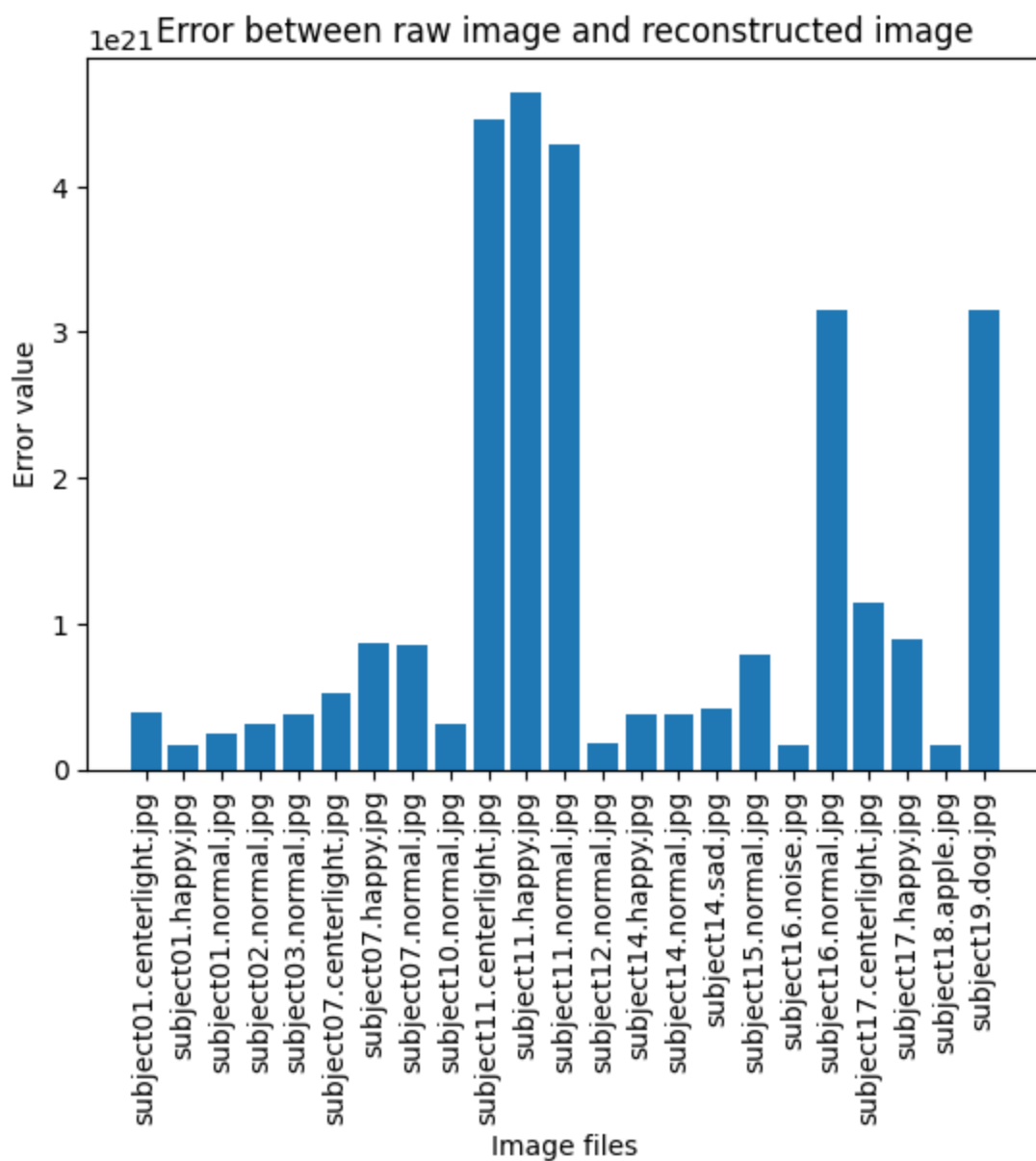# PCA-based (EigenFace) Face Detection

1. The code is attached with other files in the zip.
2. Test Image and reconstructed image
   The 2nd and 5th column represents the reconstructed image

Error between raw image and reconstructed image

The error between raw images and reconstructed image is as follows:

