Fast and Robust Circular Object Detection with Probabilistic Pairwise Voting (PPV)

supplementary material

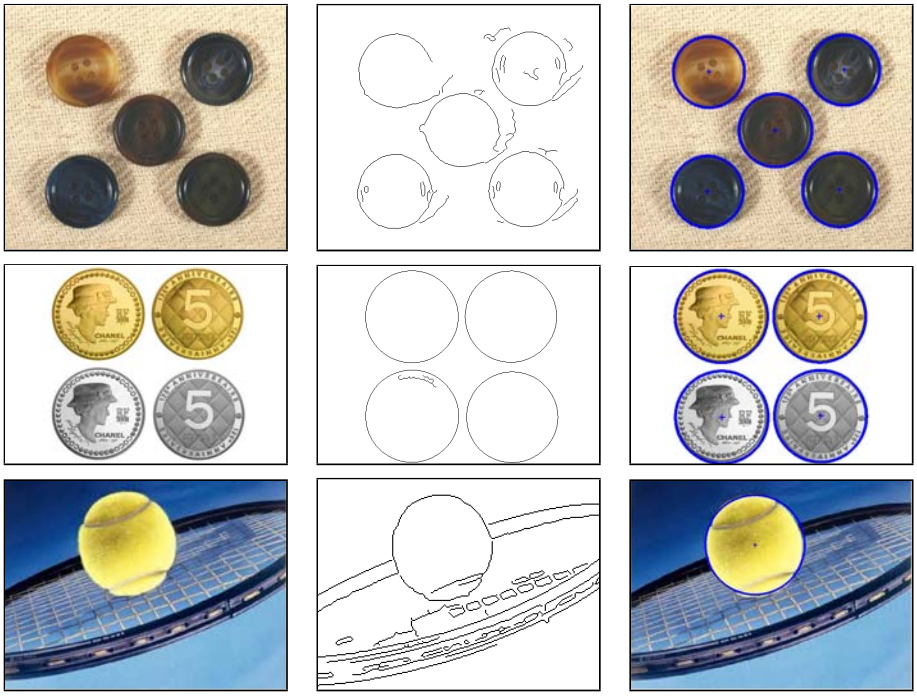
This supplementary material shows more results that could not be fitted into the main paper due to the space limitation. The experiment result includes two parts: (1) detecting circular objects in natural images and (2) localizing iris in face images.

A. Detecting Circular Objects in Natural Images

This experiment demonstrates the validity of our proposed algorithm on more real-world images, which were collected from Google Image. Each image includes one or multiple circular objects (*e.g.*, ball, coin, cell, button). For each image, we use Canny operator to get the edge map and then proceed probabilistic pairwise voting on a subset of these edge points after sampling. Fig. 1, Fig. 2 and Fig. 3 show the detecting results, which includes: (a) the input images, (b) the edge maps, and (c) the detection results of our method.

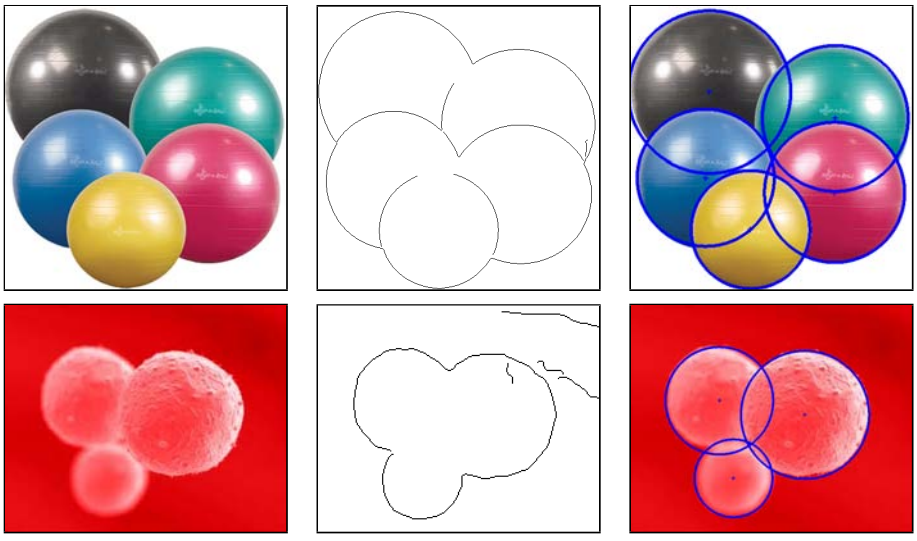
B. Localizing iris in Face Images

This experiment shows more results of iris localization on face images. All face images are from CMU MultiPIE face database. For many of the selected images, the subjects wear eye glasses (some with reflections). It is a relatively hard case for iris localization. We show the successful localization results in Fig. 4 and Fig. 5 and some failed results in Fig. 6.



