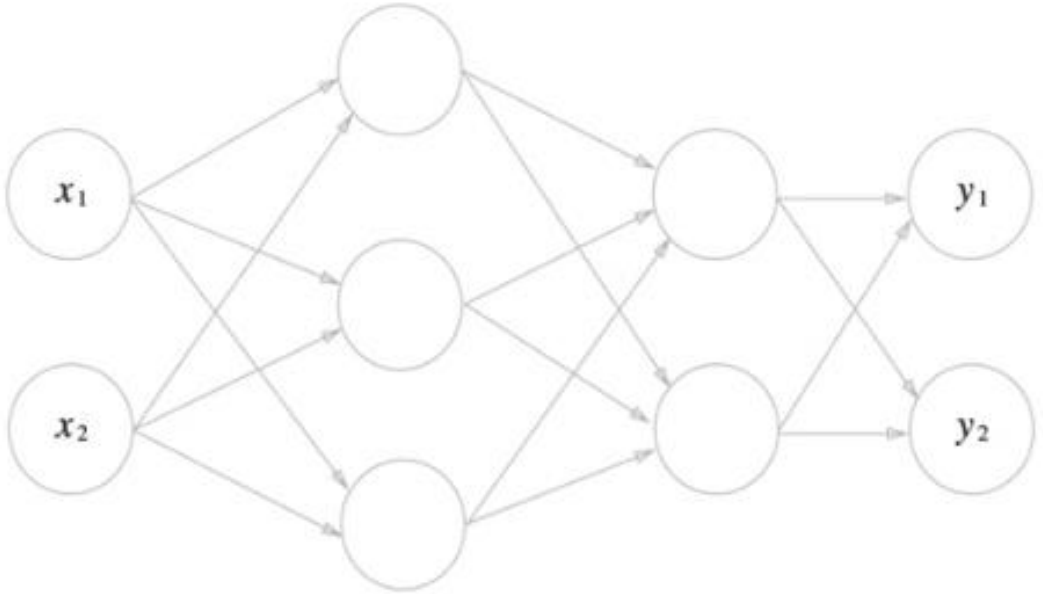
합성곱 CNN

7장

완전 연결 계층

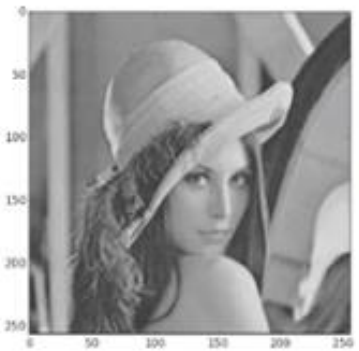
- 정의 :

인접하는 계층의 모든 뉴런이 결합



- 단점 :

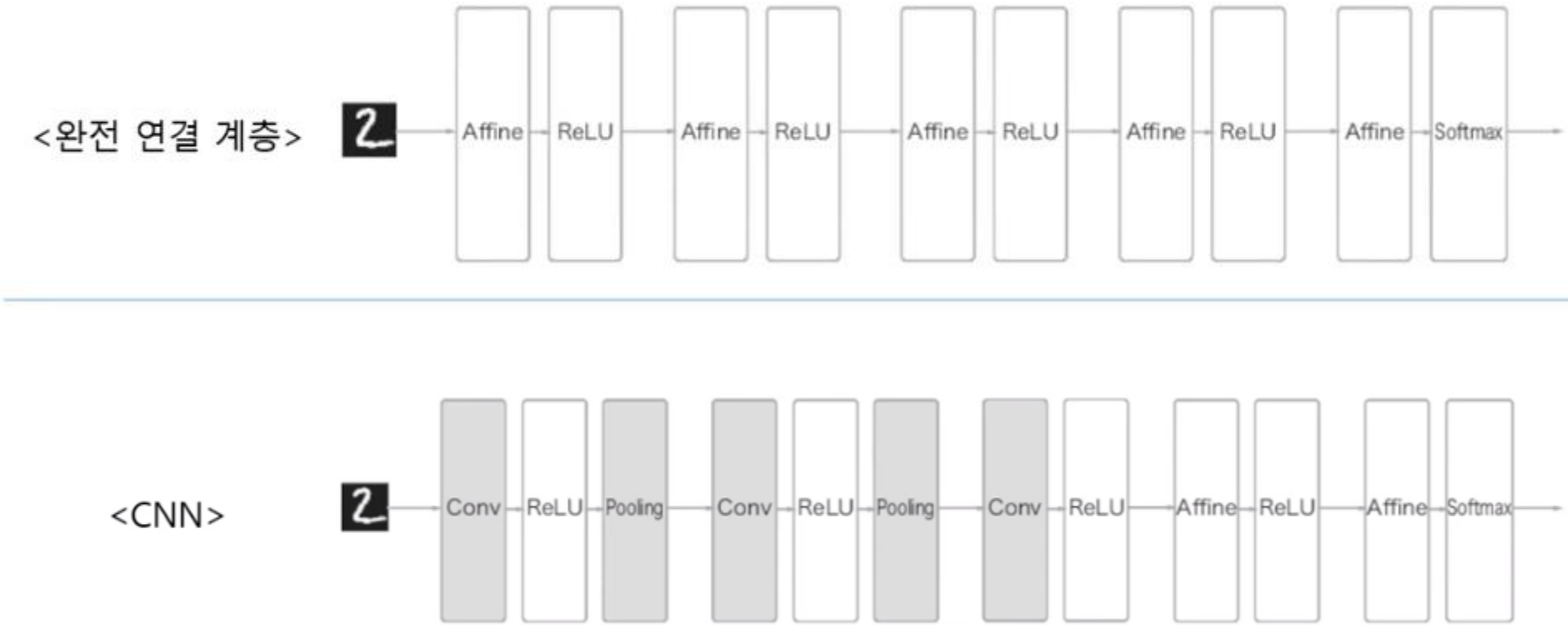
데이터의 형상이 무시됨



```python
def get_data():
    (x_train, t_train, t_train), (x_test, t_test) = ㅠ
    load_mnist(nomalize = True, flatten= True, one_hot_label = False)

    return x_test, t_test
```

< 평탄화 코드 >
(p100)

