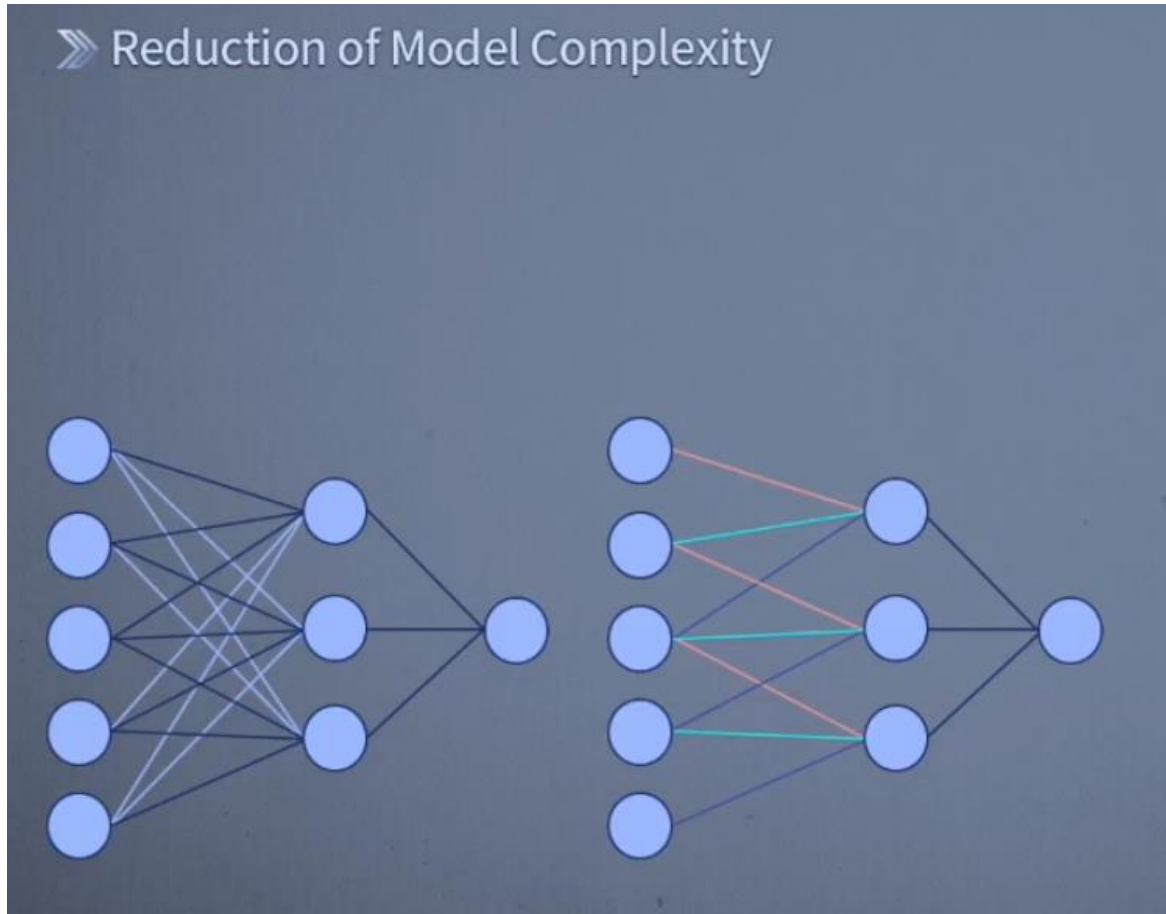


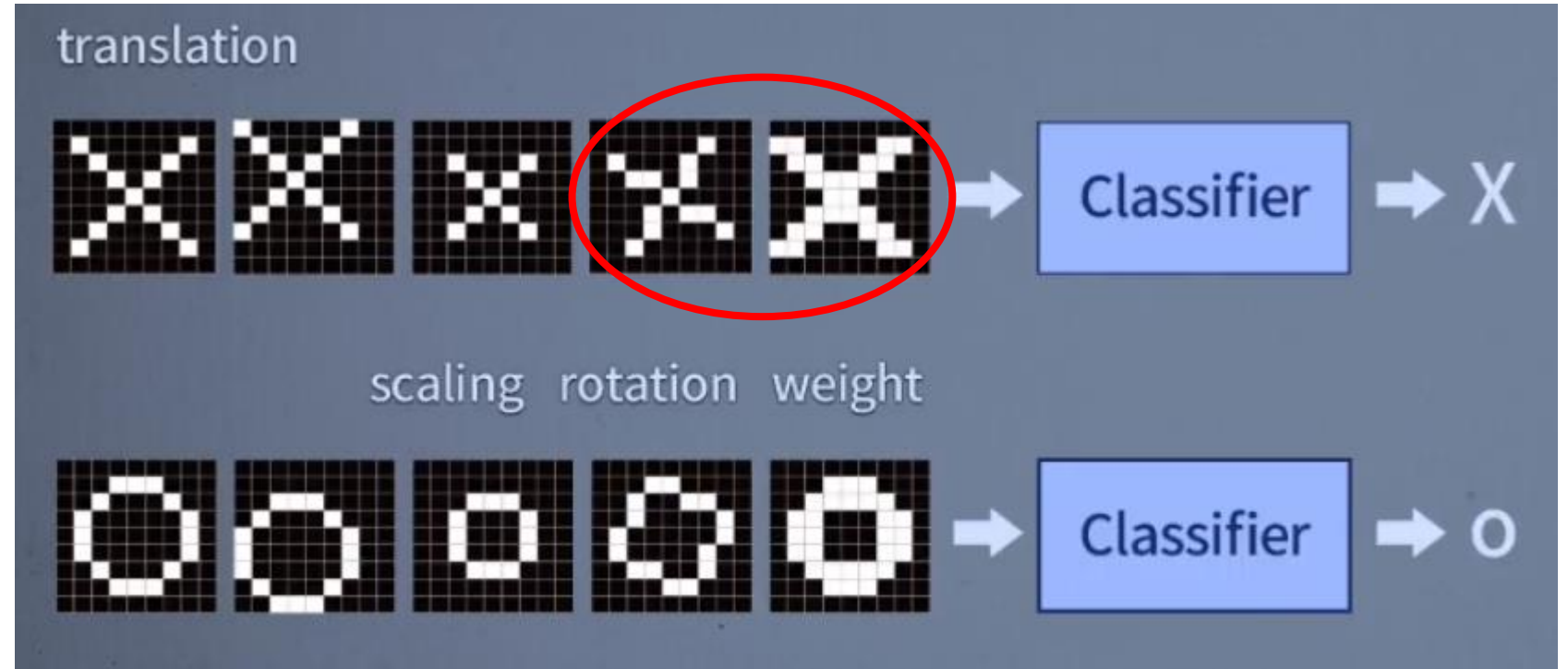
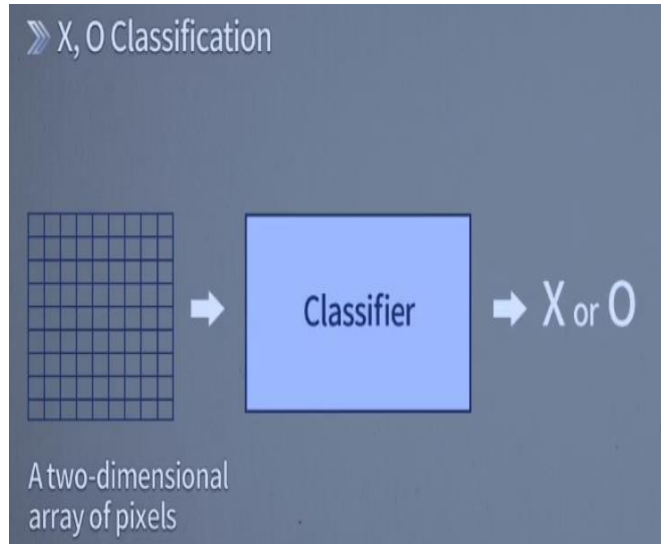
# Convolutional Neural Network 1