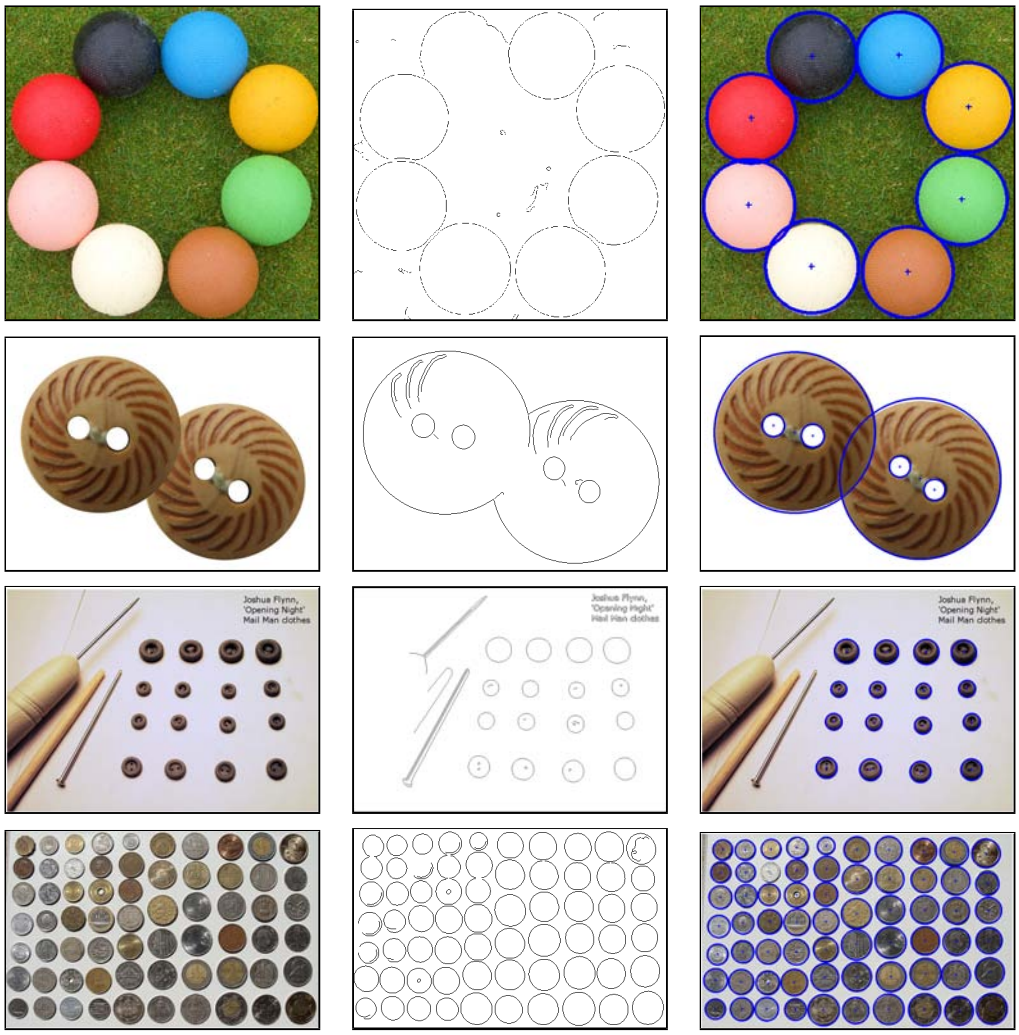
(a) (b) (c)

Fig. 1. Simple examples of detecting circular objects: (a) input images, (b) edge maps, and (c) detection results of our method. The sizes of the four input images are 425×496, 380×540, 175×288, and 194×259. The time costs for them are 2.95s, 0.80s, 1.69s and 1.14s.



(a) (b) (c)

Fig. 2. Results of detecting partially occluded circular objects: (a) input images, (b) edge maps, and (c) detection results of our method. The sizes of the two input images are 459×458 and 201×251. The time costs for them are 1.36s and 0.29s.



