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CSE 455

Project 4 Write up

**Testing recognition with cropped class images:**

Eigenfaces:

eigen_face_0.jpg eigen_face_1.jpg eigen_face_2.jpg eigen_face_3.jpg eigen_face_4.jpg eigen_face_5.jpg eigen_face_6.jpg eigen_face_7.jpg eigen_face_8.jpg eigen_face_9.jpg

0 1 2 3 4 5 6 7 8 9

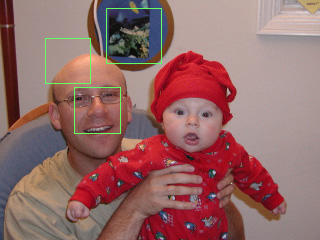
Average Face:

average_face.jpg

1. The trend I see is that the more eigenfaces one uses, the better the likelihood of good recognition results up to a certain point. With 12 eigenfaces, there are 15/24 correct recognitions. Beyond that, the success is capped at 14/24 recognitions. There isn’t a clear answer of how many eigenfaces to use, but for this data set, it looks like using 9 or more give about as good of results as it can. In general you’d want to use as few eigenfaces as possible because the more there are, the longer the calculations will take.
2. Two common mistakes were matching nonsmiling/20.tga: nonsmiling_20.jpg with smiling/2.tga: smiling_02.jpg and nonsmiling/11.tga: nonsmiling_11.jpg with smiling/4.tga: smiling_04.jpg. I think these mistakes are reasonable because in both cases, the two faces are oriented in approximately the same directions. Thus the features are in about the same places. In the case of smiling/02.tga, nonsmiling/02.tga only placed 11th in the results for 10 eigenfaces and placed 13th in the results for 11 eigenfaces. In the case of smiling/04.tga, nonsmiling/04.tga came in 3rd for both 10 and 11 eigenfaces, so this was much closer.

**Cropping and Finding Faces:**

1. Elf.tga:



Elf.tga with top three “faces” marked

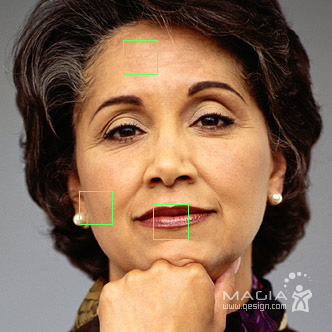
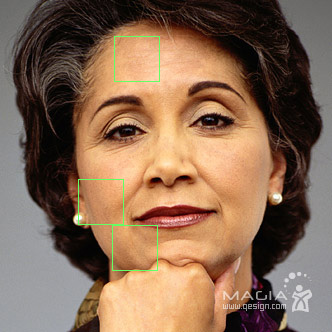
crop_elf.jpg

Cropped face.

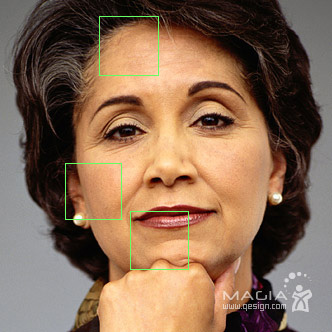
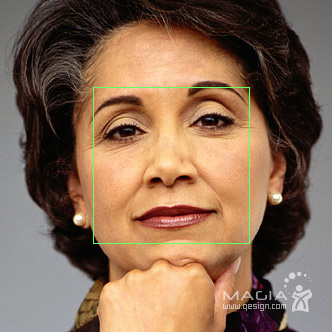
My cropping worked at the scale suggested (0.45-0.55, step =0.01).

1. Picture from the web:

For this image, I tried 3 runs, one with scale factors 0.55-0.75, step = 0.01; one with scale factors 0.45-0.55, step=0.01; one with scale factors 0.05-0.25, step = 0.01. This last run with the smallest scale factors was the most successful. I then used these scales to crop the image. \*Note, these images have been scaled within Word to fit in the document.\*

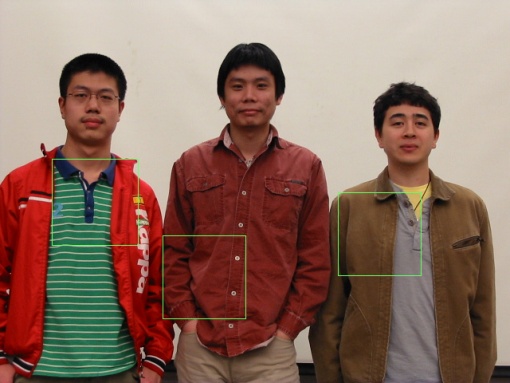
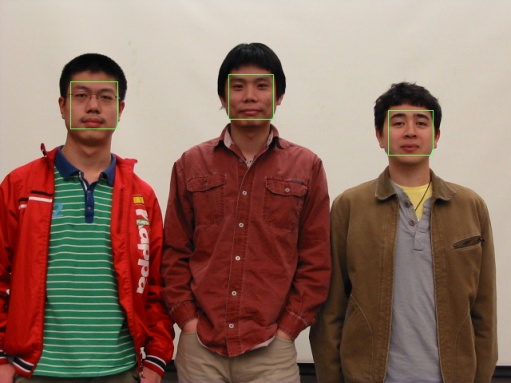
Original woman.jpg Scales: 0.55-0.75, step =0.01 Scales: 0.45-0.55, step =0.01