완전 연결 계층/ CNN 계층비교

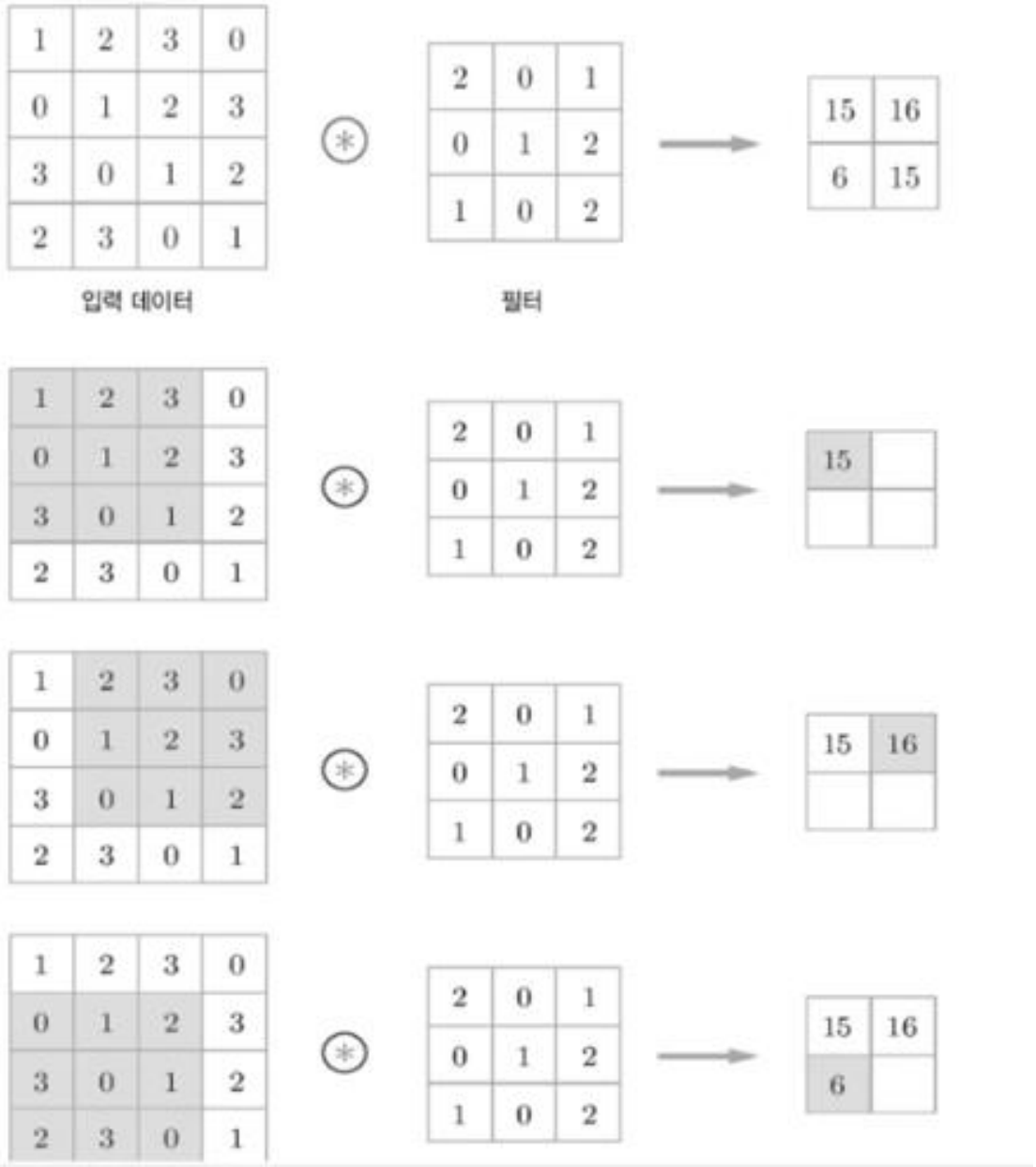


합성 곱 계층(Conv)
(합성 곱 연산)

1. 정의 : 입력 데이터에 필터를 적용하는 것

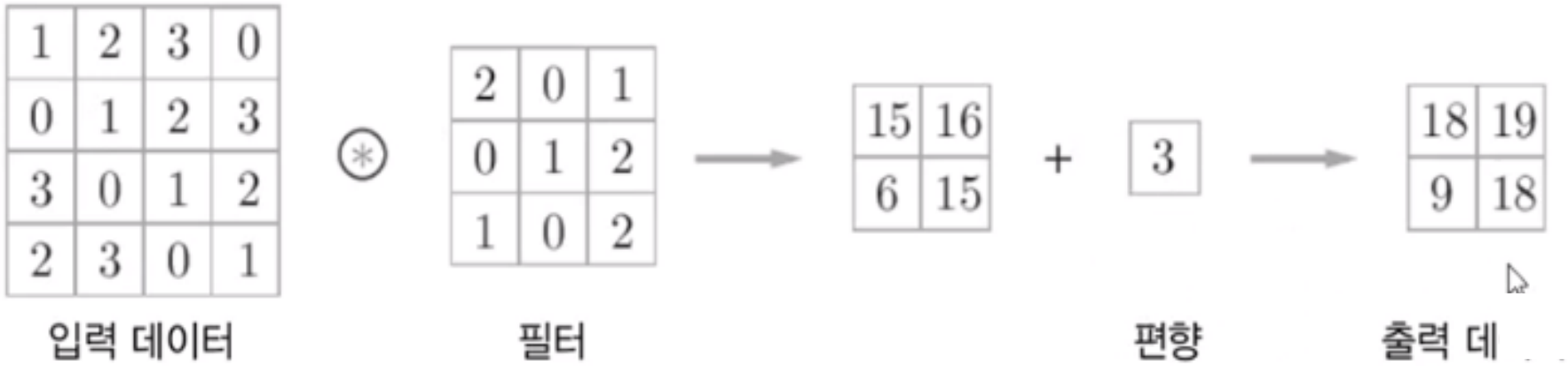
2. 방법 : - 입력과 필터에서 대응하는 원소끼리 곱합
   - 곱셈 결과의 총 합을 구함
   - 윈도우를 이동

