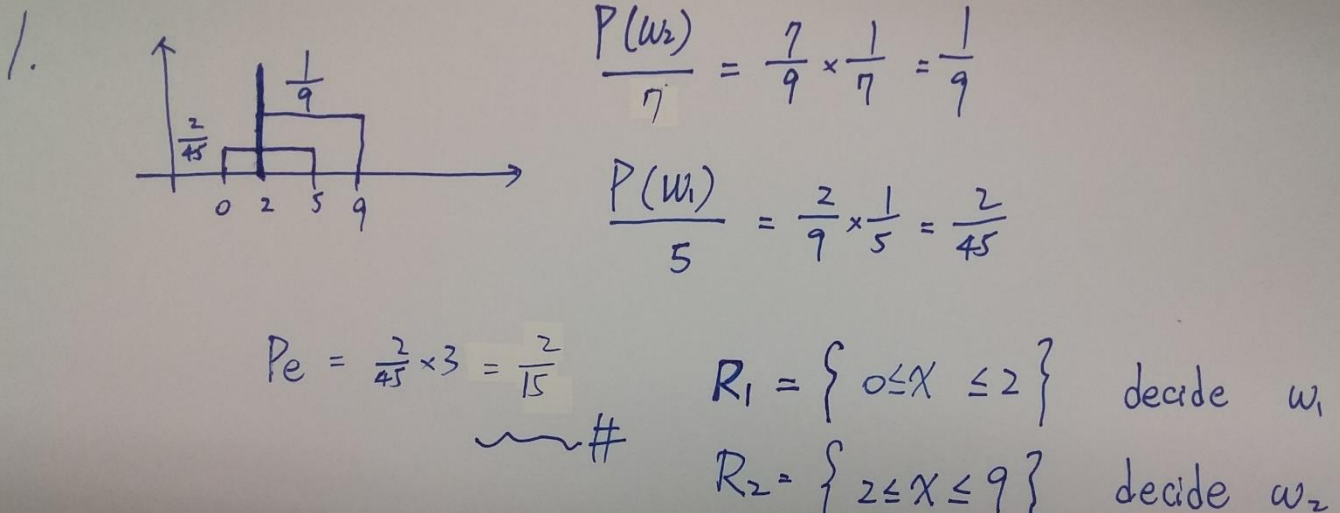# Homework #1

Deep Learning for Computer Vision

- No collaborators.

Problem 1:

$$\frac{P(\omega_2)}{7} = \frac{7}{9} \times \frac{1}{7} = \frac{1}{9}$$

$$\frac{P(\omega_1)}{5} = \frac{2}{9} \times \frac{1}{5} = \frac{2}{45}$$

$$P_e = \frac{2}{45} \times 3 = \frac{2}{15}$$

$$R_1 = \{0 \le x \le 2\} \quad \text{decide} \quad \omega_1$$

$$R_2 = \{2 \le x \le 9\} \quad \text{decide} \quad \omega_2$$

Problem 2:

1.

mean	eigen1	eigen2	eigen3	eigen4

2.

original	3 eigens	45 eigens	140 eigens	229 eigens
MSE: 0	MSE: 1007	MSE: 277.3	MSE: 22.33	MSE: 0.1096

3. Reported above.

4.

Training Accuracy

k	n	fold1	fold2	fold3	average
1	3	60.0%	67.5%	70.0%	65.8%
1	45	90.0%	86.3%	90.0%	88.8%
1	**140**	**90.0%**	**88.8%**	**91.3%**	**90.0%**
3	3	40.0%	55.0%	53.8%	49.6%
3	45	73.8%	81.3%	68.8%	74.6%
3	140	72.5%	81.3%	70.0%	74.6%
5	3	38.8%	47.5%	43.8%	43.3%
5	45	62.5%	73.8%	63.8%	66.7%
5	140	58.8%	73.8%	58.8%	63.8%

　　由於 (k, n) = (1, 140) 得到最高的正確率，因此選擇這組參數。

5.

Testing Accuracy

k	n	Accuracy
1	140	94.375%

Problem 3:

1.

original	patch1	patch2	patch3

因為各類別 patches 的顏色跟質料有顯著差異，

某種程度上可以分的出是哪類別。

2.

