DOCTORAL THESIS

Semantic image similarity based on deep knowledge for effective image retrieval

Li, Yuanxi

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Abstract

A flourishing World Wide Web dramatically increases the amount of images uploaded and shared, and exploring them is an interesting and challenging task. While content-based image retrieval, which is based on the low level features extracted from images, has grown relatively mature, human users are more interested in the semantic concepts behind or inside the images. Search that is based solely on the low level features would not be able to satisfy users requirements and not effective enough. In order to measure the semantic similarity among images and increase the accuracy of Web image retrieval, it is necessary to dig the deep concept and semantic meaning of the image as well as to overcome the semantic gap.

By exploiting the context of Web images, knowledge base and ontology-based similarities, through the analysis of user behavior of image similarity evaluation, we established a set of formulas which allows efficient and accurate semantic similarity measurement of images. When jointly applied with ontology-based query expansion approaches and an adaptive image search engine for deep knowledge indexing, they are able to produce a new level of meaningful automatic image annotation, from which semantic image search may be performed. Besides, the semantic concept can be automatically enriched in MPEG-7 Structured Image Annotation approach.

The system is evaluated quantitatively using more than thousands of Web images with associated human tags with user subjective test. Experimental results indicate that this approach is able to deliver highly competent performance, attaining good

precision efficiency. This approach enables an advanced degree of semantic richness to be automatically associated with images and efficient image concept similarity measurement which could previously only be performed manually.

Keywords: Image Index, Image Retrieval, Semantic Similarity, Relevance Feedback, Knowledge Base, Ontology, Query Expansion, MPEG-7 ...

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