{'subject01.centerlight.jpg': 3.9705690484065455e+20,
'subject01.happy.jpg': 1.7042417436638308e+20,
'subject01.normal.jpg': 2.456720983473184e+20,
'subject02.normal.jpg': 3.124515584971695e+20,
'subject03.normal.jpg': 3.8276354425720504e+20,
'subject07.centerlight.jpg': 5.1912170696714846e+20,
'subject07.happy.jpg': 8.645261009424796e+20,
'subject07.normal.jpg': 8.57330806551469e+20,
'subject10.normal.jpg': 3.17502658669801e+20,
'subject11.centerlight.jpg': 4.4629219285890184e+21,
'subject11.happy.jpg': 4.6479156576075016e+21,
'subject11.normal.jpg': 4.291590541872074e+21,
'subject12.normal.jpg': 1.754546777484493e+20,
'subject14.happy.jpg': 3.799707985107786e+20,
'subject14.normal.jpg': 3.7654022108645065e+20,
'subject14.sad.jpg': 4.205040383214326e+20,
'subject15.normal.jpg': 7.906908706472358e+20,
'subject16.noise.jpg': 1.7042417539134797e+20,
'subject16.normal.jpg': 3.153429860891389e+21,
'subject17.centerlight.jpg': 1.1482815317143295e+21,
'subject17.happy.jpg': 8.955492935511815e+20,
'subject18.apple.jpg': 1.704241750454574e+20,
'subject19.dog.jpg': 3.1534298632264976e+21}

3. Order of Images as per error

Expected Images (Before running)	Original Result (After running and sorting error)
subject01.happy.jpg	'subject01.happy.jpg'
subject01.normal.jpg	'subject18.apple.jpg'
subject12.normal.jpg	'subject16.noise.jpg'
subject10.normal.jpg	'subject12.normal.jpg'
subject02.normal.jpg	'subject01.normal.jpg'
subject14.normal.jpg	'subject02.normal.jpg'
subject14.happy.jpg	'subject10.normal.jpg'
subject14.sad.jpg	'subject14.normal.jpg'
subject01.centerlight.jpg	'subject14.happy.jpg'
subject03.normal.jpg	'subject03.normal.jpg'
subject07.centerlight.jpg	'subject01.centerlight.jpg'
subject07.normal.jpg	'subject14.sad.jpg'
subject11.centerlight.jpg	'subject07.centerlight.jpg'
subject11.happy.jpg	'subject15.normal.jpg'
subject11.normal.jpg	'subject07.normal.jpg'
subject15.normal.jpg	'subject07.happy.jpg'
subject07.happy.jpg	'subject17.happy.jpg'
subject17.centerlight.jpg	'subject17.centerlight.jpg'
subject17.happy.jpg	'subject16.normal.jpg'

subject16.normal.jpg	'subject19.dog.jpg'
subject16.noise.jpg	'subject11.normal.jpg'
subject19.dog.jpg	'subject11.centerlight.jpg'
subject18.apple.jpg	'subject11.happy.jpg'

Explanation:

There are some differences with the image errors (expected vs original). We have used MSE to calculate the error.

The difference between the original image and the reconstructed image is measured by the MSE (Mean Squared Error). The average squared difference between the two images is what this metric measures. MSE does not, however, always give a complete representation of the rebuilt image's quality.

