

CNN basics

Friday, October 9, 2020 12:53 AM

$$\circ \left(\frac{(w - f + 2p)}{\text{Stride}} + 1 \right) = \text{next feature map dim.}$$

Backpropagation -

x_{11}	x_{12}	x_{13}
x_{21}	x_{22}	x_{23}
y_{31}	y_{32}	y_{33}

*

f_{11}	f_{12}
f_{21}	f_{22}

=

0_{11}	0_{12}
0_{21}	0_{22}

$$\theta_{11} = x_{11} \bar{F}_{11} + x_{12} \bar{F}_{12} + x_{21} \bar{F}_{21} + x_{22} \bar{F}_{22}$$

$$\frac{\partial \theta_{11}}{\partial \bar{F}_{11}} = x_{11}, \quad \frac{\partial \theta_{11}}{\partial \bar{F}_{12}} = x_{12}, \quad \frac{\partial \theta_{11}}{\partial \bar{F}_{21}} = x_{21}, \quad \frac{\partial \theta_{11}}{\partial \bar{F}_{22}} = x_{22}$$

$$\theta_{12} = x_{12} \bar{F}_{11} + x_{13} \bar{F}_{12} + x_{22} \bar{F}_{21} + x_{23} \bar{F}_{23}$$

$$\left(\frac{\partial \theta_{12}}{\partial \bar{F}_{11}} = x_{12}, \quad \frac{\partial \theta_{12}}{\partial \bar{F}_{12}} = x_{13}, \quad \frac{\partial \theta_{12}}{\partial \bar{F}_{21}} = x_{22}, \quad \frac{\partial \theta_{12}}{\partial \bar{F}_{23}} = x_{23} \right)$$

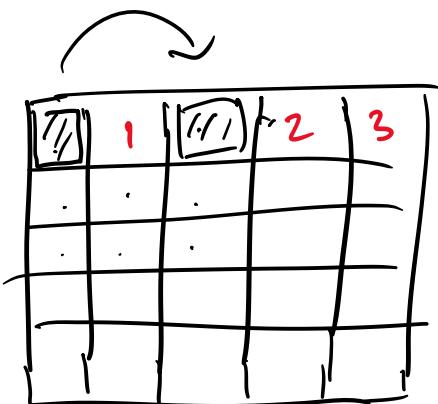
$$\frac{\partial \theta}{\partial F} = \begin{bmatrix} X_{11} + X_{12} + X_{21} + -X_{22} \\ X_{12} + X_{13} + X_{22} + X_{23} \\ X_{21} + \dots \\ X_{22} + \dots \end{bmatrix}$$

So, $\frac{\partial \text{loss}}{\partial F} = \underline{\underline{X}} * \frac{\partial \text{loss}}{\partial \theta}$ — as $\frac{\partial \text{loss}}{\partial F_{xy}} = \sum \frac{\partial \theta_{ij}}{\partial F_{xy}} \times \left(\frac{\partial \text{loss}}{\partial \theta_{ij}} \right)$

$$\frac{\partial \text{loss}}{\partial x} = ?$$

$$\rightarrow F(\text{pad}=2) * \left(\frac{\partial \text{loss}}{\partial o} \right)_{\text{flip ped}}$$

Receptive field :-



Stride = 1

IK = 3

$$(\text{num_P})(n_f - 1) + x = \text{input_dim}$$

Complexity of a CNN mult.

filter - K

in-channel - N

out-channel - M

in-dims - H, w

So,

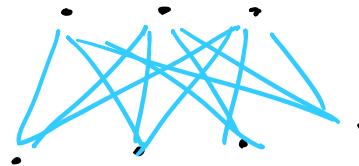
$$O(H \times w \times K^2 \times N \times M)$$

3×3 conv

Spatial -



Channel -

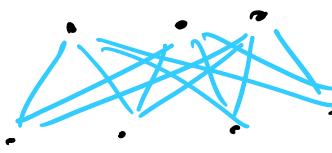


1×1 conv

Spatial



Channel



Complexity - $(HWNM)$