Computer Vision
Fall 2023
Problem Set #6

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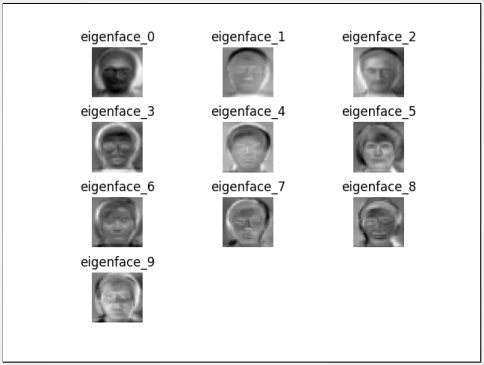
1a: Average face

ps6-1-a-1

1b: Eigenvectors



ps6-1-b-1

1c: Analysis

Analyze the accuracy results over multiple iterations. Do these "predictions" perform better than randomly selecting a label between 1 and 15? Are there any changes in accuracy if you try low values of k? How about high values? Does this algorithm improve changing the split percentage p?

when I loop it between 1 to 15, then predictions is better than the randomly selecting in same k. The accuracy is getting lower if I decrease the k and accuracy is increase when the k get higher, but it would be stay at 77.11 present start from k=70 when I use the k=[10, 20, 30, 40, 50, 60, 70, 80, 90, 100]. Accuracy is improve when change the p because when I change it from 0.1 to 0.9 and getting the result like: [0.4295, 0.5076, 0.6034, 0.6061, 0.5301, 0.5606, 0.5800, 0.5758, 0.7647]

2a: Average accuracy

Report the average accuracy over 5 iterations. In each iteration, load and split the dataset, instantiate a Boosting object and obtain its accuracy.

The accuracy for 5 iterations on Boosting:
(Boosting) Training accuracy1 75.74%
(Boosting) Training accuracy2 70.30%
(Boosting) Training accuracy3 86.98%
(Boosting) Training accuracy4 86.75%

(Boosting) Training accuracy5 97.87%

2a: Analysis

Analyze your results. How do the Random, Weak Classifier, and Boosting perform? Is there any improvement when using Boosting?

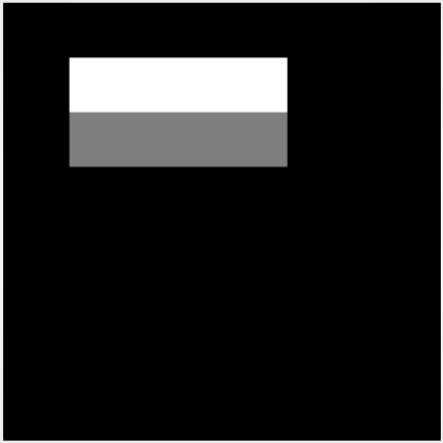
How do your results change when selecting different values for num_iterations? Does it matter the percentage of data you select for

training and testing (explain your answers showing how each accuracy changes).

The accuracy for Boosting is the best After compare the accuracy for Random, Weak Classifier and Boosting with iteration 5. The Boosting's accuracy much better than Random and Weak classifier. The accuracy will be change if change the iteration.
(Random) Training accuracy: 51.00%
(Weak) Training accuracy 74.97%
(Boosting) Training accuracy1 75.08%
(Boosting) Training accuracy2 73.29%
(Boosting) Training accuracy3 86.44%
(Boosting) Training accuracy4 82.65%
(Boosting) Training accuracy5 93.59%
Base on the above result, we can say that the Bossting is better than the Random with any iteration and there is 1 accuracy below the Weak, but the Boosting is greater than both in general.
The accuracy will be get higher if we increase the p and the testing accuracy will be getting lower. p=0.8:
Training accuracy for 5: 92.78%
Testing accuracy: 24.02%
p=0.9:
Training accuracy for 5: 93.59%

