Homework #0 Report

Deep Learning for Computer Vision

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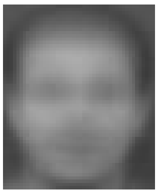
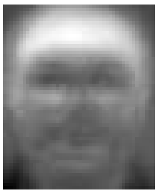
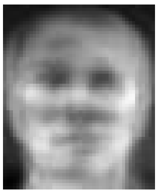
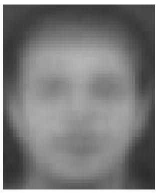
1. **Mean face and first four eigen faces.**

mean face	1st eigen face	2nd eigen face	3rd eigen face	4th eigen face
				

2. **$Person_8Image_1$ reconstructed face with first $n = 3, 50, 170, 240, 345$ eigenfaces.**

$n = 3$	$n = 50$	$n = 170$	$n = 240$	$n = 345$
				

3. **Mean squared error between the reconstructed image and the original image.**

$n = 3$	$n = 50$	$n = 170$	$n = 240$	$n = 345$
1566.35	134.03	39.85	21.48	3.04

4. **k-nearest neighbors algorithm to classify the testing set images.**

Traingin Set	Test Set

(a) origin data set

Fold 1	Fold 2	Fold 3	Test Set
Fold 1	Fold 2	Fold 3	Test Set
Fold 1	Fold2	Fold 3	Test Set

(b) randomly split the training set into 3-fold

Implement 3-fold cross-validation as above, and record the average validation performance(recognition rate) on different hyperparameters, and the results:

	$n = 3$	$n = 50$	$n = 170$
$k = 1$	0.727	0.966	0.966
$k = 3$	0.616	0.9	0.894
$k = 5$	0.541	0.808	0.8

According to the results, we can tell that it performed best at $(k = 1, n = 50)$ which has the highest average recognition rate on validation rate.(Although there is a tie with $(k = 1, n = 170)$, our goal is dimension reduction).Hence I pick $(k = 1, n = 50)$as my choice of hyperparameters.

5. **recognition rate of the testing set.**
   The result on the test set using $(k = 1, n = 50)$:

recognition rate on test set	0.916

Reference

1. sklearn.decomposition.PCA
2. sklearn.neighbors.KNeighborsClassifier
3. sklearn.model_selection.KFold
4. stackoverflow: PCA projection and reconstruction in scikit-learn
5. discussion with R10922096 徐紹軒