Computer Vision
Spring 2021
Problem Set #6

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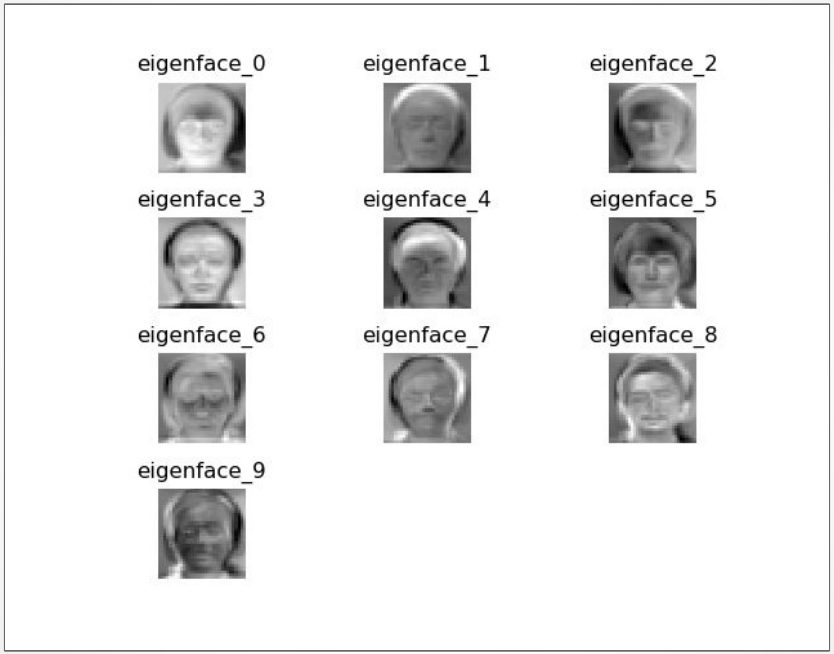
1a: Average face

ps6-1-a-1

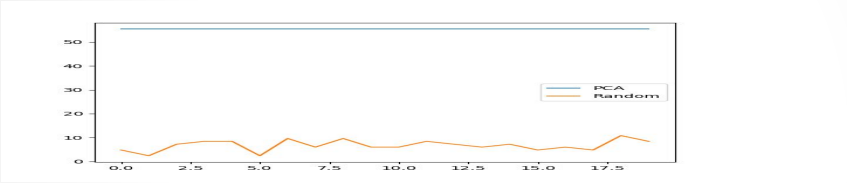
1b: Eigenvectors



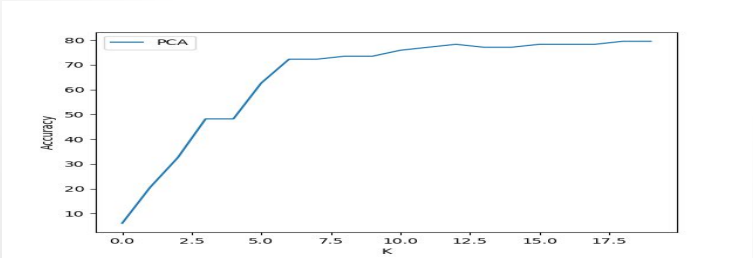
ps6-1-b-1

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?



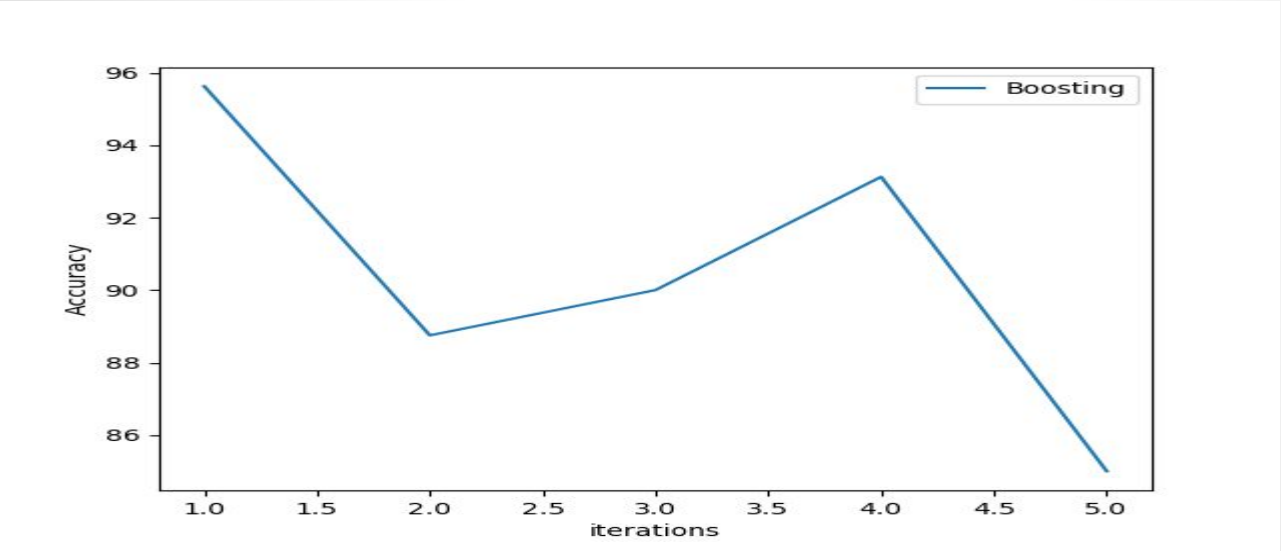
PCA perform better than random selection as shown in the graph over multiple iteration



