

2. PCA

a.

```
Train 1000 images '5' from mnist
average = np.mean(trainset, axis=0)
pca = decomposition.PCA(n_components=2)#top 2 components
```

b.

```
p=10 and p=50.
pca = decomposition.PCA(n_components=50) p=10
c=(test_img-average)*eigenfaces.T*eigenfaces+average
```

c.

```
Compute and display a DFFS (distance-from feature-space) and SSD
(sum-of-square-differences) heat maps for detection
Get the big input image first
SSD=np. sqrt((test-x_mean)**2.sum())
DFFS=np. sqrt(ssd-(test**2.sum(), (test-x_mean)*eigenfaces.T**2.sum()))
```

d.

Evaluate the performance of SSD and DFFS (i.e. illustrate when it works, and when it does not work).
Get ideas from a paper **View-Based and Modular Eigenspaces for Face Recognition**

False Alarm Rate and Decision Rate

When the DR is the same, DFFS should have smaller FAR

When the FAR is the same, DFFS should have higher DR