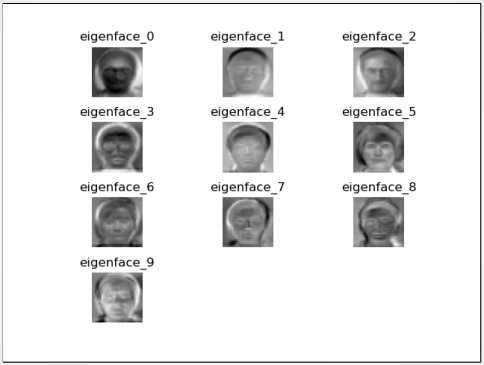
Computer Vision
Fall 2021
Problem Set #6

Ian Dover
idover3@gatech.edu

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?

Good predictions = [53, 56, 48, 41, 54]
Bad predictions = [30, 27, 35, 42, 21]
Accuracy = [63.86, 67.47, 57.83, 49.40, 65.06]%
On average, the naive classification performs at a 61% accuracy which is well above random. By randomly choosing a label, the accuracy tends to be around 6-7%, and this is much worse.
Lowering the k values tends to reduce the accuracy linearly.
Raising the k value increases the consistency of the naive classification, but it slightly reduces the upper potential for a high accuracy (by chance).

Changing the split percentage appears to change the variability in accuracies between runs, but it does not have a huge effect on average accuracy.

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.

random training accuracy = [51.12, 47.81, 48.76, 49.35, 50.06] = 49.42%
weak training accuracy = [75.62, 75.86, 76.09, 75.27, 75.86] = 75.74%
boosting training accuracy = [94.56, 94.20, 93.14, 93.37, 93.49] = 93.752%
random test accuracy = [48.58, 44, 81, 53.30, 46.70, 54.72] = 54.71%
weak test accuracy = [73.11, 71.23, 71.23, 74.53, 71.23] = 72.27%
boosting test accuracy = [94.34, 93.40, 91.51, 91.51, 91.51] = 92.45%

2a: Analysis

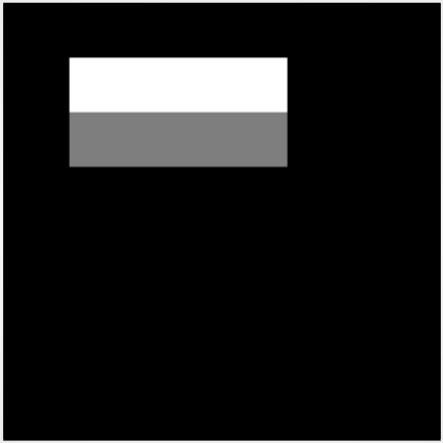
Analyze your results. How do the Random, Weak Classifier, and Boosting perform? Is there any improvement when using Boosting?

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 random classifier performs truly random at 50% accuracy. The weak classifier performs at a consistent 70-77% accuracy. The boosting classifier performs at around 73% accuracy.
When increasing the number of iterations from 5 to 15, the accuracy of the Boosting classifier increase to around 99%.
Increasing the size of the training set to 0.9 increases the variability in accuracy of the boosting classifier, but it hovers around the same average accuracy as it did before; perhaps slightly lower.

3a: Haar Features

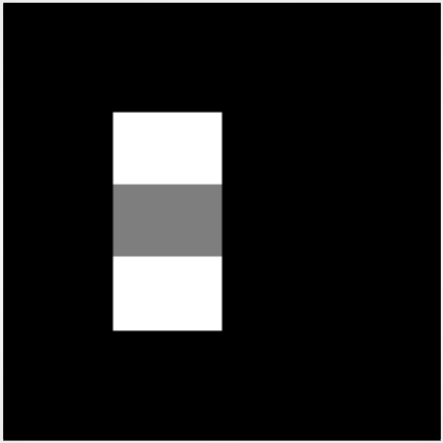


ps6-3-a-1

3a: Haar Features

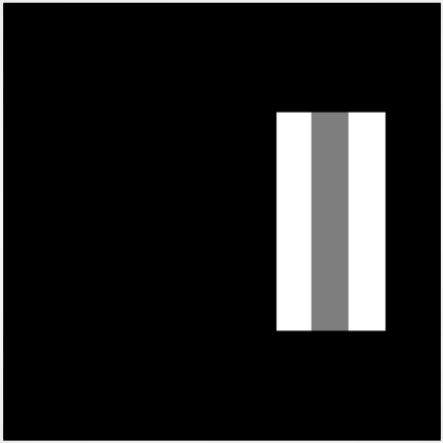
ps6-3-a-2

3a: Haar Features



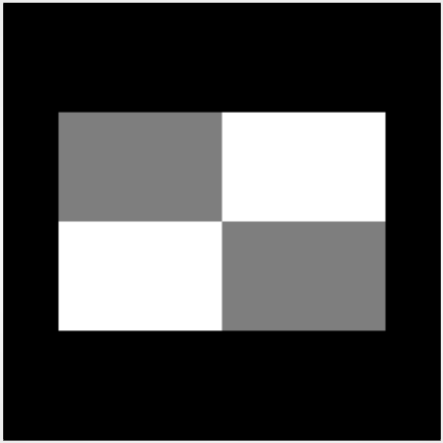
ps6-3-a-3

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.

Working with integral images does help with computation time by transforming the problem from a O(n) time summation algorithm to a O(1) time lookup algorithm. This means that without the integral image, the algorithm would be n times slower, where in is the average area in pixels of the box.

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?

I think

my answer is ...

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