Object Retrieving from Image Database

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Abstract: The objective of this study is to develop a system that can retrieval objects from large image database. We propose a novel method for generic object detecting. The main advantages of this method are that it is simple, computationally efficient and bases on features that is easily seen by naked-eye.

1. Introduction

Although different solution for object detection have been developed, but it is now still a difficult problem. Almost these approaches based on features which with human eyes it is difficult to see. In our method, we base on features that is easily seen by naked-eye and very close with natural detecting by human. When an artist draw an object, he outlines some basic lines. These lines meet each other at specific points. This arrangement makes it is easy to recognize what the object is. From this, we propose an approach for detecting object base on edge, corner.

2. Object Detection Based on Multi Features

1.1 Edge, Corner and HoG Feature

It is easy to see that the most important features for recognition object are the overall shape of that object and all boundaries. Shape or boundary is basically composed by *edges*. These edges are arranged in an specific order and meet each other at some points called *corners*.

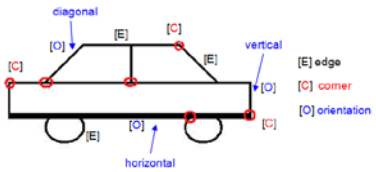

Fig. 1. *Three main components make object be figured.*

Beside, edge orientation also play an prominent role for figuring object. With the same number of edges, a talent artist can organize in different order and different orientation to make viewer imagine different objects. Fig. 1 describes how these principal components make object imagination. Based on this, we propose an approach for object detecting which focuses on edge, corner and edge orientation

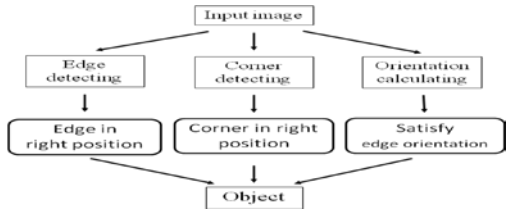

Fig. 2. *Object detecting based on edge, corner and edge orientation.*

In order to know whether edge/corner is at right position or not, we should point out the place where edge/corner must belong to before detecting object. The position of edge/corner is called *edge map/corner map*. To make edge map and corner map, we use same method as Zhenfeng Zhu *et al* in [1].

Fig. 3. *Making edge map and corner map from training set.*

1.2 SURF Feature

After a candidate satisfies edge map, corner map and orientation, we pass that candidate to SURF[2] checking stage. We choose SURF because it is invariant with scale, illumination, and similar but faster than SIFT.

Fig. 4. *Making vocabulary for matching SURF feature.*

We choose BoF method for matching between two set of SURF descriptors. Bag of features are made by quantizing all descriptors from training image set to K bins. Once descriptors have been assigned to form feature vectors, we use Naïve Bayes classifier to determine whether an input image belongs to one category or not.

$$P(C_j \mid I) \quad \alpha \quad P(C_j)P(I \mid C_j) = P(C_j)\prod_{t=1}^{k} N^{(t,I)}P(v_t \mid C_j) \quad (2)$$

3. Experimental Results and Evaluation

Our proposed scheme is evaluated on five object-categories: front/rear car, side car, bicycle, train and airplane. We use both CALTECH and UIUC image database. Beside we also get object image from the officcial website of PASCAL 2009.

Fig. 5. *Example of areoplane detection result*

We test seperately with only CEH (corner, edge, HoG), only SURF and combination. The final result average precision (AV), average recall (AR) is shown in table 1.

Object	ECH		SURF		ECH+SURF	
	AP	AR	AP	AR	AP	AR
F/r car	97.4%	89.7%				
Side car	95.8%	92.4%				
Bike	83.8%	72.7%	69.1%	88.7%	76.8%	70.7%
Train	76.3%	75.8%	71.9%	72.1%	84.1%	74.1%
Plane	79.8%	80.9%	80.4%	88.2%	85.6%	87.6%

Table 1*. Comparison between ECH, SURF and combination*

Reference

[1] Zhenfeng Zhu., J. Uchimura, "Car detection based on multi-cues integration," *ICPR04*, Cambridge, UK, Aug. 2004.

[2] H. Bay, T. Tuytelaars, and L. V. Gool, "Surf: Speeded up robust features," *ECCV06*, Graz, Austria, May 2006.

[3] H. Harzallah, F. Jurie, C. Schmid, "Combining efficient object localization and image classification," *ICCV09*, Kyoto, Japan, Sep. 2009.