Computer Vision Project 2 Report

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PART 1: Wink Detection

1 Method

I improved the detection by limiting the locations and number of eyes and by calculating the similarity between two eyes. Detailed are described as below:

(1) Limitation of eye location

I first detected the eyes and calculated the center of eyes. Then I classify the eyes by their relative locations on faces into three categories: eyes on upper left face, eyes on upper right face, and eyes on lower face. As the eyes are impossible to be on lower face, I treated them as wrong ones.

(2) Limitation of eye number

Because only one eye can be detected on left or right face, I take the largest eye as the real eyes. In this case, each face could only have one or zero eye on either left or right face.

(3) Similarities

For a winked face, the eyes should be very different. So if two eyes are detected, I calculated the similarities between two eyes. If the two eyes are quite different, I considered the face as a winked face. If only one eye is detected, I also treat the face as a winked face because the winked eye is very different from the open eye.

2 Performances

(1) Folder of images

Detection result:

No. pic	1	2	3	4	5	6	7	8
True	1	1	1	0	1	1	0	1

Original	0	1	1	0	0	0	0	1
After	1	1	1	0	0	1	1	1

No.pic	9	10	11	12	13	14	15	16
True	1	0	0	1	1	1	1	0
Original	1	0	0	1	0	1	0	1
After	1	0	0	1	1	1	0	0

No.pic	17	18	19	20	21	22	23	24
True	1	1	1	1	2	2	1	1
Original	1	0	1	0	1	1	1	0
After	1	0	1	1	0	2	1	1

The original method detects 10 corrected winked faces and one wrong face out of 21 faces. My method can detect 16 corrected winked faces and one wrong face. Apparently, the accuracy improves from 47.6% to 76.2%.

From the results, my method still is unable to detect winked faces that both eyes are slighted winked (Figure1. left). I think the reason is the similarity is too high if both eyes are winked a little bit. My method also makes mistakes when detecting faces with blurred eyes (Figure1. right). The painting blurs the region of eyes, which causes incorrect low similarity.

Figure 1. Images that are detected wrong with program 1. Big circles are faces and small circles are possible eyes.

(2) Live video
The original method will detect a lot of possible eyes. Sometimes it will mistakenly treat noses as eyes. My method will detect eyes correctly and detect winked eyes better.

PART 2: Silence Detection

1 Method

I improved the detection by limiting the number of mouth and including the finger detection. Details are described as below:
(1) Limiting mouth number
As only one mouth can be detected on one face, I consider the largest one as the real mouth.
(2) Finger detection

For shush gesture, one finger should be detected on the mouth. So I add the finger detection into this program. I only consider the finger near the center of the face (1/4 to 3/4 of face).

2 Performances

(1) Folder of images

Detection result:

No. pic	1	2	3	4	5	6	7
True	0	0	0	1	0	1	1
Original	0	0	1	1	0	1	0
After	0	0	0	1	1	1	1

No. pic	8	9	10	11	12	13	14
True	0	0	0	0	0	1	1
Original	1	1	0	0	0	1	1
After	0	0	0	0	0	1	0

No. pic	15	16	17	18	19	20	21
True	1	1	2	0	2	1	0
Original	0	0	1	0	1	0	0
After	1	0	1	0	1	0	0

The original method detects 6 corrected shush and 3 wrong ones out of 12 shush faces. My method detects 7 corrected shush and 1 wrong one. Apparently, my method significantly reduces the error rate.

From the performance, my method is unable to detect inclined finger (Figure2. left), which leads to missing shush. My method also sometimes detect the shush mouth when the mouth is relatively big (Figure2. right).

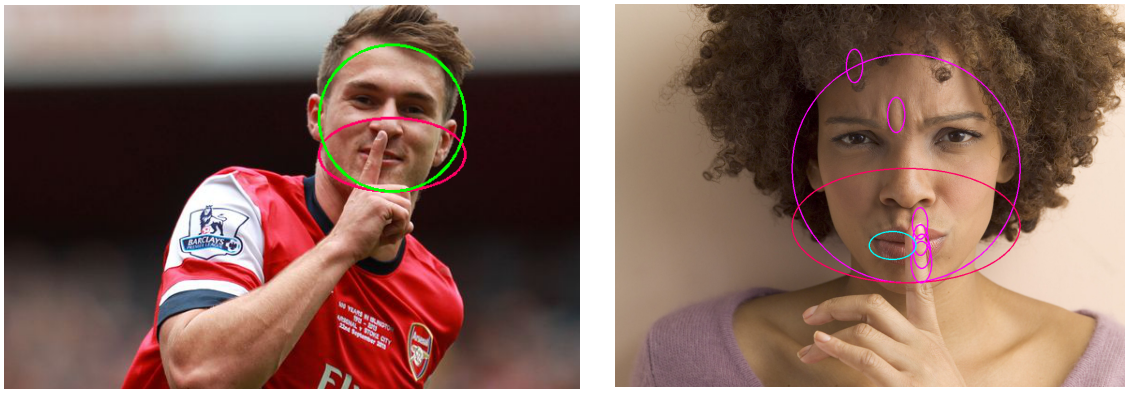

Figure 2. Images that are detected wrong with program 2. Big circles are faces and big eclipses are lower faces. Small circles are mouth or fingers.

(2) Live video

The original method will detect a lot of possible mouths. Sometimes it will mistakenly treat noses as mouth. My method will detect shush better.