Accuracy increases as we increase the value of k and then plateaus out
If the split percentage is increased to 0.9 it improves the accuracy

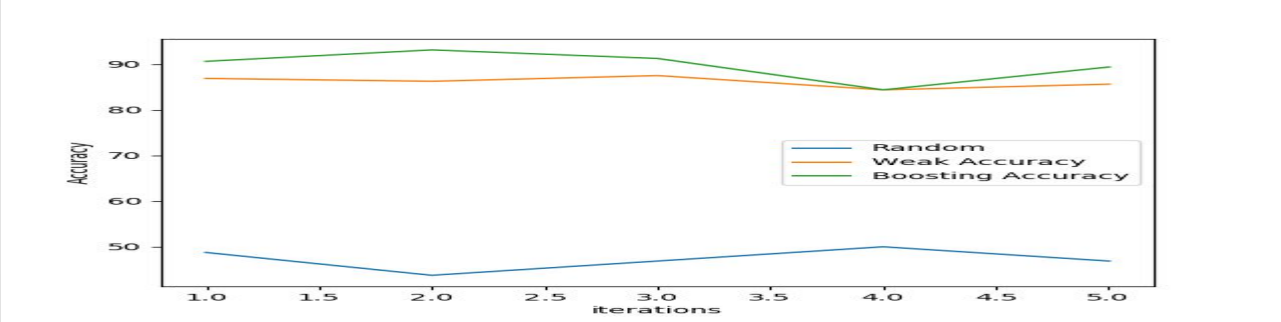
2a: Average accuracy

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

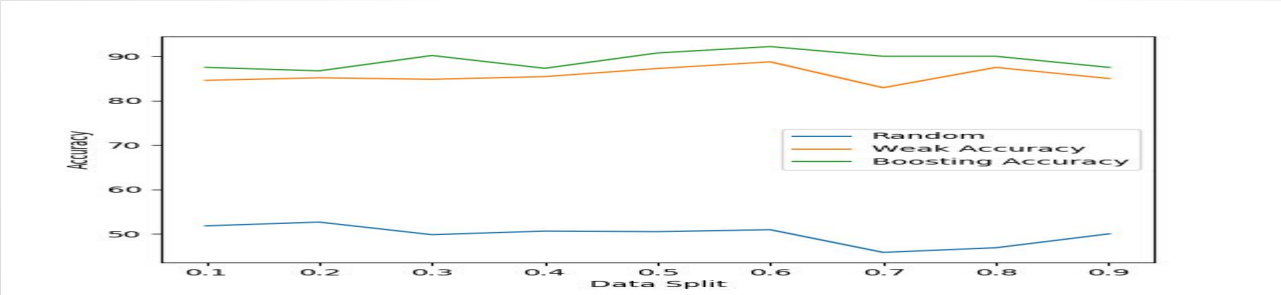


2a: Analysis

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).



