

# Convolution Layers 실습

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## Parameters

Conv2d(in\_channels, out\_channels, kernel\_size, stride=1, padding=0, dilation=1, groups=1, bias=True, padding\_mode='zeros')

- input size (10, 1, 20, 20)
- N (batch 크기) : 10
- C (channel) : 1
- H (2D input Tensor 높이) : 20
- W (2D input Tensor 너비) : 20

```
연산 전 >> torch.Size([10, 1, 20, 20])
conv1 연산 후 >> torch.Size([10, 3, 16, 16])
conv2 연산 후 >> torch.Size([10, 10, 12, 12])
차원감소 연산 후 >> torch.Size([10, 1440])
fc1 연산 후 >> torch.Size([10, 50])
fc2 연산 후 >> torch.Size([10, 10])
```

```
self.conv1 = nn.Conv2d(in_channels=1, out_channels=3, kernel_size=5, stride=1)
self.conv2 = nn.Conv2d(in_channels=3, out_channels=10, kernel_size=5, stride=1)
self.fc1 = nn.Linear(10 * 12 * 12, 50)
self.fc2 = nn.Linear(50, 10)
```

```
cnn = CNN()

# input size 10, 1, 20, 20
output = cnn(torch.randn(10, 1, 20, 20))
```

① conv 1 연산

$$H_{out}, W_{out} = \frac{20 + 2 \times 0 - 1 \times (5 - 1) - 1}{1} + 1 = \frac{15}{1} + 1 = 16$$
$$= 20 + 0 - 1 \times 4 - 1$$
$$= 20 + 0 - 4 - 1 = 15$$

(10, 3, 16, 16)

② conv 2 연산

$$\frac{16 + 2 \times 0 - 1 \times (5 - 1) - 1}{1} + 1 = 11 + 1 = 12$$
$$16 + 0 - 1 \times 4 - 1$$
$$= 16 + 0 - 4 - 1 = 11$$

(10, 10, 12, 12)

③ 차원감소

$$10 \times 12 \times 12 = 1440$$

(10, 1440)

④ fc1 연산

in-features =  $10 \times 12 \times 12$

out-features = 50

input : (10, 1440)

(10, 50)

⑤ fc 2 연산

in-features = 50

out-features = 10

(10, 10)

input (10, 50)

Shape:

- Input:  $(*, H_{in})$  where \* means any number of dimensions including none and  $H_{in} = \text{in\_features}$
- Output:  $(*, H_{out})$  where all but the last dimension are the same shape as the input and  $H_{out} = \text{out\_features}$ .

- 입력 크기=(H, W)
- 필터 크기=(FH, FW)
- 출력 크기=(OH, OW)
- 패딩=P
- 스트라이드=S

$$OH = \frac{H + 2P - FH}{S} + 1$$

$$OW = \frac{W + 2P - FW}{S} + 1$$

Output Tensor( $N, C_{out}, H_{out}, W_{out}$ )

- $N$ : batch의 크기
- $C_{out}$ : out\_channels 에 넣은 값과 일치 함.
- $H_{out} = \lfloor \frac{H_{in} + 2 \times padding[0] - dilation[0] \times (kernel\_size[0] - 1) - 1}{stride[0]} + 1 \rfloor$
- $W_{out} = \lfloor \frac{W_{in} + 2 \times padding[1] - dilation[1] \times (kernel\_size[1] - 1) - 1}{stride[1]} + 1 \rfloor$