ex) 1*2 + 2*0 + 3*1
+ 0*0 + 1*1 + 2*2
+ 3*1 + 0*0 + 1*2 = 15



편향

- 항상 하나(1 X 1) 만 존재

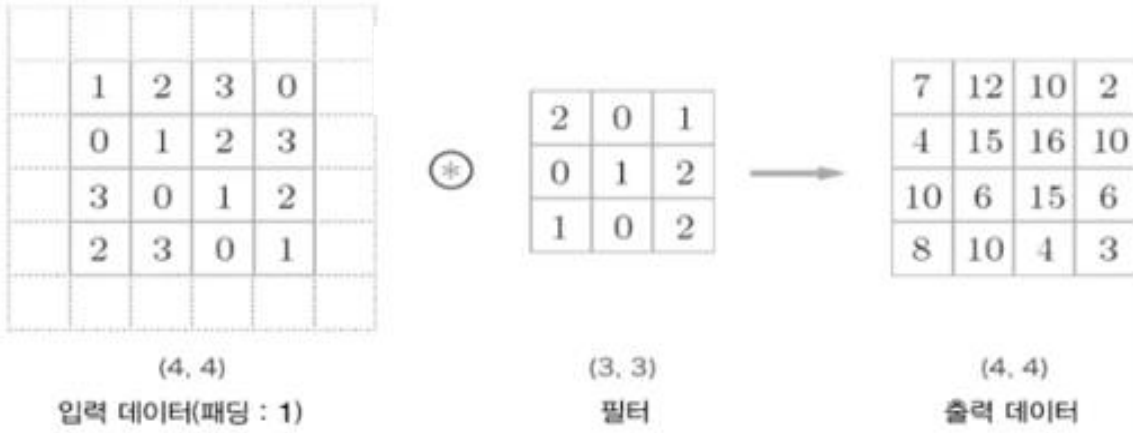


Numpy 에서는 1 x 1 행렬을 더해주는 것으로 수행가능하다!

