

DLCV HW1

鄭承昀 R07522823

Problem 1 Bayes Decision Rule

$$P(\omega_1) = \frac{2}{9}, \quad P(x|\omega_1) = \begin{cases} \frac{1}{5} & x \in [0, 5] \\ 0 & \text{otherwise} \end{cases}$$

$$P(\omega_2) = \frac{7}{9}, \quad P(x|\omega_2) = \begin{cases} \frac{1}{7} & x \in [2, 9] \\ 0 & \text{otherwise} \end{cases}$$

assume that the decision boundary at T :

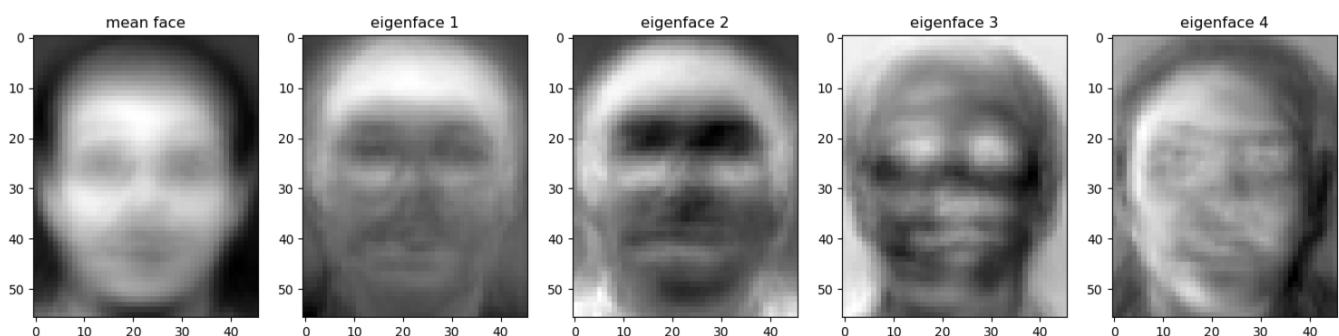
$$\begin{aligned} & \int_T^\infty P(x|\omega_1)P(\omega_1)dx + \int_{-\infty}^T P(x|\omega_2)P(\omega_2)dx \\ &= \frac{2}{9} \cdot \frac{1}{5} \cdot (5 - T) + \frac{7}{9} \cdot \frac{1}{7} \cdot (T - 2) \\ &= \frac{1}{15}T \end{aligned}$$

$$(5 - T) \geq 0 \quad \text{and} \quad (T - 2) \geq 0 \quad \rightarrow \quad 2 \leq T \leq 5$$

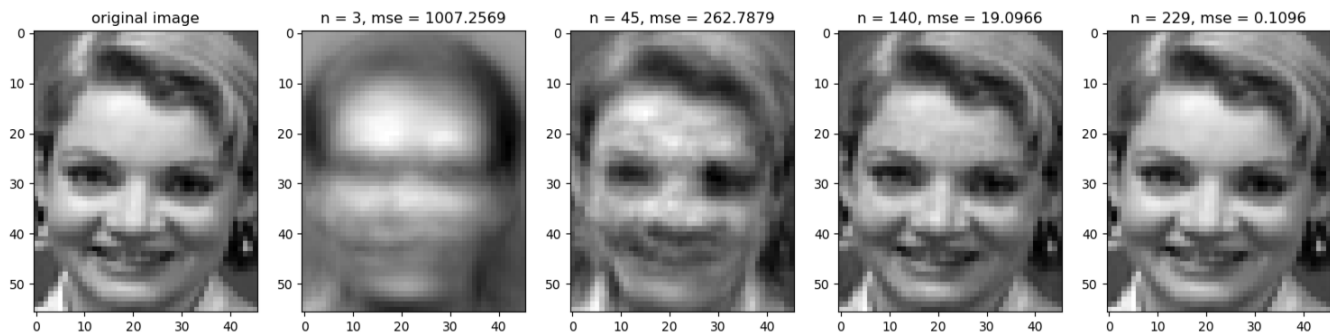
to minimize the error: $T = 2$ and $P_e = \frac{2}{15}$
if $x \geq 2$ we choose ω_2 ; else, we choose ω_1

Problem 2 Principal Component Analysis

1. Mean face and first four eigenfaces



2. Reconstruction and MSE



3. k-NN in projected spaces

	k = 1	k = 3	k = 5
n = 3	0.704	0.617	0.521
n = 45	0.929	0.858	0.792
n = 140	0.929	0.858	0.754

當 $k = 1$ 時， $n = 45$ 和 $n = 140$ 有相同的 accuracy。但是當 $k = 5$ 時， $n = 45$ 的 accuracy 大於 $n = 140$ 。所以我猜測 $n = 45$ 比較好。故最後選擇 $k = 1$ 和 $n = 45$ 。

