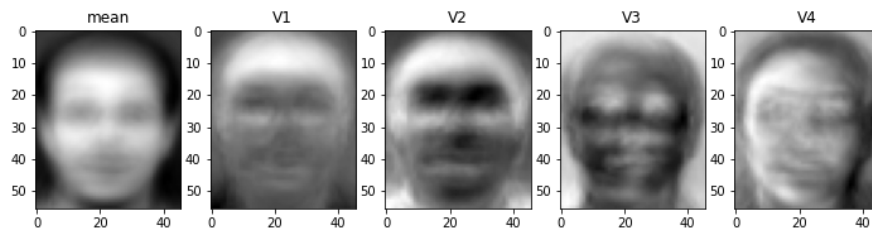


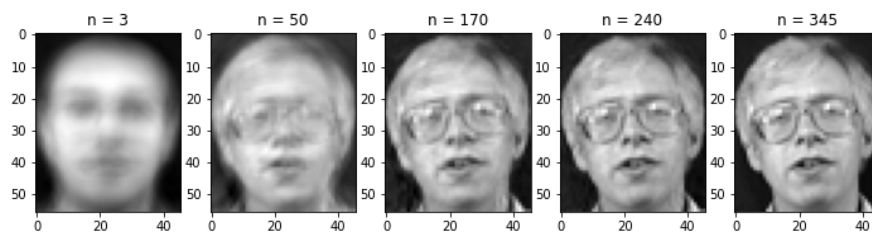
---

## Problem 2

1. Plot the mean face and the first four eigenface



2. Plot the five reconstructed images.



3. The corresponding MSE values

```
n = 3.00, mse = 746.80
n = 50.00, mse = 236.55
n = 170.00, mse = 46.72
n = 240.00, mse = 13.37
n = 345.00, mse = 0.22
```

4. Use `sklearn.model_selection.GridSearchCV(cv=KFold(n_splits=3, shuffle=True))` to determine the best k and n value. The cross validation results would be

```
k =      1      3      5
n = 3    [0.65555556 0.56666667 0.47222222]
n = 50   [0.94722222 0.87777778 0.80555556]
n = 170  [0.96111111 0.87777778 0.78333333]
```

we can choose  $k = 1$ ,  $n = 170$  because it got the best score on validation set.

5. The recognition rate of the testing set.

```
the recognition rate = 0.95
```