

Original Research Paper

SEVQER: Automatic Semantic Visual Query Builder to Support Intelligent Image Search in Traffic Images

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Abstract: Image search is a challenging process in the field of Content Based Image Retrieval (CBIR). Image search-by-example, search-by-keyword and search-by-sketch methods seldom provide user interface that allows user to accurately formulate their search intent easily. To overcome such issue, a novel image search interface-Semantic Visual Query Builder (SeVQer) is proposed as a non-verbal interface which allows user to drag and drop from the image data provided to formulate user query. The drag and drop mechanism minimizes the difficulty of verbalizing query image into keywords or sketching a correct drawing of the query image. SeVQer was implemented and compared with 3 image search methods (search-by-example, search-by-keyword and search-by-sketch) in terms of task completion time and user satisfaction using traffic images. SeVQer achieved statistically significant lower task completion time with an average of 28 sec, a promising 50% reduction than search-by-sketch (average of 56 sec). The significance of this work is two-fold: the SeVQer user interface allows user to easily formulate intent specific query, while the novel architecture and methodology reduces the semantic gap in general.

Keywords: Intention Gap, Semantic Visual Query, Image Search Interface, Semantic-Based Image Retrieval

Introduction

Image retrieval is a very active research area with two main challenges - semantic gap and intention gap. The semantic gap is an interpretation inconsistency between low level visual features and high-level semantics (Wang *et al.*, 2006; Smeulders *et al.*, 2000) while intention gap is the gap between the users' search intents and the corresponding search queries (Zha *et al.*, 2010; Cox *et al.*, 2000) as illustrated in Fig. 1. The intention gap is the subset of semantic gap and is associated to the design of user interface of an image search system that allows users to effectively express their search intent. However, researches done on user interface design and support for CBIR systems (Pečenović *et al.*, 2000; Santini and Jain, 2000; Nakazato *et al.*, 2003) are scarce.

Different users perceived and understood an image differently (Yoon, 2011), making understanding the user

context for image searching process an essential step in designing an image retrieval system (Choi, 2010). In attempts to minimize the semantic gap between the users and image retrieval systems (Gudivada and Raghavan, 1995), query mechanism plays a vital role. A search query is commonly used by a user to express his or her search intent and information needs to retrieve images from image database that fit his or her perception. The submitted user queries affected directly the image search results and accuracy (Croft and Thompson, 1987). One of the major challenges is the utilization of semantic meaning and representation in user search queries in order to accurately describe the intention of the user search queries as well as the search domain (Hu *et al.*, 2009).

The query formulation problem is where user can imagine what they desire but is unable to properly formulate or translate their information needs