패딩

- 정의 : 데이터 주변을 특정 값으로 채우는 것
- 효과 : 출력 크기를 조정 가능

<패딩 0>

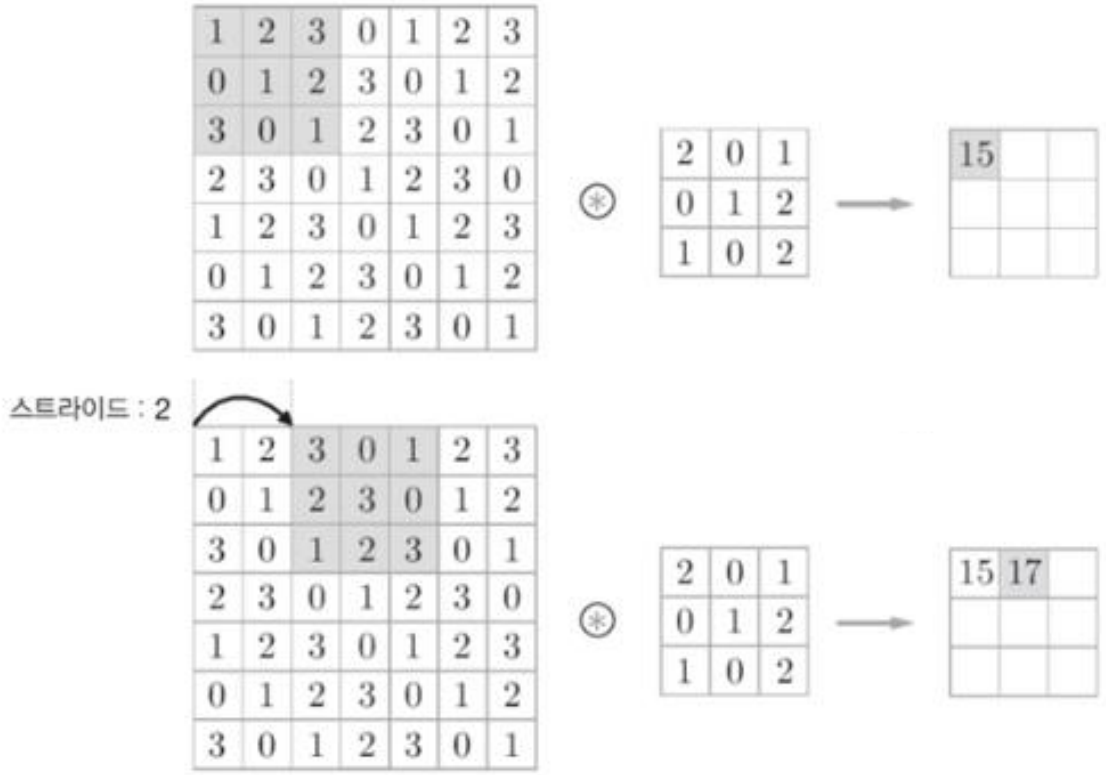


<패딩 x>

스트라이드

- 정의 : 필터를 적용하는 간격을 지정

< 스트라이드 2 예시 >



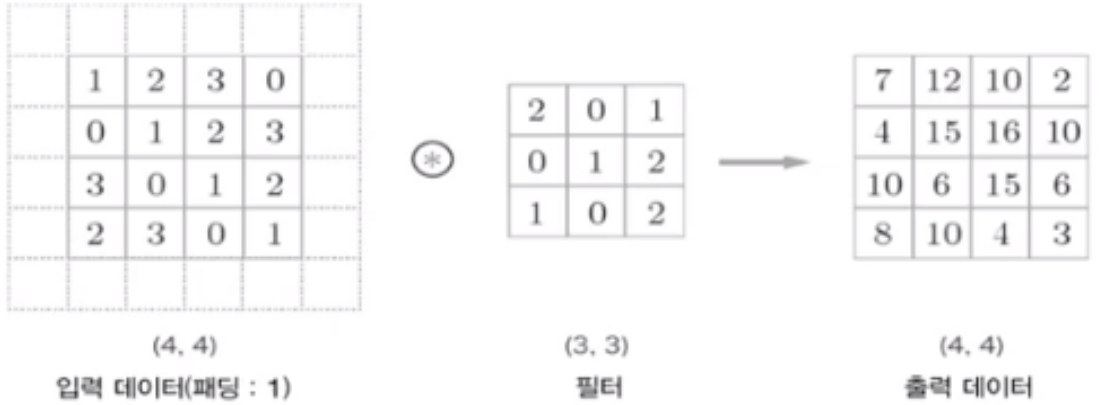
합성 곱 연산

입력 크기 : (H, W)
필터 크기 : (FN, FW)
출력 크기 : (OH, OW)
패딩 : P 스트라이드 : S

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

$$OW = \frac{H + 2P - FN}{S} + 1$$

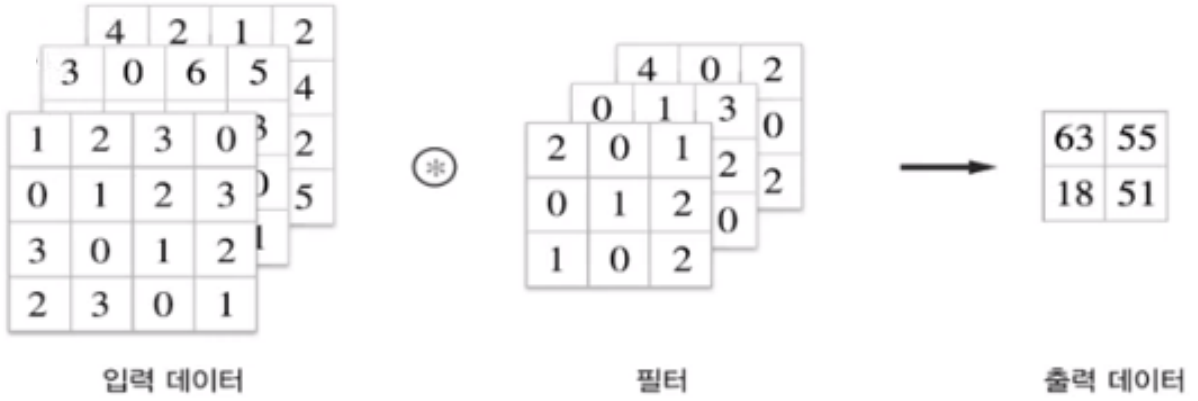
<예시>



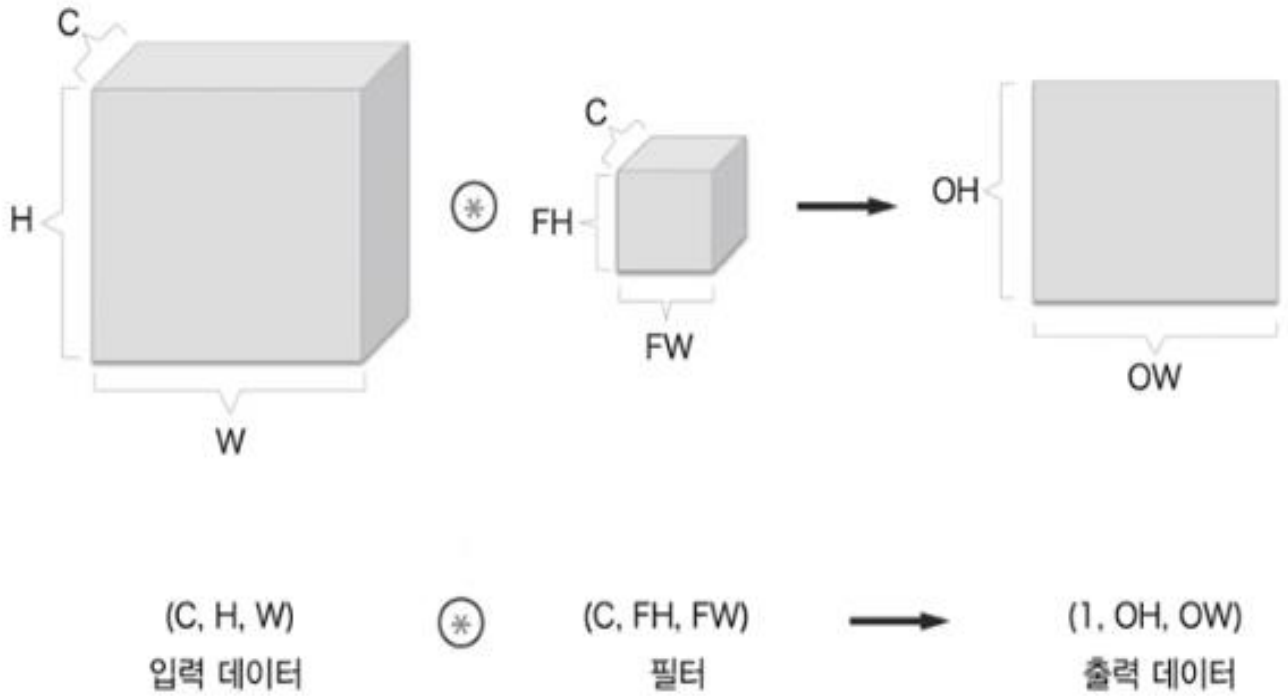
$$OH = \frac{4 + 2 * 1 - 3}{1} + 1 = 4$$

