

Lecture 12. Convolutional Neural

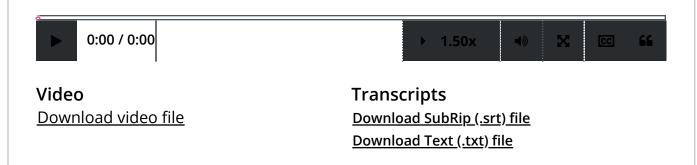
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3. CNN - Continued Convolution Neural Networks (Continued)





CNN - Numerical Example

1/1 point (graded)

In this problem, we are going to work out the outputs of a tiny toy example of CNN that is made up of just one conv layer consisting of just one filter F of shape 2×2 followed by a max-pooling layer of shape 2×2 . The input image is of shape 3×3

The output of the CNN is calculated as $\operatorname{Pool}\left(\operatorname{ReLU}\left(\operatorname{Conv}\left(I\right)\right)\right)$ where ReLU is the rectified linear activation function given by:

$$\operatorname{ReLU}(x) = \max(0, x)$$

Also assume that the stride for the convolution and pool layers is $\boldsymbol{1}$

For the following values of the image I and filter weights F enter below the value of the output of the CNN (hint - it will be a single integer):

$$I = egin{bmatrix} 1 & 0 & 2 \ 3 & 1 & 0 \ 0 & 0 & 4 \end{bmatrix}$$

$$F = egin{bmatrix} 1 & 0 \ 0 & 1 \end{bmatrix}$$

5

✓ Answer: 5

Solution:

First let's calculate the output of the convolutional layer

$$I = egin{bmatrix} 1 & 0 & 2 \ 3 & 1 & 0 \ 0 & 0 & 4 \end{bmatrix}$$

$$F = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\operatorname{Conv}\left(I
ight) = egin{bmatrix} 1 & 0 & 2 \ 3 & 1 & 0 \ 0 & 0 & 4 \end{bmatrix} \cdot egin{bmatrix} 1 & 0 \ 0 & 1 \end{bmatrix}$$

$$\operatorname{Conv}\left(I
ight)=egin{bmatrix}2&0\3&5\end{bmatrix}$$

$$\operatorname{ReLU}\left(\operatorname{Conv}\left(I
ight)
ight)=\operatorname{ReLU}\left(\left[egin{matrix}2&0\3&5\end{matrix}
ight]
ight)$$

$$\operatorname{ReLU}\left(\operatorname{Conv}\left(I
ight)
ight) = egin{bmatrix} 2 & 0 \ 3 & 5 \end{bmatrix}$$

$$\operatorname{Pool}\left(\operatorname{ReLU}\left(\operatorname{Conv}\left(I\right)\right)\right) = \operatorname{Pool}\left(\begin{bmatrix}2 & 0 \\ 3 & 5\end{bmatrix}\right)$$

$$\operatorname{Pool}\left(\operatorname{ReLU}\left(\operatorname{Conv}\left(I\right)\right)\right)=5$$

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You have used 3 of 3 attempts

1 Answers are displayed within the problem

CNN Meaning

1/1 point (graded)

If you are trying to recognize a large number of features, you should have a small number of filters.

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Solution:

Each filter represents a distinct set of weights, which corresponds to searching for a particular feature in the image. If you have a large number of features, you want many filters.

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