PCA Subspace
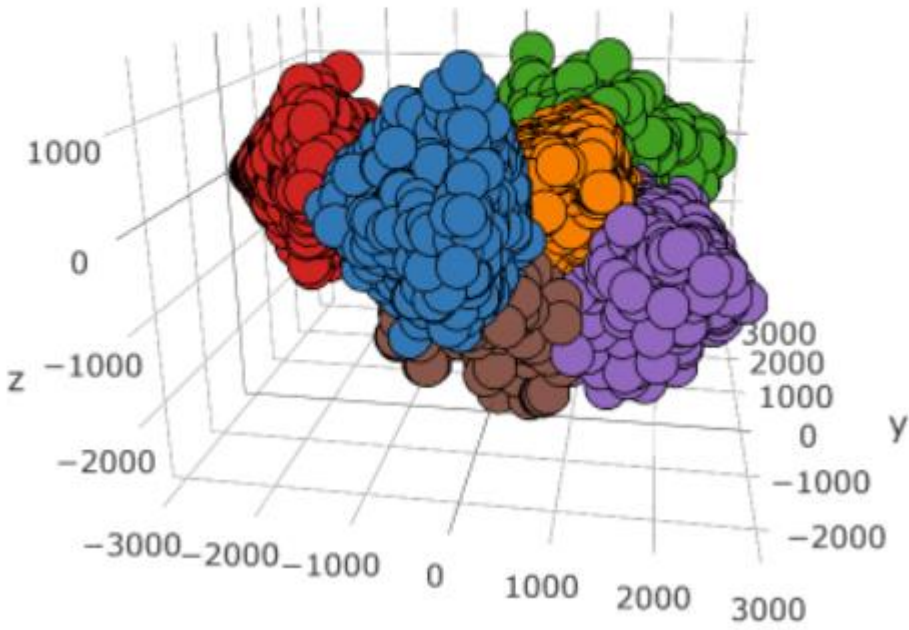
3.
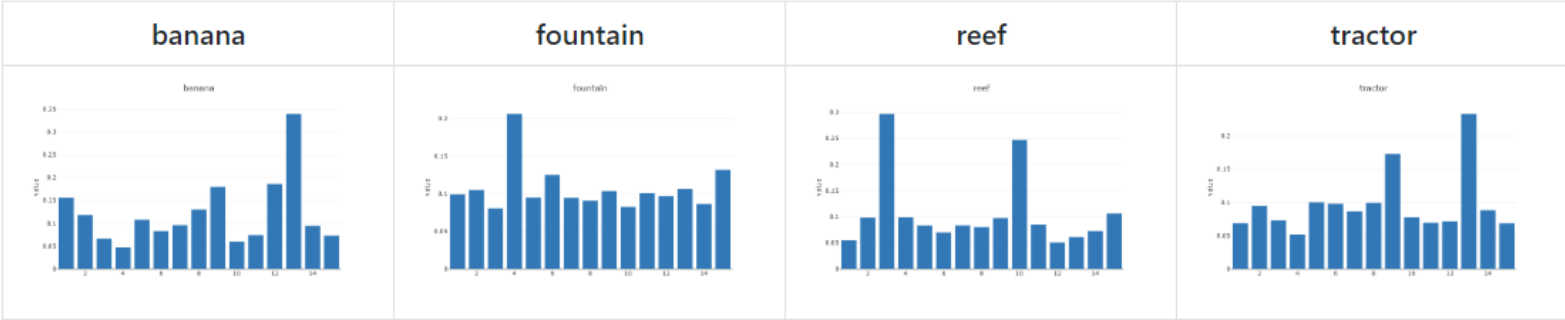
4. Accuracy: 55.6%

Problem 4:

1.

$$4.-1. \quad G(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{(x^2+y^2)}{2\sigma^2}}$$

$$= \underbrace{\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}}}_{1D} \times \underbrace{\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{y^2}{2\sigma^2}}}_{1D}$$

Q.E.D.

2.

2D Gaussian filter 造成模糊效果。

3.

kx = [-1/2, 0, 1/2], ky = [-1/2, 0, 1/2]^T

4.

圖片經過 2D Gaussian filter 再算 gradient，輪廓

邊緣都更加明顯。