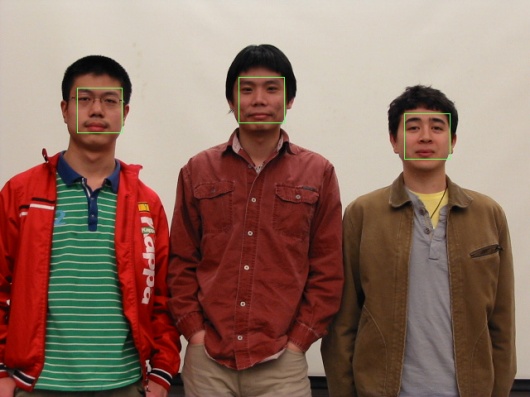
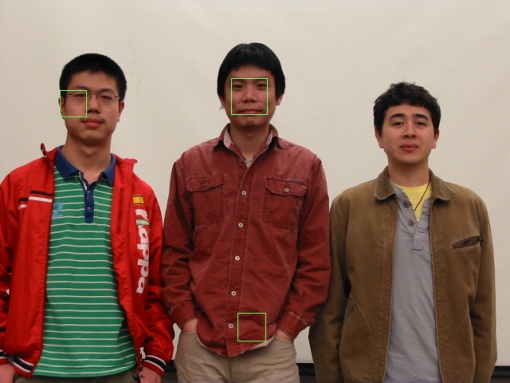
Scales: 0.25-0.45, step=0.01 Scales: 0.05-0.25, step=0.01 Cropped Face

On the tests with the three larger scales, I found a similar three false positives. Since I did get a true positive for a different scale, I attribute these mistakes to a poor scale choice. The face in the image was at too different a scale from the eigenfaces that a match could not be detected.

1. Nonsmiling face: IMG\_0003.tga (note: images scaled here in word to fit on the page)

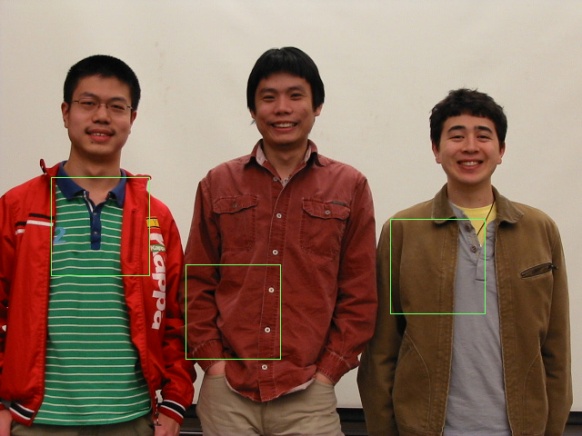
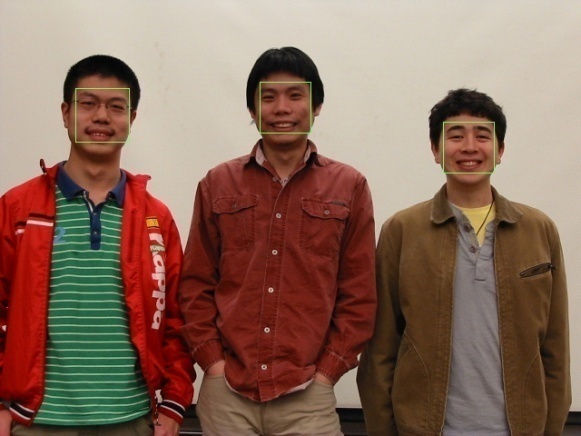
Scale: 0.05-0.25, 0.01 Scale 0.25-0.45, 0.01

