillance, professionals start to officially record part of their routine operations on video, and families start shooting more footage when no film costs are involved. The resulting image repositories are useless if no proper mechanism exist to access the data. Some of the indexing may be done on input, but no meta-data can rule out the interest in finding images from an unpredictable angle. This creates the unusual situation that the data are already being gathered in large volumes while the tools to access are just being considered. So, the young field of content-based retrieval has no lack of urgency.

Content-based image retrieval has posed with exceptional force new research questions in computer vision. Digital repositories easily grow to 1000 or 10,000 images. The large volumes not only require attention for the computational efficiency and integrity of image databases, also the algorithmic robustness is put back on the agenda of computer vision. As the actual vision problem to solve is only posed at the time of query specification, features and similarity measures have to be designed such that they can be changed on-line. Flexibility and generality of vision under unknown sensing conditions are an inevitable component of the computer vision in content-based retrieval. In addition, to combine the search with text and speech, content-based image retrieval requires understanding of the semantics of the image, at least partially. Robustness, computational efficiency, interaction, generality of feature expression under uncontrolled sensing, flexibility of similarity, and partial semantic understanding are some of the new challenges content-based image retrieval poses on computer vision.

Content-based image retrieval also has brought new paradigms (back) to computer vision. Where the emphasis has been on automated computer vision, image retrieval brings user input and feedback back in the computer vision loop. This is not just a matter of effective man-machine interaction, but it also has a much deeper impact by requiring the whole analysis be based on broad and general feature sets with great expressive and discriminatory power, invariant to the accidental conditions influencing the sensing. And, where the emphasis has been on precise segmentation, content-based image retrieval has shown that imperfect or weak segmentation may suffice to find an object. To find scenes with trees, it is not necessary to segment out every tree perfectly. It suffices to find some evidence for the common texture of trees. To a sailboat, an algorithm attributed to Lynda Shapiro proposes to search for a white hole in the water. This may not work well in all cases but serves well to bootstrap a further interaction with the user. As a consequence, context-based, iteratively-interactive, and semantic-cue search are high on the image retrieval agenda.

Given the motivation, given the new context of computer vision, and given the experience-laden solutions from computer vision to content-based image retrieval, we expect that the topic will continue to inspire new directions of research in computer vision. The special issue is a reflection of that state of the art, see also Smeulders et al. (2000) for a review. The special issue covers powerful and invariant feature sets, region-based segmentation, and combining classifiers all essential components to meet the challenge of generality as requested by content-based image retrieval. In addition, the consequence of having interaction in the loop is being discussed together with the possibilities to describe the image content by its semantic meaning. For a proper interplay with the user, also information visualization and navigation are other essential components of image retrieval systems. We believe that these nine papers offer a glimpse into the state of the art in image retrieval.

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Reference

Smeulders, A.W.M., Worring, M., Santini, S., Gupta, A., and Jain, R. 2000. Content-based image retrieval: The end of the early years. *IEEE Trans. PAMI*, 22(12):1349–1380.