# Convolutional Neural Networks



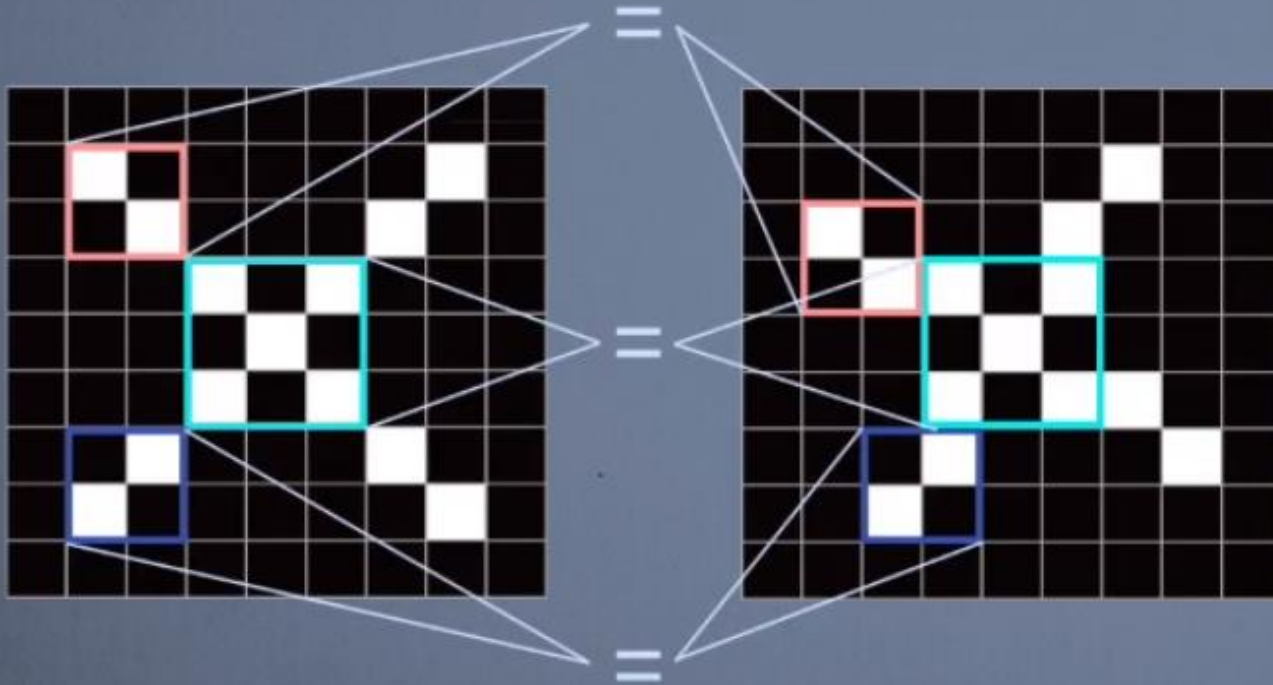
Partially connected & shared weights  
CNN은 Images, Speech, Text 분야에 주로  
사용됨

# Image classification



# Local feature

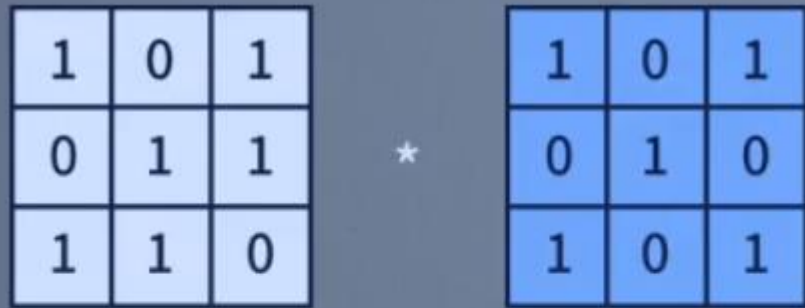
- Critical LOCAL features are the same



Local features를 찾아내고 그  
Local features를 종합하여 이미지를  
인식한다.