Testing accuracy: 10.41%

3a: Haar Features

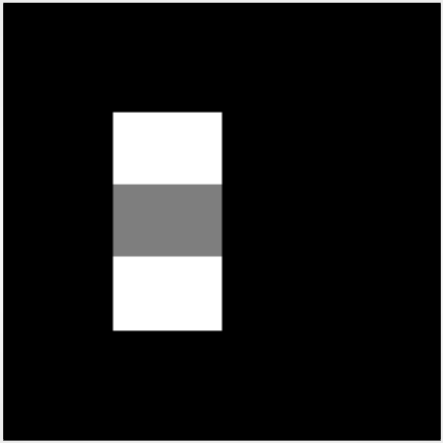


ps6-3-a-1

3a: Haar Features

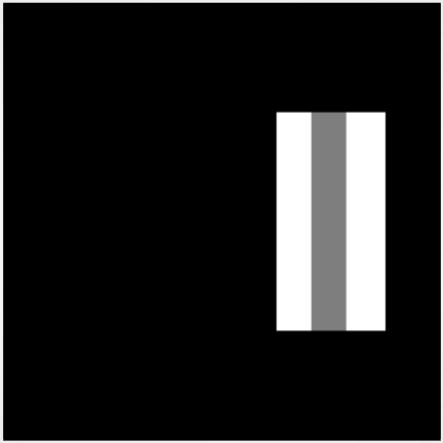
ps6-3-a-2

3a: Haar Features



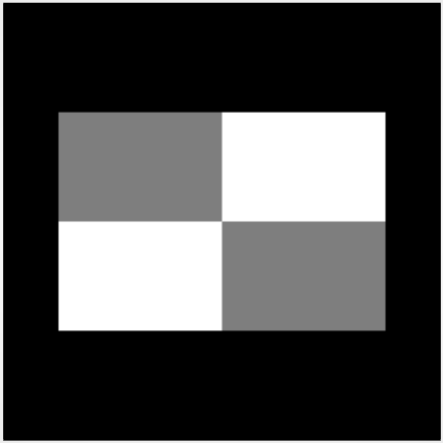
ps6-3-a-3

3a: Haar Features



ps6-3-a-4

3a: Haar Features



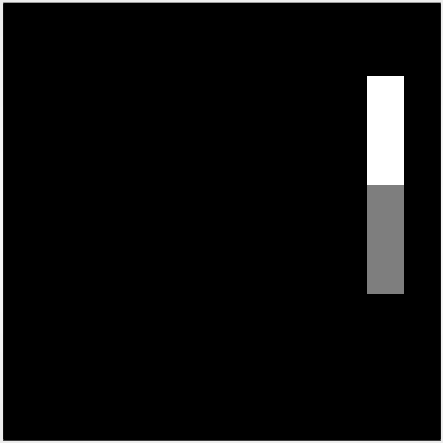
ps6-3-a-5

3c: Analysis

How does working with integral images help with computation time? Give some examples comparing this method and np.sum.

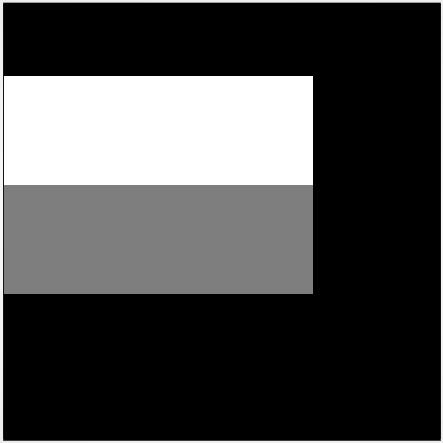
Using integral images enables constant-time computation for obtaining the sum of pixel values within any rectangular area, compared to direct summation methods like np.sum, significantly improving computational efficiency for tasks involving repeated region-based calculations in image processing.

4b: Viola Jones Features



ps6-4-b-1

4b: Viola Jones Features



ps6-4-b-2

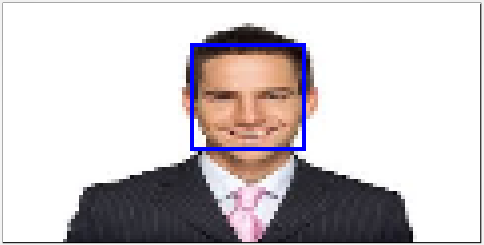
4b: Analysis

Report the classifier accuracy both the training and test sets with a number of classifiers set to 5. What do the selected Haar features mean? How do they contribute in identifying faces in an image?

Classifier accuracy when set to 5:
Prediction accuracy on training: 97.14%
Prediction accuracy on testing: 76.53%

Selected Haar features represent spatial patterns of contrast between adjacent image regions, used by Viola-Jones to detect faces based on characteristic contrasts and textures found in facial structures.

4c: Viola Jones Face Recognition



ps6-4-c-1

5b-1 Extra Credit: Cascade Classifier

Report the cascaded classifier accuracy on both the training and test sets. What was the best percentage for the train/test split? What values did you choose for the false positive target, the false positive rate, and the detection rate? What impact did these have on the overall cascaded classifier?

I think

my answer is ...

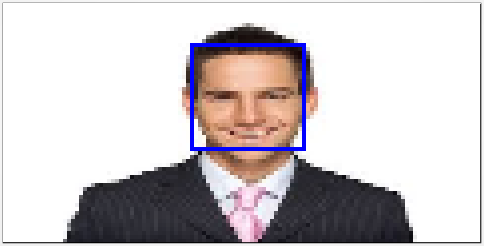
5b-2 Extra Credit: Cascade Classifier

How many classifiers did your cascade algorithm produce? How many features did each of these classifiers have? Compare this classifier to just a single Viola Jones classifiers.

I think

my answer is ...

5b-3 Extra Credit: Cascade Classifier Face Recognition



ps6-5-b-1