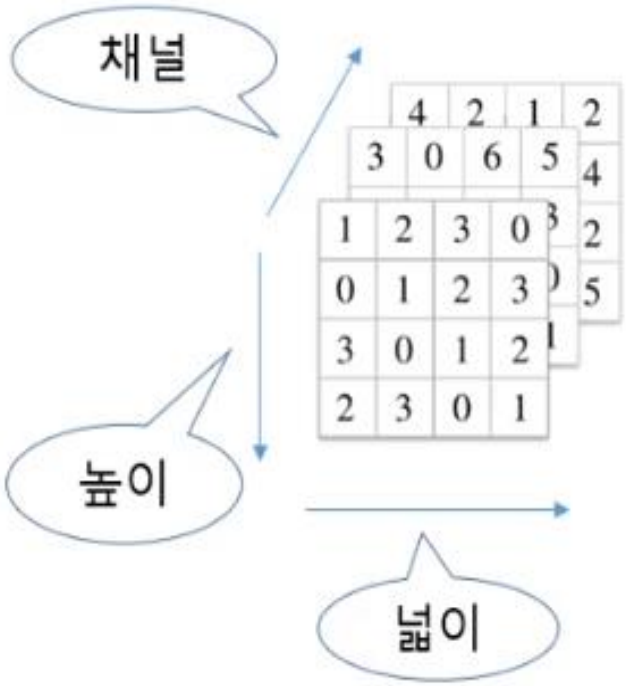
3차원 데이터의 합성 곱 연산

- idx 별 입력데이터와 필터 합성곱 연산
- idx 별 결과 데이터의 칸들끼리
  총 합

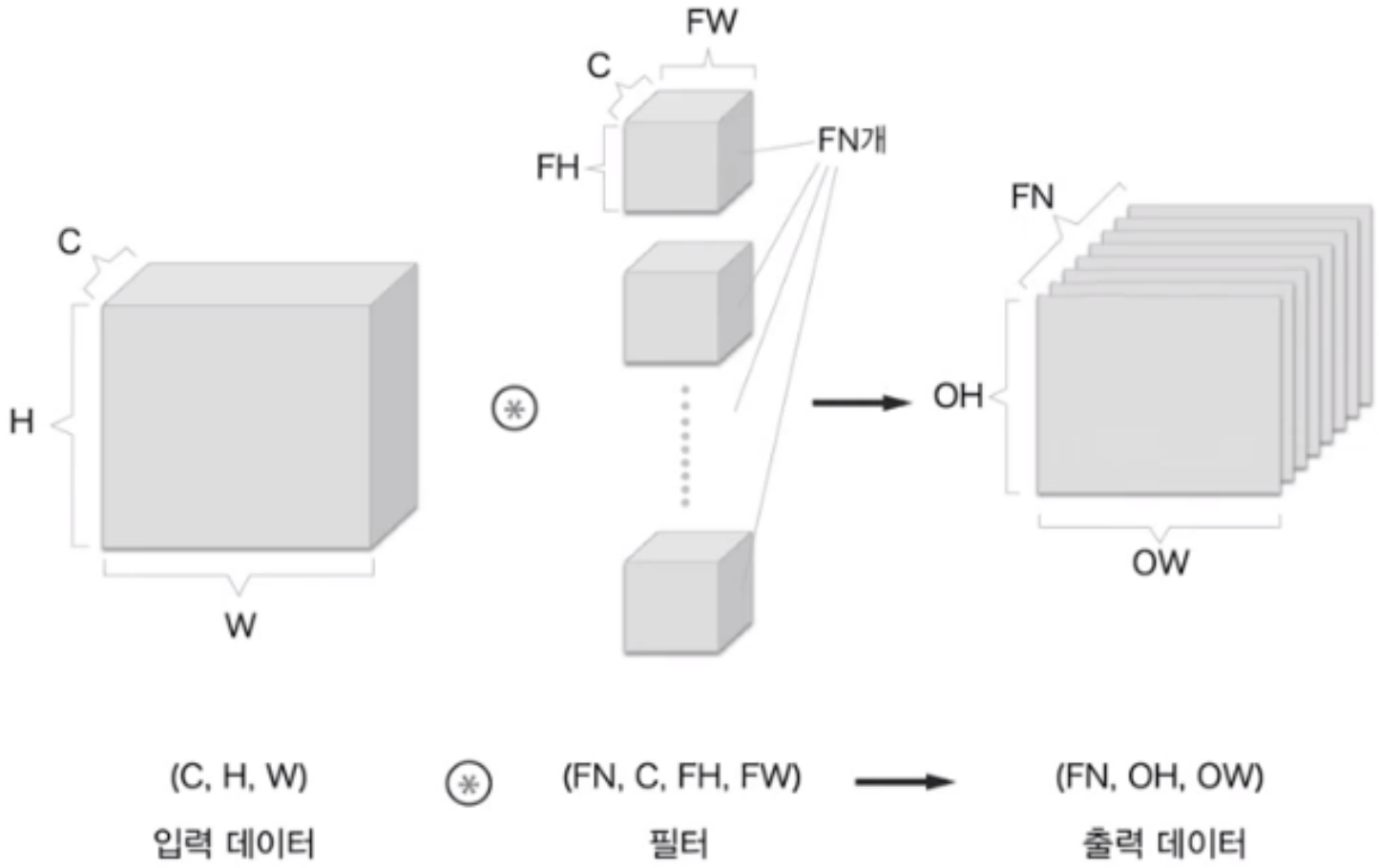


3차원 합성 곱

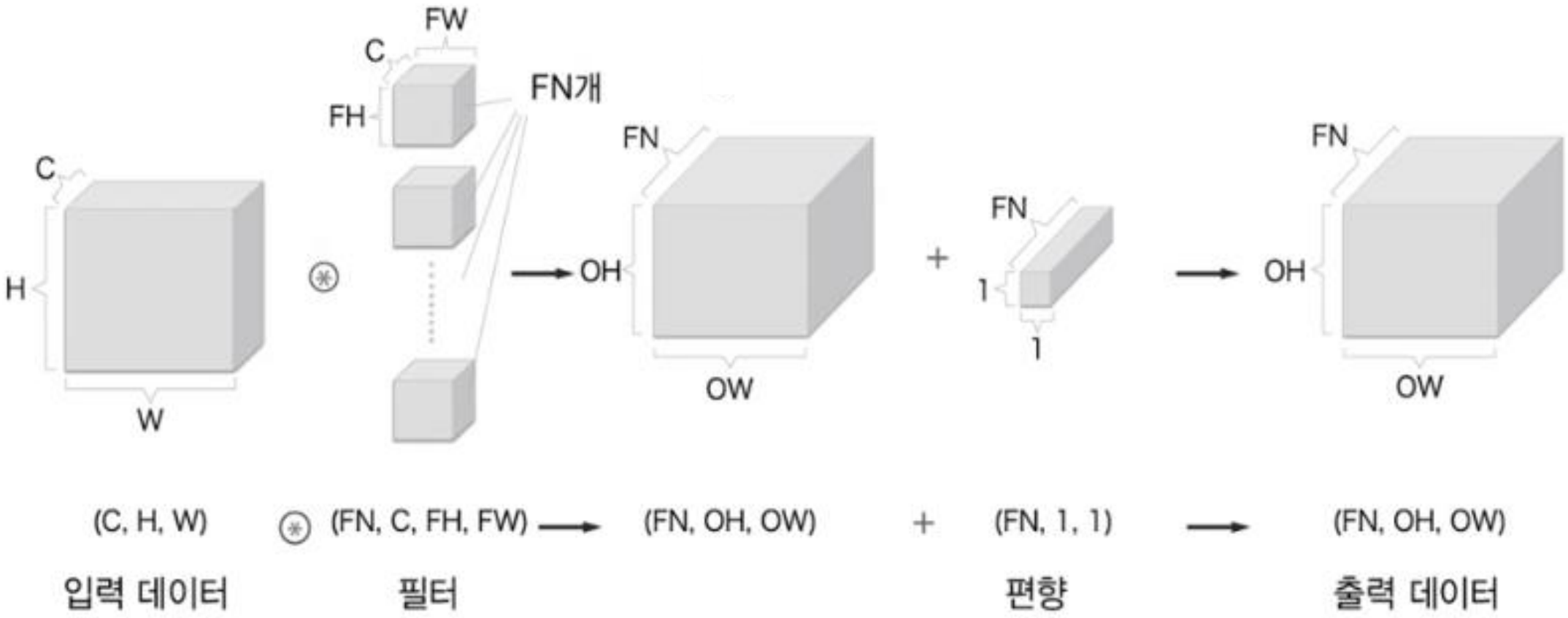




N x 채널



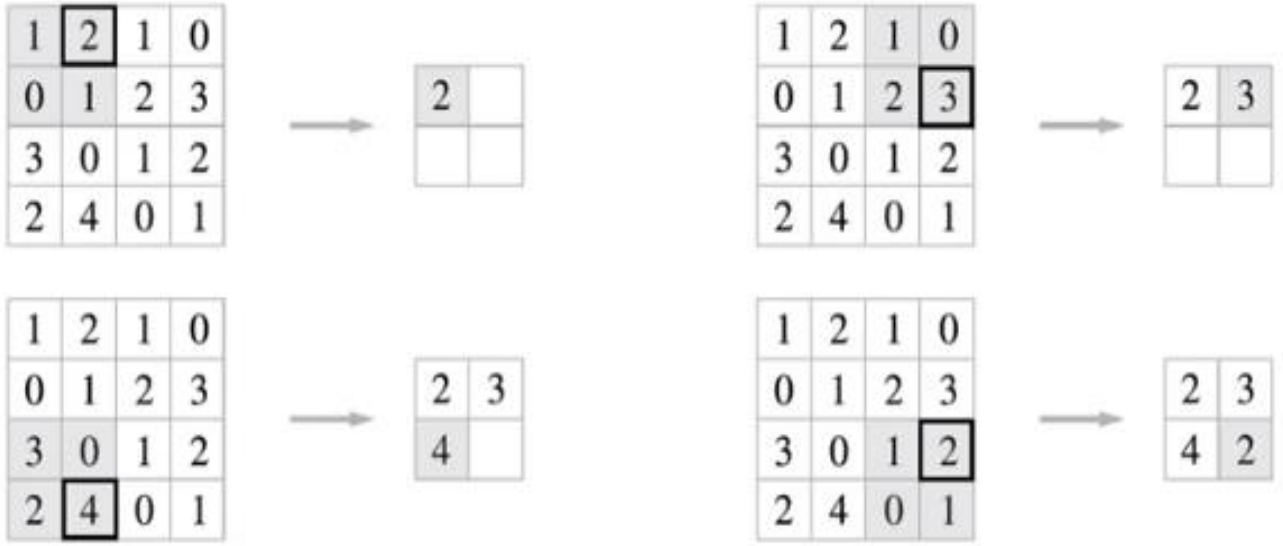
편향



풀링

- 정의 : 세로 / 가로 방향의 공간을 줄이는 연산
- 최대 풀링 : 최대값만 뽑아내는 연산
- 풀링의 윈도우 크기와 스트라이드는 같은 값으로

< 2 X 2 최대 풀링 >

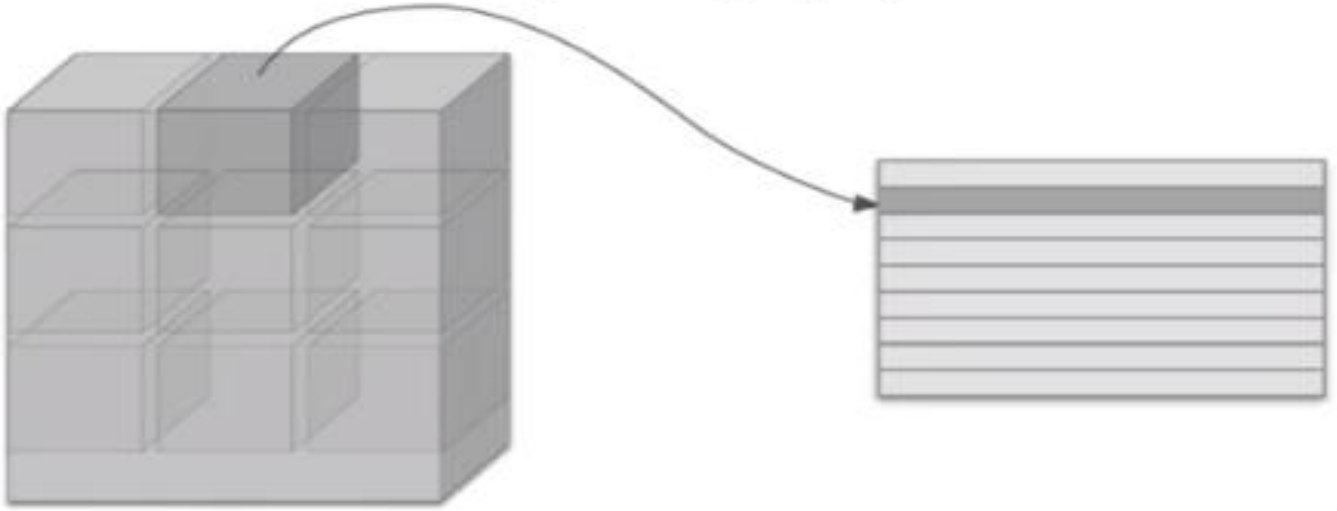


Im2col (함수)

