Homework 7

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Part II: Programming and Questions

7. (a)

Answer:

The fourth face in the dataset:

7. (b)

Answer:

The mean of all the examples in the dataset fea: $[91.94698, 95.09418, 101.15502, ..., 117.36201, 110.7413, 104.42233]$

```
# Compute the mean of all the examples in the dataset fea.
fea_mean = fea.mean(axis=0)
print("the mean of all the examples in the dataset fea: {}".format(fea_mean))
```

```
the mean of all the examples in the dataset fea: [ 91.94698  95.09418 101.15502 ... 117.36201 110.7413  104.42233]
```

7. (c)

Answer:

```
# Do dimensionality reduction with pca.
fea_centered = fea - fea_mean

u, s, vT = np.linalg.svd(fea_centered) #note that s contains only the diagonal elements
print("U.shape, S.shape, V.T.shape ->", u.shape, s.shape, vT.shape, end="\n\n")

fea_pca_5 = np.matmul(fea_centered, np.transpose(vT[:5, :]))

# values of the associated 5 attributes of the fourth image
print(np.around(fea_pca_5[3], decimals=3))
```

```
U.shape, S.shape, V.T.shape -> (1288, 1288) (1288,) (2914, 2914)

[-202.542 -261.477 -418.974   29.399   39.785]
```

7. (d)

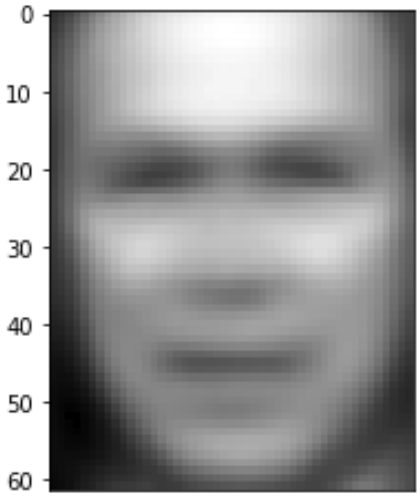
Answer:

The fourth face in the dataset onto the first 5 principle components: $[-202.542, -261.477, -418.974, 29.399, 39.785]$

7. (e)

Answer:

The fourth face back into the original space based on the first 5 principle components:



The fourth face back into the original space based on the first 50 principle components: