

Analysis and Evaluation of Visual Information Systems Performance

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Abstract

This dissertation investigates the system-centred evaluation of visual information retrieval from generic photographic collections.

The development of visual information retrieval systems has long been hindered by the lack of standardised benchmarks. Researchers have proposed numerous systems and techniques, and although different systems clearly have their particular strength, there is a tendency by researchers to use different means of showing retrieval performance to highlight the own algorithm's benefits. For the field of visual information search to advance, however, objective evaluation to identify, compare and validate the strengths and merits of different systems is therefore essential. Benchmarks to carry out such evaluation have recently been developed, and evaluation events have also been organised for several domains. Yet, no efforts have considered the evaluation of retrieval from generic photographic collections (*i.e.* containing everyday real-world photographs akin to those that can frequently be found in private photographic collections as well, *e.g.* pictures of holidays and events).

We therefore first analyse a multitude of variables and factors with respect to the performance and requirements of visual information systems, and we then design and implement the framework and resources necessary to carry out such an evaluation. These resources include: a parametric image collection, representative search requests, relevance assessments and a set of performance measures. In addition, we organise the first evaluation event for retrieval from generic photographic collections and report on its realisation. Finally, we present an analysis and the evaluation of the participating retrieval systems as well as of the evaluation event itself.

Filling this particular gap by making possible a systematic calibration and comparison of system performance for retrieval from generic photographic collections constitutes the main scientific contribution of this research. This dissertation thereby enables a deeper understanding of the complex conditions and constraints associated with visual information identification, the accurate capturing of user requirements, the appropriate specification and complexity of user queries, the execution of searches, and the reliability of performance indicators.

Declaration

“I, Michael Grubinger, declare that the PhD thesis entitled *Analysis and Evaluation of Visual Information Systems Performance* is no more than 100,000 words in length, exclusive of tables, figures, appendices, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work”.

Signature

Date

List of External Publications

Publications in journals and proceedings of peer reviewed conferences and workshops:

- Michael Grubinger, Clement H. C. Leung. A Benchmark for Performance Calibration in Visual Information Search. In *Proceedings of The 2003 International Conference on Visual Information Systems (VIS'2003)*, pages 414–419, Miami, FL, USA, September 2003. Knowledge Systems Institute.
- Paul Over, Clement H. C. Leung, Horace Ip, Michael Grubinger. Multimedia Retrieval Benchmarks. *Digital Multimedia on Demand, IEEE Multimedia April-June 2004*, pages 80–84, 2004.
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- Michael Grubinger, Paul D. Clough, Henning Müller, Thomas Deselaers. The IAPR TC-12 Benchmark - A New Evaluation Resource for Visual Information Systems. In *The Proceedings of the International Workshop OntoImage'2006*

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- Michael Grubinger, Paul D. Clough, Clement H. C. Leung. The IAPR TC-12 Benchmark for Visual Information Search. *IAPR Newsletter April 2006*, Volume 28, Number 2, pages 10–12, 2006.
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- Michael Grubinger. Benchmarking for Content Based Visual Information Search. *SCM6102 Research Project Report*, School of Computer Science and Mathematics, Victoria University of Technology, Melbourne, Australia, November 2002.
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- Michael Grubinger, Clement H. C. Leung, Paul D. Clough. Towards a Topic Complexity Measure for Cross-Language Image Retrieval. In *CLEF Working Notes*, Vienna, Austria, September 2005.
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