

سؤال 1

الف)

(ب) تقریباً مقدار blur ی که در این تصویر
حاصل می شود را با این 8 kernel محاسبه و خروجی موارد
شماره

۱۵۵x

1	0	1	0	1	0	1	0
0	$\frac{5}{9}$	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{4}{9}$	1
1	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{2}{9}$	0
0	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{4}{9}$	1
1	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{4}{9}$	$\frac{2}{9}$	0
0	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{4}{9}$	1
1	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{2}{9}$	$\frac{4}{9}$	$\frac{5}{9}$	0
0	1	0	1	0	1	0	1

سؤال 2

Layer	Output d	num of parameter
Input	32x32x3	0
Conv-10	32x32x10	$10 \times (3 \times 3 \times 3) + 10$
ReLU	32x32x10	0
POOL-2	16x16x10	0
CONV3-20(3,2)	4x4 x 20	$(3 \times 3 \times 10) + 20 = 110$
ReLU	4x4x20	0
Pool-2	2x2x20	0
FLATTEN	110	0
FC-10	10	$(110 \times 10) + 10 = 1110$

سؤال 3

الف) طبق a و b

$$L = \frac{1}{2} (y - \hat{y})^2 = \frac{1}{2} (y - (w^T v + a))^2 = \frac{1}{2} (y - w_1 v_1 - w_2 v_2 - a)^2 \quad (1)$$

$$\frac{\partial L}{\partial a} = -(y - w_1 v_1 - w_2 v_2 - a)$$

Subject:

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$$\frac{\partial L}{\partial w_r} = -v_r (y - w_1 v_1 - w_r v_r - a)$$

$$\frac{\partial L}{\partial w_1} = -v_1 (y - w_1 v_1 - w_r v_r - a)$$

$$\frac{\partial L}{\partial z_j} = \sum_{i \in \{1, r\}} \frac{\partial L}{\partial v_i} \frac{\partial v_i}{\partial z_j}$$

(2)

$$\frac{\partial v_1}{\partial z_1} = \begin{cases} 1 & z_1 > \max(z_{r,0}) \\ 0 & \# \end{cases}$$

$$\frac{\partial v_r}{\partial z_r} = \begin{cases} 1 & z_r > \max(z_{1,0}) \\ 0 & \# \end{cases}$$

- z_r (if $z_{1,0} < z_r$)

$$\frac{\partial L}{\partial z_1} = \begin{cases} \delta_1 & z_1 > \max(z_{r,0}) \\ 0 & \# \end{cases}$$

$$\frac{\partial L}{\partial z_r} = \begin{cases} \delta_r & z_r > \max(z_{1,0}) \\ 0 & \# \end{cases}$$

$$\frac{\partial L}{\partial z_r} = \begin{cases} \delta_1 + \delta_r & z_r > \max(z_{1,0}, z_1) \\ \delta_r & \max(z_{1,0}) < z_r < \max(z_{1,0}, z_1) \\ \delta_1 & \max(z_{1,0}) < z_r < \max(z_r, 0) \\ 0 & \max(z_{1,0}, z_1) > z_r \end{cases}$$

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$$\frac{\partial L}{\partial k_i} = \sum_{j=1}^r \frac{\partial L}{\partial z_j} \frac{\partial z_j}{\partial k_i}$$

$$z_i = k_1 n_i + k_r n_r + k_r n_r \quad \frac{\partial z_i}{\partial k_i} = \begin{cases} n_i & i \in \{1, 2, 3\} \\ 0 & \# \end{cases}$$

$$\frac{\partial L}{\partial k_1} = (\alpha_1 n_1 + \alpha_r n_r + \alpha_r n_r)$$

$$\frac{\partial L}{\partial k_r} = (\alpha_1 n_r + \alpha_r n_r + \alpha_r n_r)$$

$$\frac{\partial L}{\partial k_r} = (\alpha_1 n_r + \alpha_r n_r + \alpha_r n_r)$$

$$\frac{\partial L}{\partial b} = \sum_{j=1}^r \frac{\partial L}{\partial z_j} \frac{\partial z_j}{\partial b} = \sum_{j=1}^r \frac{\partial L}{\partial z_j} = \sum_{i=1}^r \alpha_j$$

بنا بر اینست

$$\frac{\partial L}{\partial b} = \sum_{j=1}^m \alpha_j$$

$$\frac{\partial L}{\partial k_j} = \sum_{i=1}^m \alpha_i n_{i+j-1}$$

سوال ۲

$$44 = \left\lfloor \frac{n + (P-K)}{S} \right\rfloor + 1 \quad \begin{matrix} n = 100 \\ P = 0 \\ S = 3 \end{matrix} \Rightarrow \left\lfloor \frac{100 - K}{3} \right\rfloor = 44 =$$

$$\left\lfloor \frac{1-K}{3} \right\rfloor + 44 = 44 \Rightarrow \left\lfloor \frac{1-K}{3} \right\rfloor = -3 \quad \begin{matrix} K = 10 \\ K = 9 \\ K = 1 \end{matrix}$$

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(ب)

$$\#P = ((K \times K \times 10) \times 99) + 99$$

$$\#P = 77154$$

تعداد ک عددها فرست

(ج) ابتدا تعداد ضرب های مورد نیاز، هرگز از ۱۰۰۰ است.

هرگز از ۴۴×۴۴ بار در لایه موردی ضرب می شود. هر بار ضرب، (K×K×۱۰) ضرب دارد.

$$99 \times K \times K \times 10 \times 44 \times 44 = 99 \times 44 \times 44 \times 9 \times 9 \times 10 =$$

$$338722 \ 590$$