Deep Learning for Computer Vision

Homework 1

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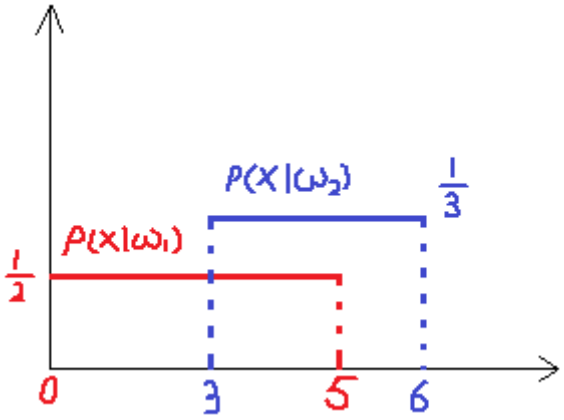
Problem 1: Bayes Decision Rule



推導：

T: 0~3

$$P_e = \int_T^{\infty} p(x|\omega_1) \times P(\omega_1) dx = \frac{1}{5} \times \frac{3}{4} \; x|_T^{\infty} = \frac{3}{20} \times (5 - T)$$

最小值為 T=3, $P_e = \frac{3}{10}$

T: 3~5

$$P_e = P_{FA} + P_{FR} = \int_T^{\infty} p(x|\omega_1) \times P(\omega_1) dx + \int_{-\infty}^{T} p(x|\omega_2) \times P(\omega_2) dx$$

$$= \frac{1}{5} \times \frac{3}{4} \; x|_T^{\infty} + \frac{1}{4} \times \frac{1}{3} \; x|_{-\infty}^{T} = \frac{3}{20} \times (5 - T) + \frac{1}{12} \times (T - 3)$$

$$= \frac{1}{2} - \frac{1}{15} \times T$$

由上面最後推導出的式子可以得知，T 越大，error 的機率越小，因此 T 為 5，帶入之後可以得到

$P_e = \frac{1}{6}$ 。

T: 5~6

$$P_e = \int_{-\infty}^{T} p(x|\omega_2) \times P(\omega_2) dx = \frac{1}{4} \times \frac{1}{3} \; x|_{-\infty}^{T} = \frac{1}{12} \times (T - 3)$$

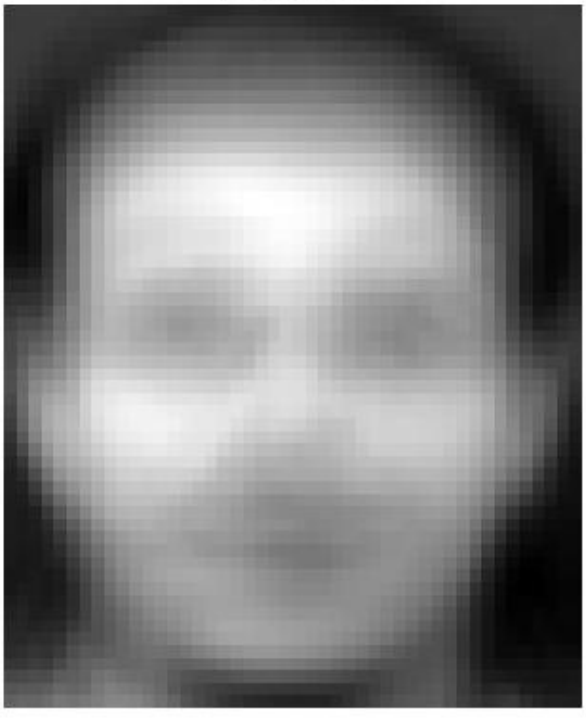
最小值在 T=5, $P_e = \frac{1}{6}$

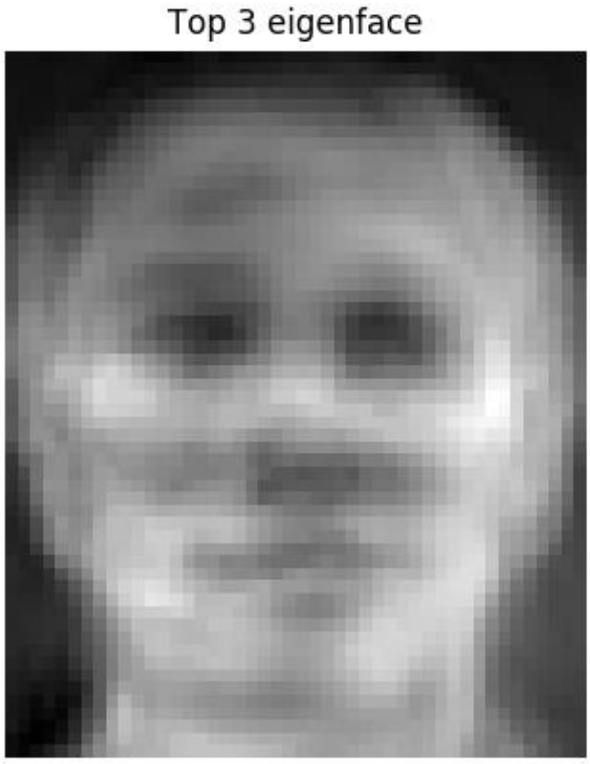
答案: $P_e = \frac{1}{6}$

Problem 2: Principal Component Analysis and k-Nearest Neighbors Classification

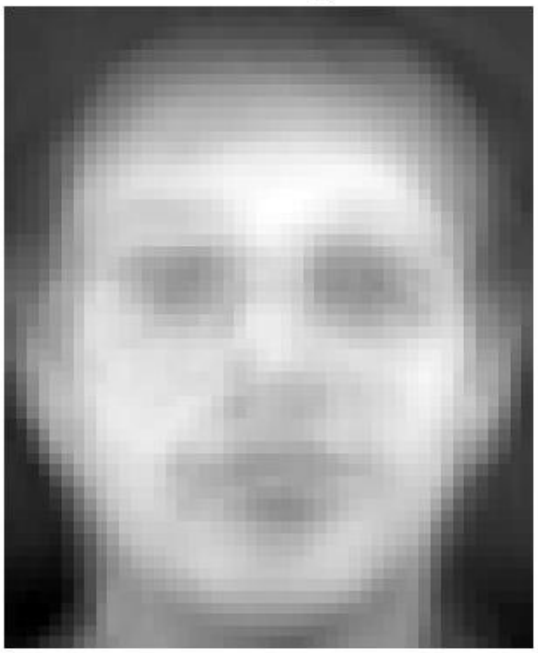
(a)

Eigen-face 可能因為正負號的關係，顏色跟其他人的相反。

Mean face	First eigenface
	

Second eigenface	Third eigenface
	

(b)

N = 3	N = 50
	

N = 100	N = 239
	

(c)

經過 3-fold cross-validation 後，得到以下結果：

Accuracy	N = 3	N = 50	N = 159
K = 1	0.6667	0.9292	0.9333
K = 3	0.5833	0.8375	0.8458
K = 5	0.5292	0.7792	0.775

根據上述結果可得，我們選 N = 159, K = 1 時，有最好的結果。

帶入 Test set 中，得到 Accuracy = 0.94375