# Convolution 연산

- 이미지에서 local features를 찾아내는 연산(행렬)
- 두 행렬 size는 동일

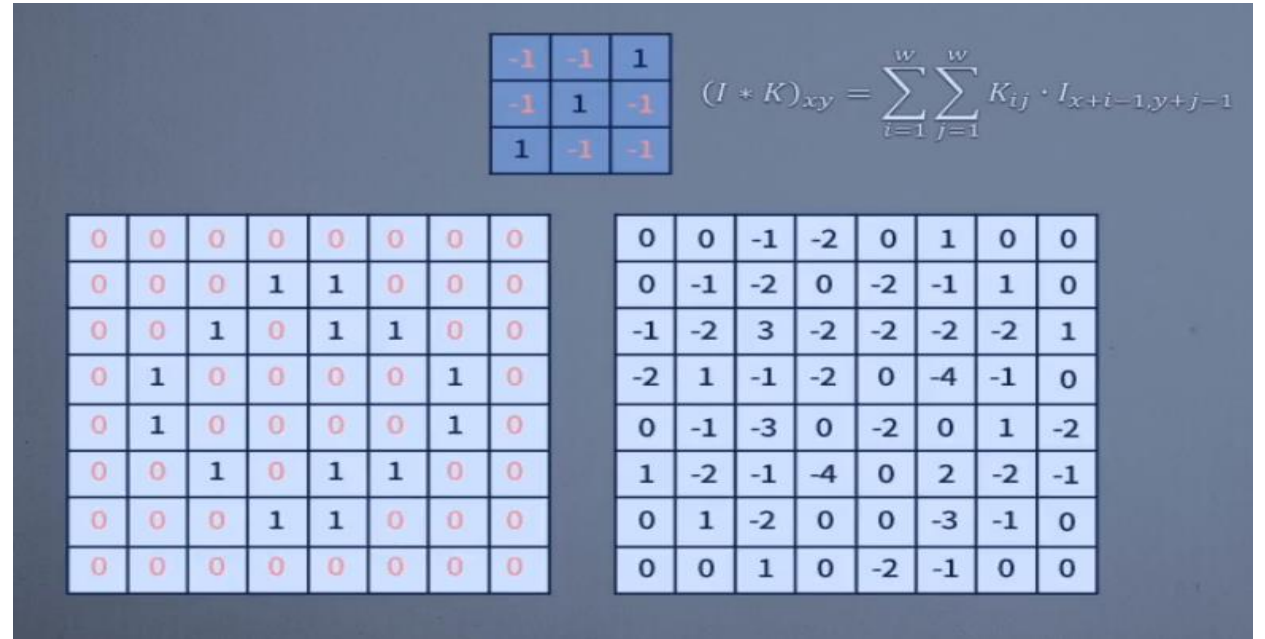
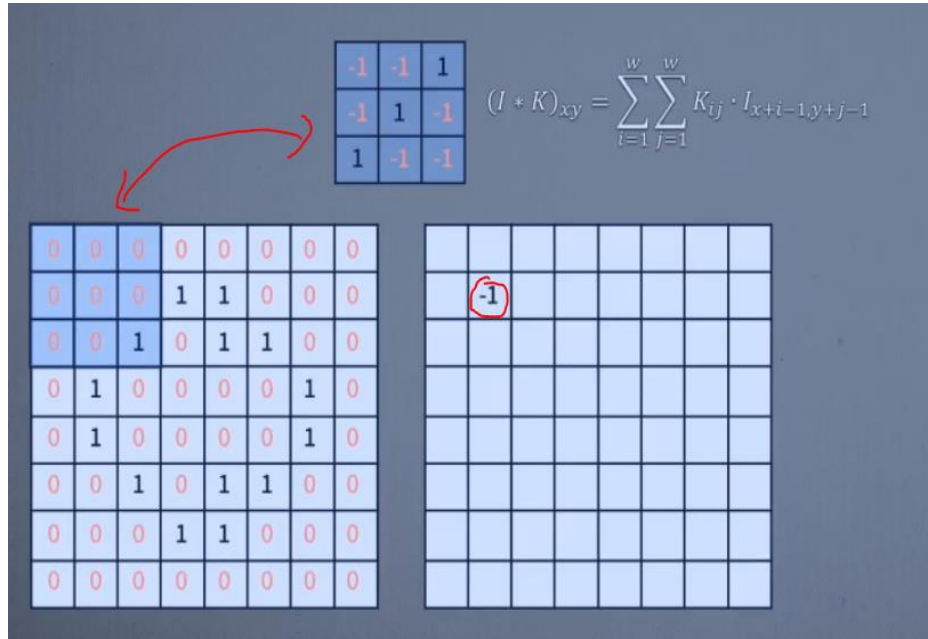