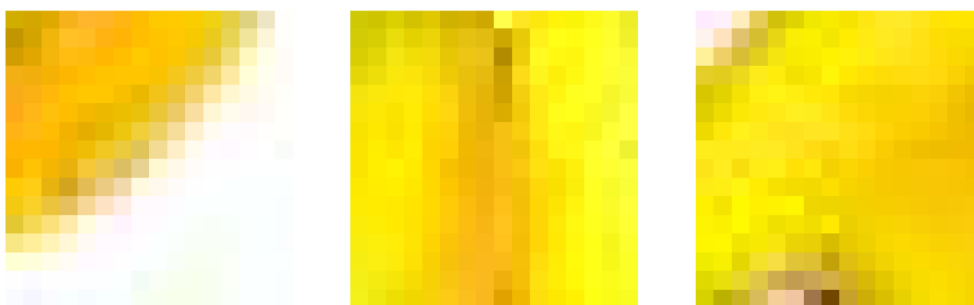
4. Choose $k = 1$, $n = 45$

The recognition rate of the testing set is 0.95625

Problem 3 Visual Bag-of-Words

1. Pick 4 images (one from each category) randomly and plot 3 such patches from each image

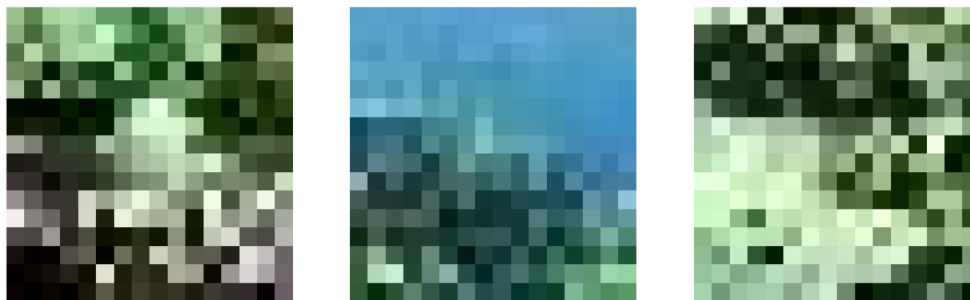
- banana



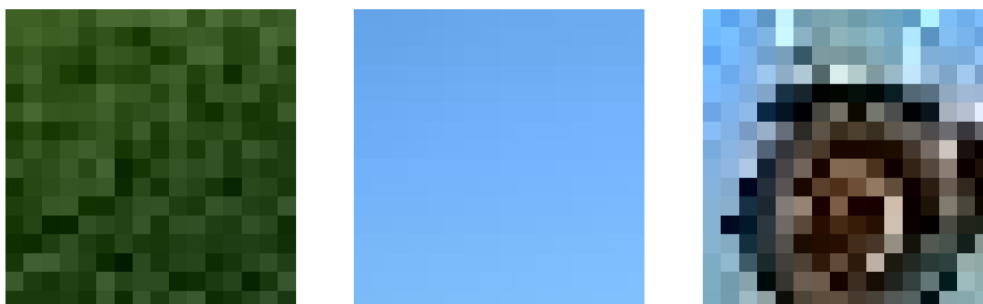
- fountain



- reef

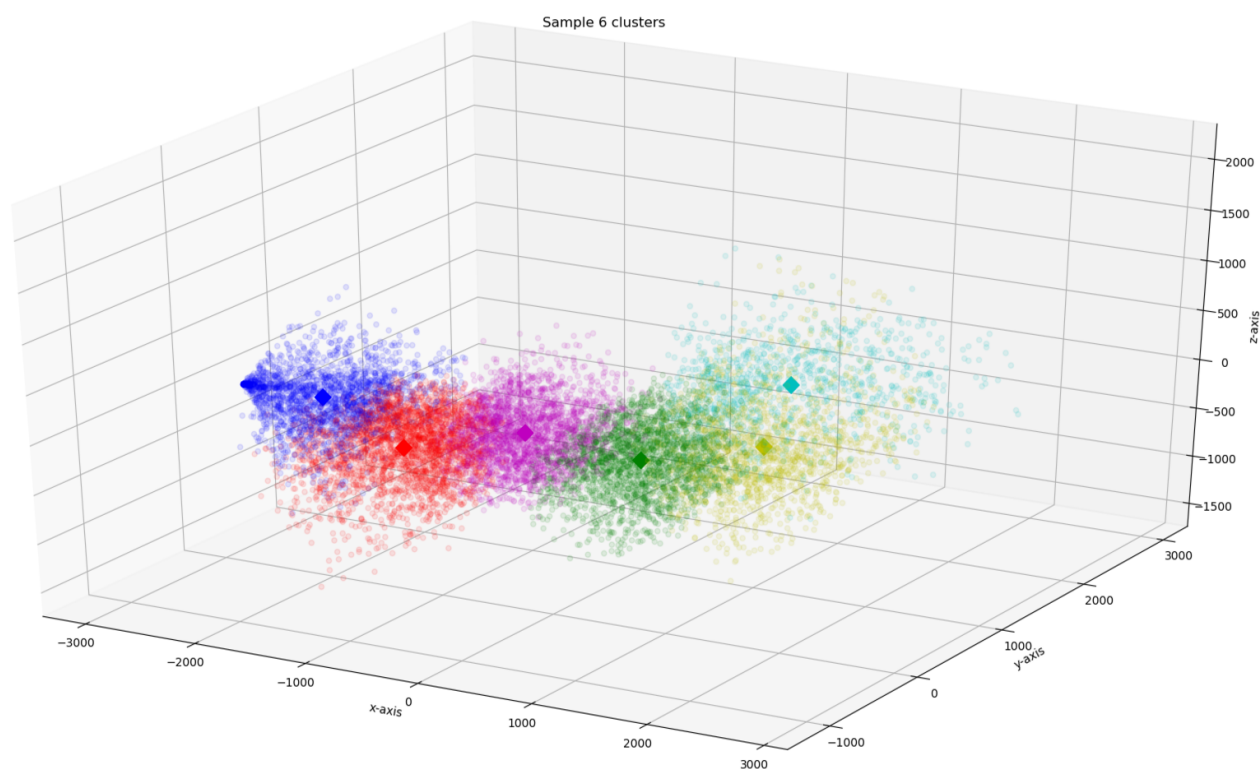


- tractor

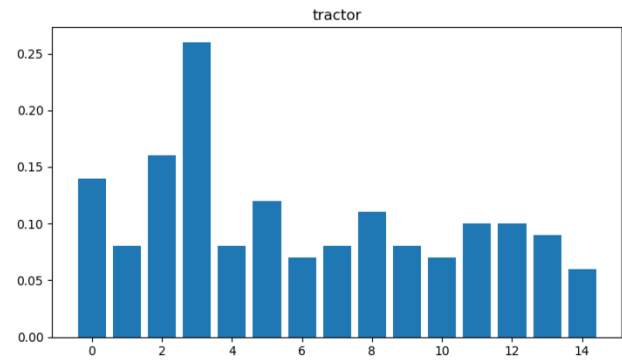