The amount of noise and other distortions in the original image as well as the compression method used to rebuild the image have an impact on MSE. The reconstructed image may occasionally be visually appealing yet have a high MSE, and vice versa.
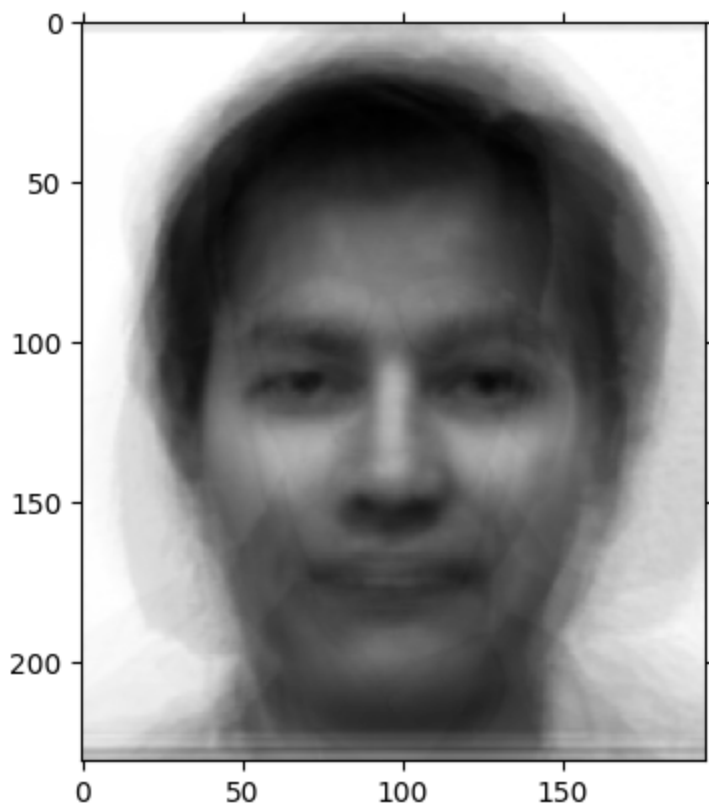
SSIM (Structural Similarity Index) and PSNR (Peak Signal-to-Noise Ratio) are two additional metrics that can be utilized to provide a more thorough assessment of the reconstructed image's quality. These measurements account for the perceived quality of the image as well as its level of noise and distortion.
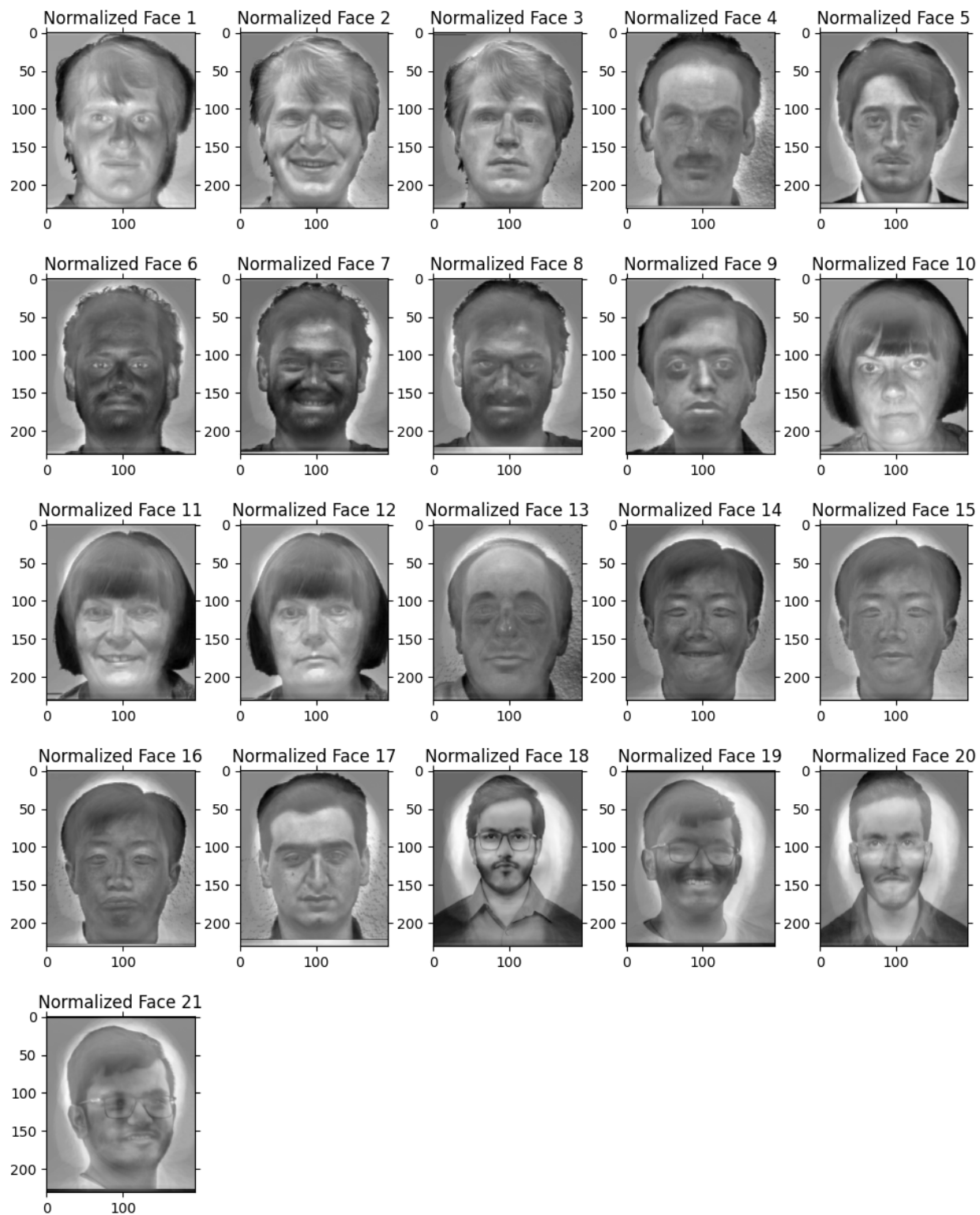
<u>Some Results</u>

Test Images

01centerlight	01happy	01normal	02normal	03normal
07centerlight	07happy	07normal	10normal	11centerlight
11happy	11normal	12normal	14happy	14normal
14sad	15normal	16noise	16normal	17centerlight
17happy	18apple	19dog		

—- Mean Face —--

____ Normalized Face_____

— Eigenface —