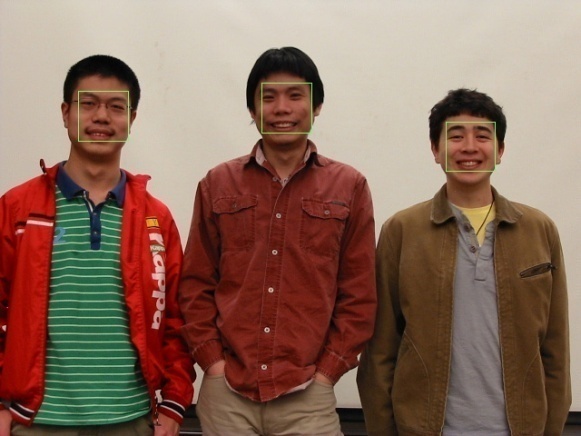
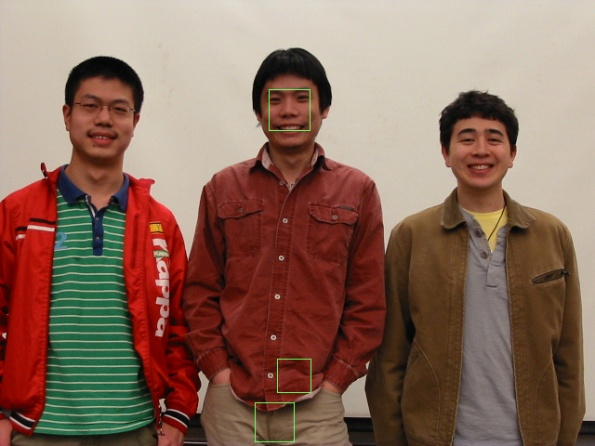
Scale: 0.45-0.55, 0.01 Scale: 0.55-0.65, 0.01

Since correct faces were found at certain scales, I believe all errors in this set are due to using the wrong scales.

1. Smiling face: IMG\_0004.tga (note: images scaled here in word to fit on the page)

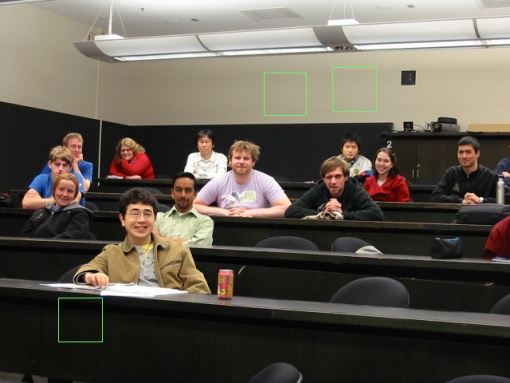
Scale: 0.05-0.25, 0.01 Scale 0.25-0.45, 0.01

Scale: 0.45-0.55, 0.01 Scale: 0.55-0.65, 0.01

Since correct faces were found at certain scales, I believe all errors in this set are due to using the wrong scales.

1. IMG\_0002.tga (note: images scaled here in word to fit on the page)

Scale: 0.05-0.35, 0.01 Scale: 0.45-0.55, 0.01



Scale: 0.80-1.0, 0.1



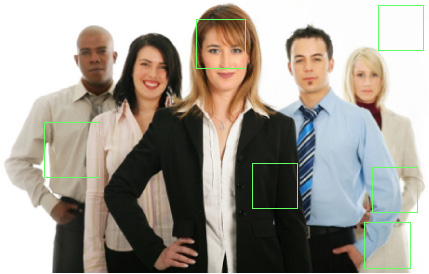
Scale: 1.3

I think errors in this set of pictures are due both to not using correct scaling in all the photos. Also, the faces are at different orientations to the camera, so this will look different than the eigenfaces.

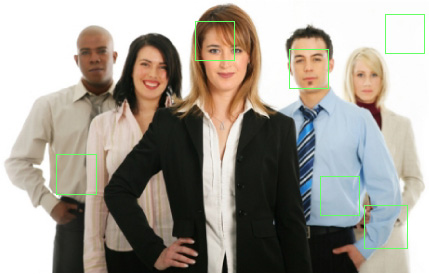
1. Group of people from the web (Scaled in Word to fit here)



Scale: 0.15-0.35, 0.01



Scale: 0.45-0.55, 0.01



Scale: 0.55-0.65, 0.01

On these pictures, errors arose due to differences of scales.

**Verify face**

1. I ran each smiling face against a different face for thresholds 1000, 2000, 3000, 4000, …, 1800. Each time, it correctly said that the face is not the same as the user.
2. For thresholds 8000, 9000, 9500, 10000 I ran 10 of the smiley faces against themselves. (I’m sorry I ran out of time to complete this.) At 8000 and 9000 I got 0/10 correct. At 9500 I got 1/10 correct, and at 10000 I got 3/10 correct. From this, I know that the correct threshold is above 10000. I would say perhaps 12000.