The diagram illustrates the convolution operation using two 3x3 matrices. The first matrix, representing the input image  $I$ , has a light blue background and contains the values:  $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ . The second matrix, representing the kernel  $K$ , has a darker blue background and contains the values:  $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ . A star symbol  $*$  is placed between the two matrices to denote the convolution operation.

$$I * K = \sum K_{ij} \times I_{ij}$$

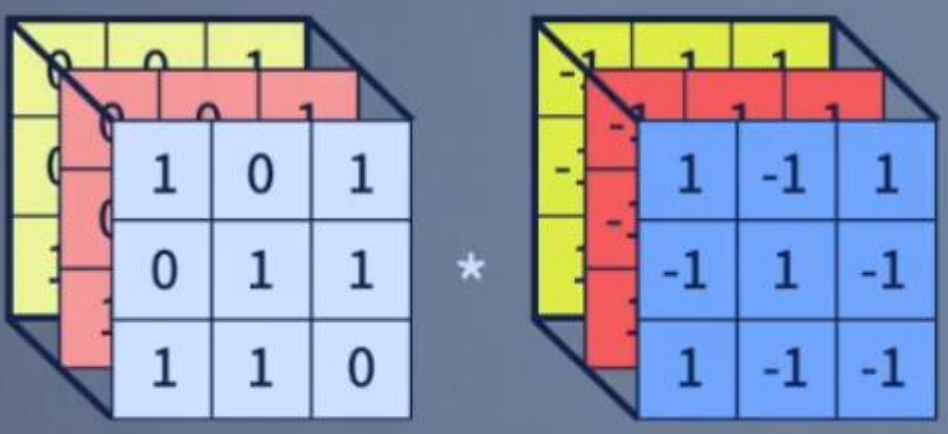
각 대응대는 pixel 끼리 곱하고, 다 더해준다.

# Convolution 연산



Convolution 결과에 zero padding한 결과 : feature map  
양수값이 크다 : 대각선이 원래 이미지에 나타나는 값(즉, local feature가 존재한다.  
음수값은 필요없으므로 0으로 바꿔준다.

# Convolution 연산(3D)



The diagram illustrates a 3D convolution operation. It shows two 3x3x3 tensors being multiplied (indicated by an asterisk) to produce a 3x3x3 result tensor. The first tensor has a blue front face with values  $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ , a red middle face with values  $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ , and a yellow back face with values  $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ . The second tensor has a blue front face with values  $\begin{bmatrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$ , a red middle face with values  $\begin{bmatrix} -1 & 1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$ , and a yellow back face with values  $\begin{bmatrix} -1 & 1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$ . Below the tensors, the convolution operation is represented by the equation:

$$I * K = \sum_{channel} \sum_{i,j} K_{ij}^{channel} \times I_{ij}^{channel}$$

R채널, G채널, B채널을 위한 Mask를 따로 정의하고 Convolution을 독립적으로 수행한다음 다 더한다.

Mask의 개수와 입력 이미지의 채널 개수는 같아야 한다.

Convolution 결과 local feature map은 무조건 1장이 나온다.

원래 이미지가 있고, 거기에 Convolution을 적용하면 feature map이 나온다.(Local feature를 강조한) 그러나 이 Feature map 또한 사실 이미지로 해석할 수 있다.