Boosting on an average performs better across all the iterations



Boosting accuracy is better across all splits

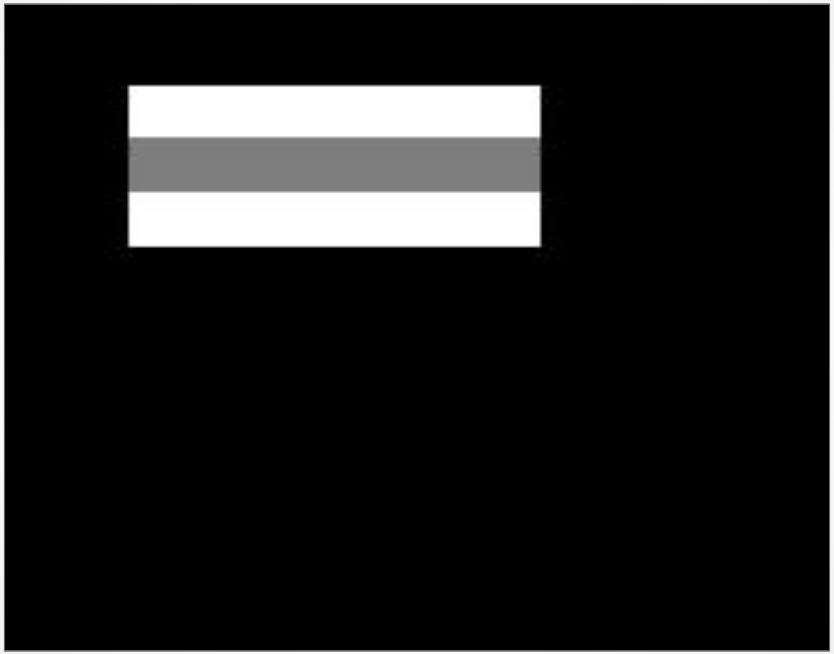
3a: Haar Features

ps6-3-a-1

3a: Haar Features

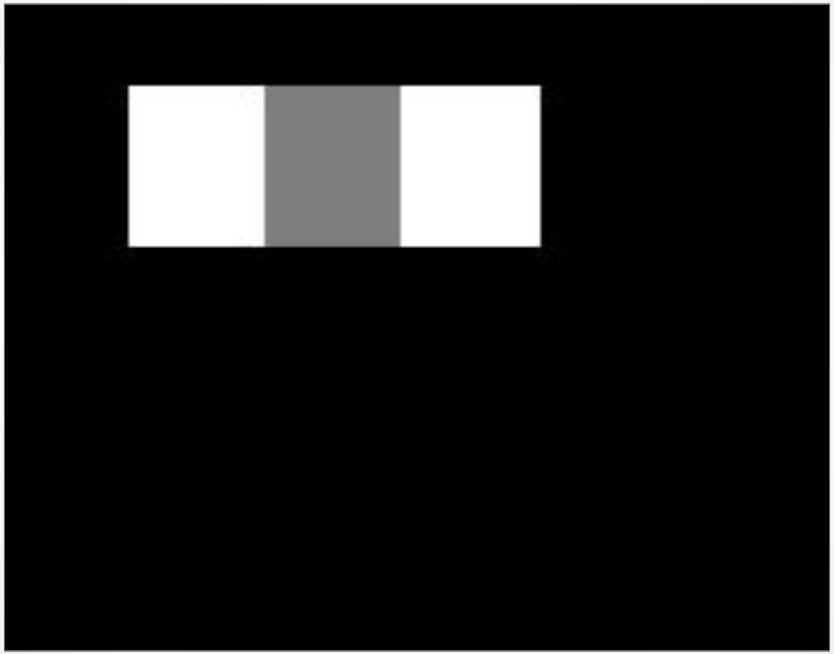
ps6-3-a-2

3a: Haar Features



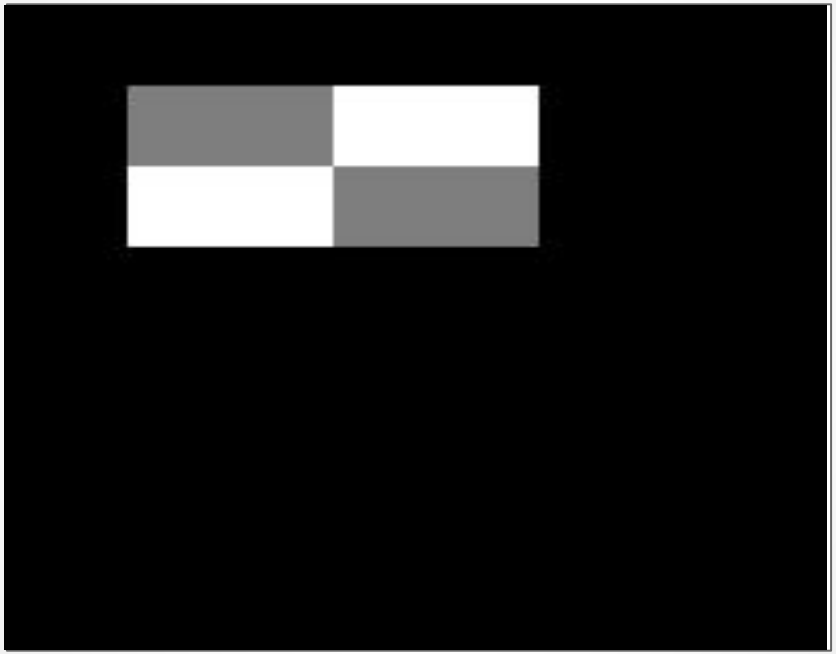
ps6-3-a-3

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.

Haar feature score can be computed in constant time with integral images.

For Example to evaluate the above feature using np.sum the time complexity would be O(height*width) whereas using an integral image it could be done in constant time. Since integral image is precomputed and can be used to evaluate multiple feature it is highly efficient compared to np.sum

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?

Prediction accuracy on training: 100.00%
Prediction accuracy on testing: 80.00%

The selected Haarfeature for a particular classifier has the lowest misclassification.

Haar features help in accentuating distinguishable attributes of a face , for eg the rectangular horizontal feature on an eyebrows with dark side on the eyebrow and lighter side on the skin would have a very high score, similarly (3,1) feature type would have a very high score on nose bridge

4c: Viola Jones Face Recognition

ps6-4-c-1