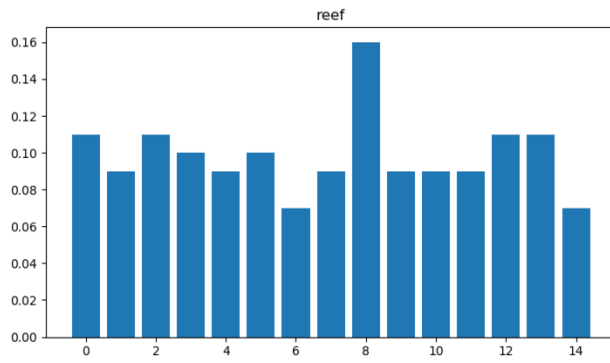
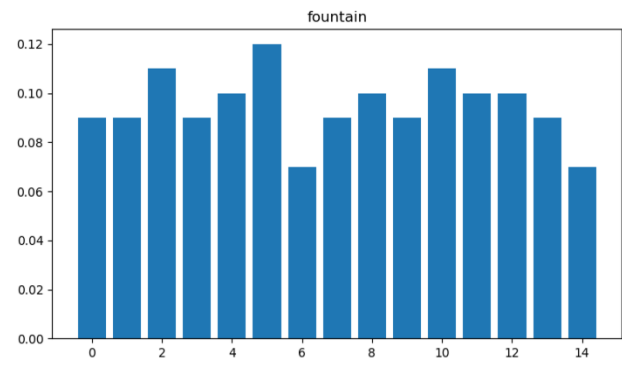
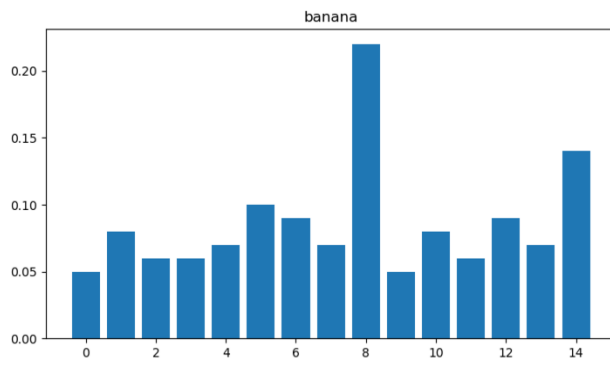


我覺得無法用幾個patch就將照片做分類。因為只用少許的patch可能無法看到能真正做出辨識的特徵。就如同上面呈現出來的12張圖片，幾基本上根本看不出來是什麼東西。就算是透過顏色來看也會發現明明是不同的類別的東西卻有相同的顏色。

2. Construct the 3-dimensional PCA subspace from the training features (randomly select 6 clusters)



3. Choose one image from each category and visualize its BoW using histogram plot



4. k-NN classify

The recognition rate of the testing set is 0.558