(a) (b) (c)

Fig. 3. Results of detecting various multiple circular objects: (a) input images, (b) edge maps, (c) detection results of our method. The sizes of the four input images are 697×700, 394×525, 651×910, and 313×500. The time costs for them are 2.31s, 2.10s, 2.32s and 26.46s.

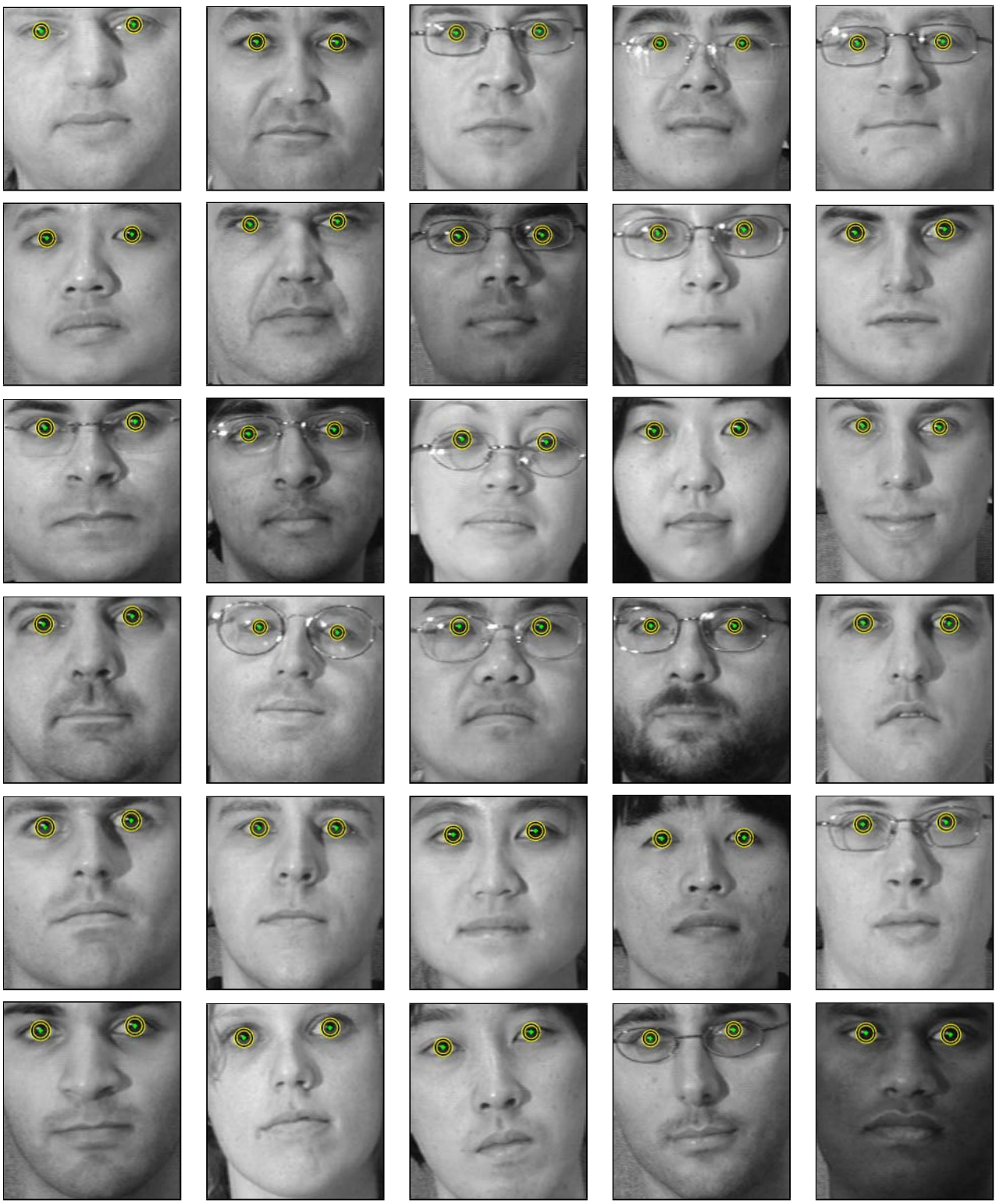


Fig. 4. Successful results of iris localization on CMU MultiPIE database.

Fig. 5. Successful results of iris localization on CMU MultiPIE database.

Fig. 6. Failed results of iris localization on CMU MultiPIE database.