Homework 10

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(a)

Shape is (1000, 3, 256, 256). Each dim means: images number, color(R, G, B), image width, image height.

(b)

Shape is (40, 80, 2400). Each dim means: recording number, channels, samples.

(c)

Shape is (32, 300, 3, 512,512). Each dim means: video number, frame number, color(R, G, B), image width, image height.

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(a)

$i + k_i$ and $i + k_2$ should within the boundary of the X.

(b)

The size of Z will be $[5 \times 4]$.

(c)

The largest positive values will be 6, the position is (1,3), (2,3), (3,3).

(d)

The largest negative values will be -2, the position is (3, 4).

(e)

0 will appears on position (1, 1), (1, 2)

3

(a)

Shapes of Z and U is $[i - k_1 + 1 \times j - k_2 + 1 \times n] = [46 \times 62 \times 10]$

(b)

Number of input channel is $48 \times 64 \times 10 = 30720$

Number of input channel is $46 \times 62 \times 10 = 28520$

(c)

Multiplications will be performed $46 \times 62 \times 10 = 28520$ times.

(d)

Trainable parameters will be $3 \times 3 \times 10 \times 20 + 10 = 1810$

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(a)

$$\frac{\partial J}{\partial Z[i, j_1, j_2, m]} = \frac{\partial J}{\partial U} \cdot \frac{\partial U}{\partial Z[i, j_1, j_2, m]} = \frac{\partial J}{\partial U} \cdot \frac{e^{-Z[i, j_1, j_2, m]}}{(1 + e^{-Z[i, j_1, j_2, m]})^2}$$

(b)

$$\begin{aligned}\frac{\partial J}{\partial W[k_1, k_2, n, m]} &= \frac{\partial J}{\partial Z[i, j_1, j_2, m]} \cdot \frac{Z[i, j_1, j_2, m]}{W[k_1, k_2, n, m]} \\ &= \frac{\partial J}{\partial Z[i, j_1, j_2, m]} \cdot X[i, j + k_1, j_2 + k_2, n]\end{aligned}$$

(c)

$$\begin{aligned}\frac{\partial J}{\partial X[i, j_i, j_2, n]} &= \frac{\partial J}{\partial Z[i, j_1, j_2, m]} \cdot \frac{Z[i, j_1, j_2, m]}{X[i, j_i, j_2, n]} \\ &= \frac{\partial J}{\partial Z[i, j_1, j_2, m]} \cdot W[k_1, k_2, n, m]\end{aligned}$$

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(a)

$$\mathbf{y} = [2, 2, 10, 0]$$

(b)

$$\mathbf{y} = [2, 3, 10, 1]$$

(c)

If using sub-sampling with stride = s, shape will be (B, N, Ceil(C/s)).

if using max pooling with size=p and stride=s, shape will be (B, N, Ceil(C/s))