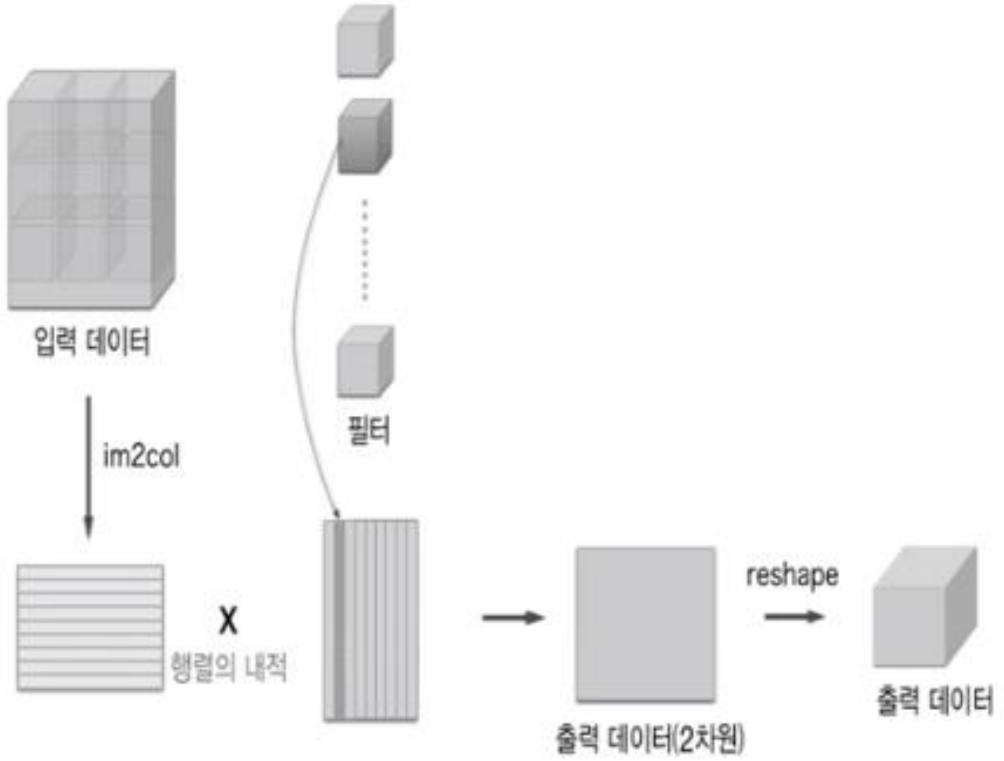
- 기능 : 입력 데이터를 가중치 계산에 용의하게 펼친다.

[데이터 수, 채널 수, 높이, 너비]

2차원 데이터

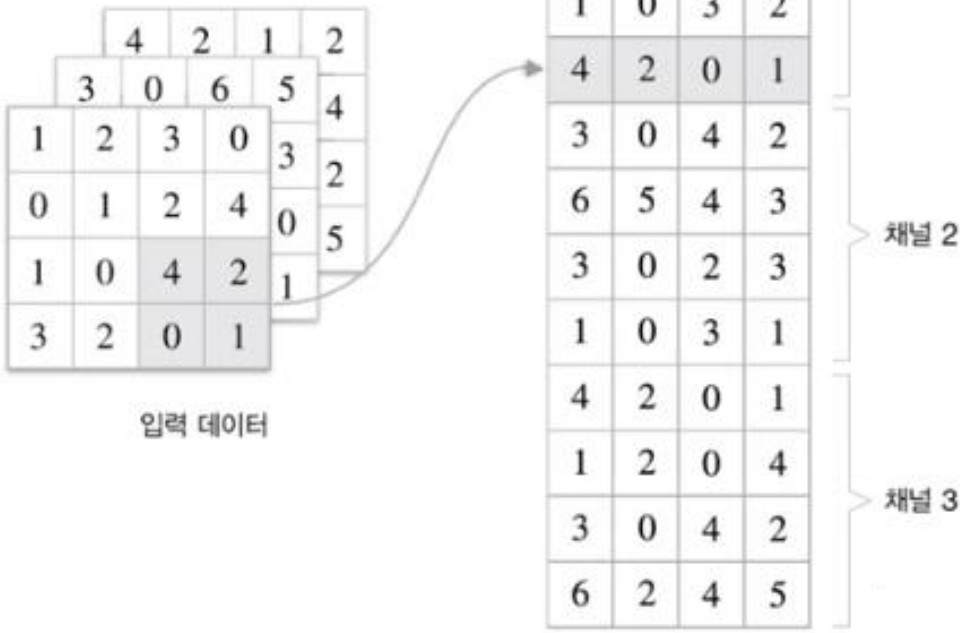


합성 곱 계층 코드



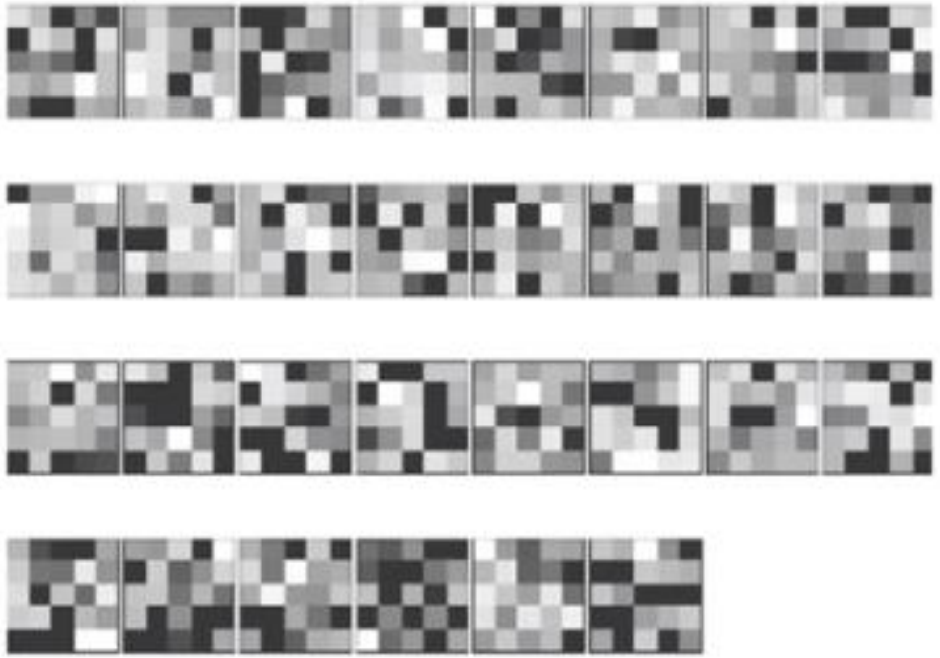

```python
class Convolution:
    def __init__(self, W, b, stride = 1, pad = 0 ):
        self.W = W
        self.b = b
        self.stride = stride
        self.pad = pad

    def forward(self, x):
        FN, C, FH, FW = self.W.shape
        N, C, H, W = x.shape
        out_h = int(1 + (H + 2*self.pad - FH) / self.stride)
        out_w = int(1 + (W + 2*self.pad - FW) / self.stride)

        col = im2col(x, FH, FW, self.stride, self.pad)
        col_W = self.W.reshape(FN, -1)
        out = np.dot(col, col_W) + self.b

        out = out.reshape(N, out_h, out_w, -1).transpose(0, 3, 1, 2)

        return out
```

