Chapter 7
Robust Duplicate Detection of 2D and 3D Objects

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ABSTRACT

In this paper, the authors analyze their graph-based approach for 2D and 3D object duplicate detection in still images. A graph model is used to represent the 3D spatial information of the object based on the features extracted from training images to avoid explicit and complex 3D object modeling. Therefore, improved performance can be achieved in comparison to existing methods in terms of both robustness and computational complexity. Different limitations of this approach are analyzed by evaluating performance with respect to the number of training images and calculation of optimal parameters in a number of applications. Furthermore, effectiveness of object duplicate detection algorithm is measured over different object classes. The authors' method is shown to be robust in detecting the same objects even when images with objects are taken from different viewpoints or distances.

INTRODUCTION

With the technological evolution of digital acquisition and storage technologies, millions of images and video sequences are captured every day and shared in online services such as Facebook, Flickr, and Picasa. As keyword-based indexing is very time consuming and inefficient due to linguistic and semantic ambiguities, content-based image and video retrieval systems have been proposed (Vajda, Dufaux, Minh, & Ebrahimi, 2009), which search and retrieve documents based on visual features. Within such systems, a query document is compared to all the documents in the database by making use of content-based features extracted from it. However, since the features are extracted from images which contain two-dimensional projections of three-dimensional scenes, the features may change significantly depending on the view point. Thus, systems often fail to retrieve relevant content in response to some queries.

In general, content-based image retrieval can utilize different representations for describing the image content, including global descriptors, feature points, or regions. Recently, interest has turned towards higher-level representations such as objects. Given a query image containing an object, an image retrieval system can perform two tasks: object recognition or object duplicate detection. Object recognition aims at finding all the instances of a certain object class (such as cars, or shoes), while object duplicate detection represents a more specific task of finding only a particular sample of that object class (such as "red Citroen C3 car" or "white Converse sneakers"). Figure 1 illustrates the relationship between object duplicate detection and object recognition problems. Therefore, within a complete system object recognition is usually applied first to detect a relevant class of objects (e.g., faces, cars) and then object duplicate detection is used to find a specific instance of that object class. Our object

Figure 1. Illustration of relationship between object recognition and object duplicate detection. While the former groups objects into different classes such as cars and shoes, the latter distinguishes between specific shoes or cars
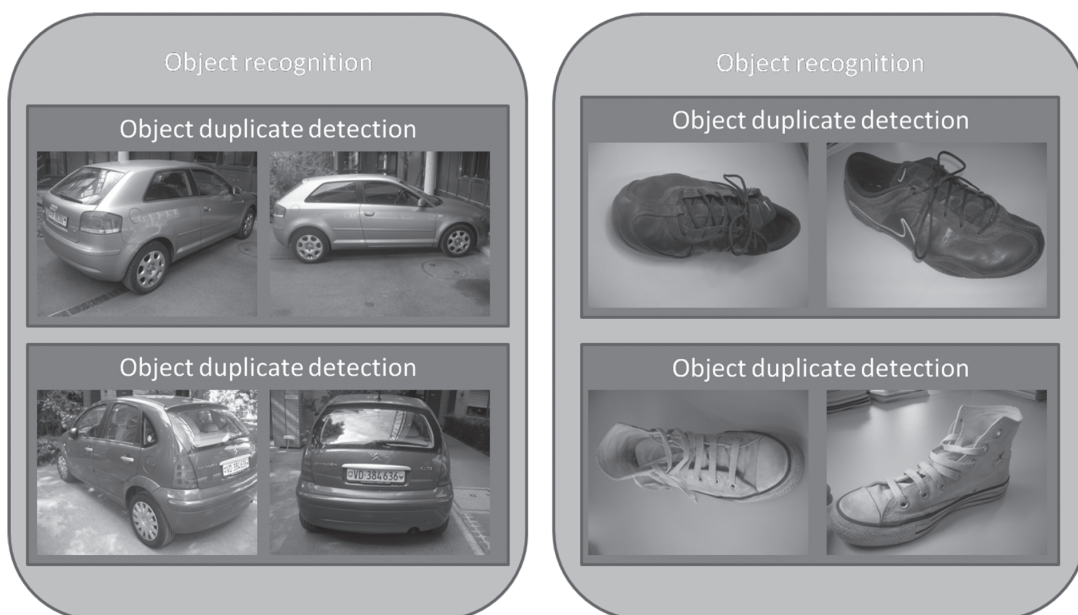
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