풀링 계층 구현 (2 x 2)

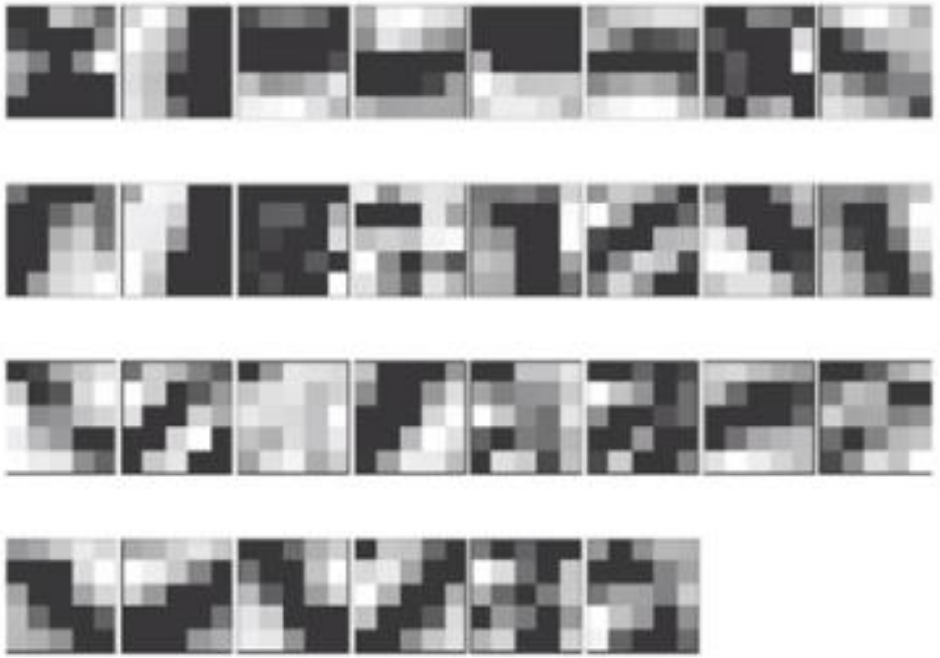


CNN 구현 <시각화>

학습 전



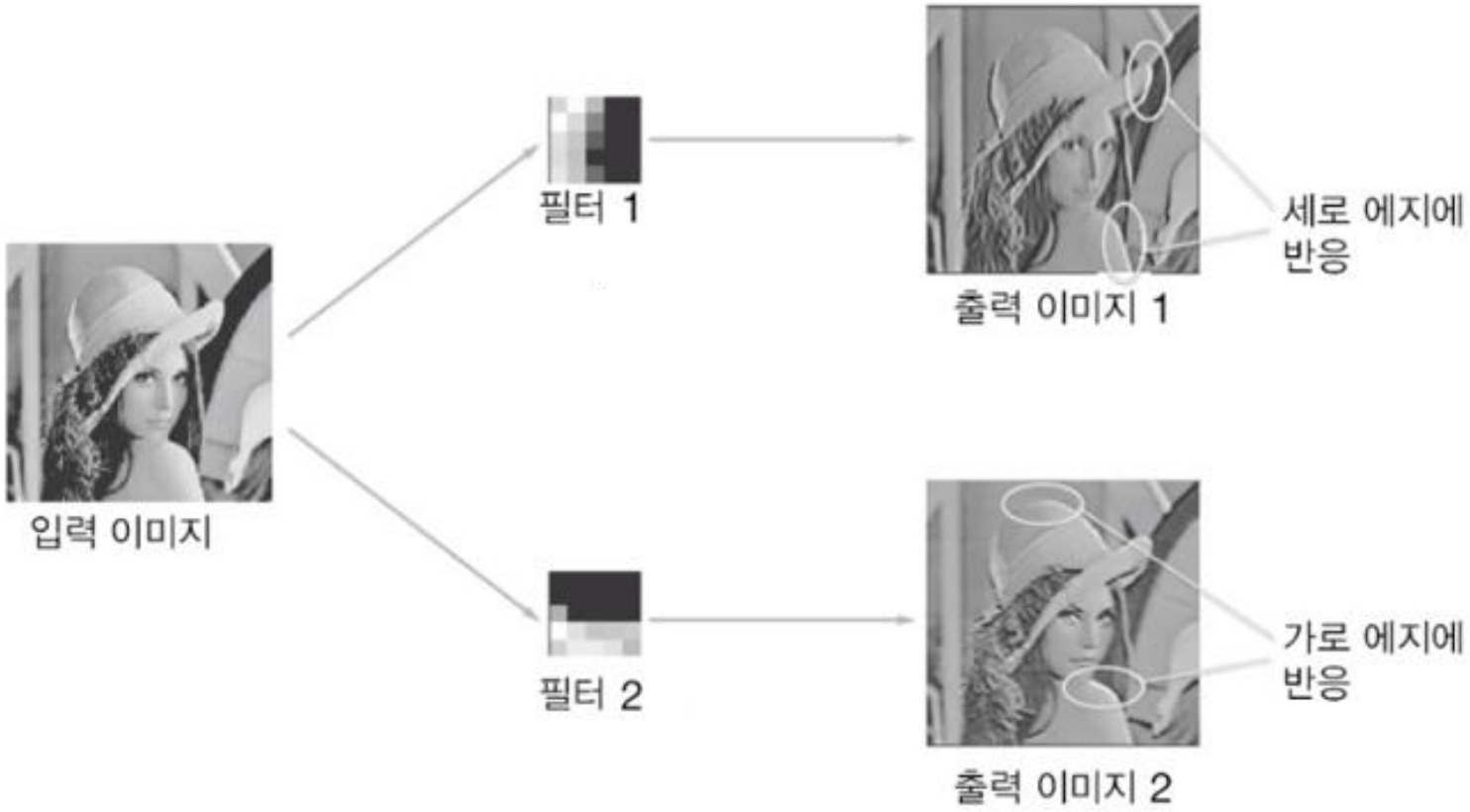
학습 후



CNN 구현 <시각화>

- 에지 :
색상이 바뀐 경계선

- 블롭 :
국소적으로 덩어리진 영영



THANK YOU