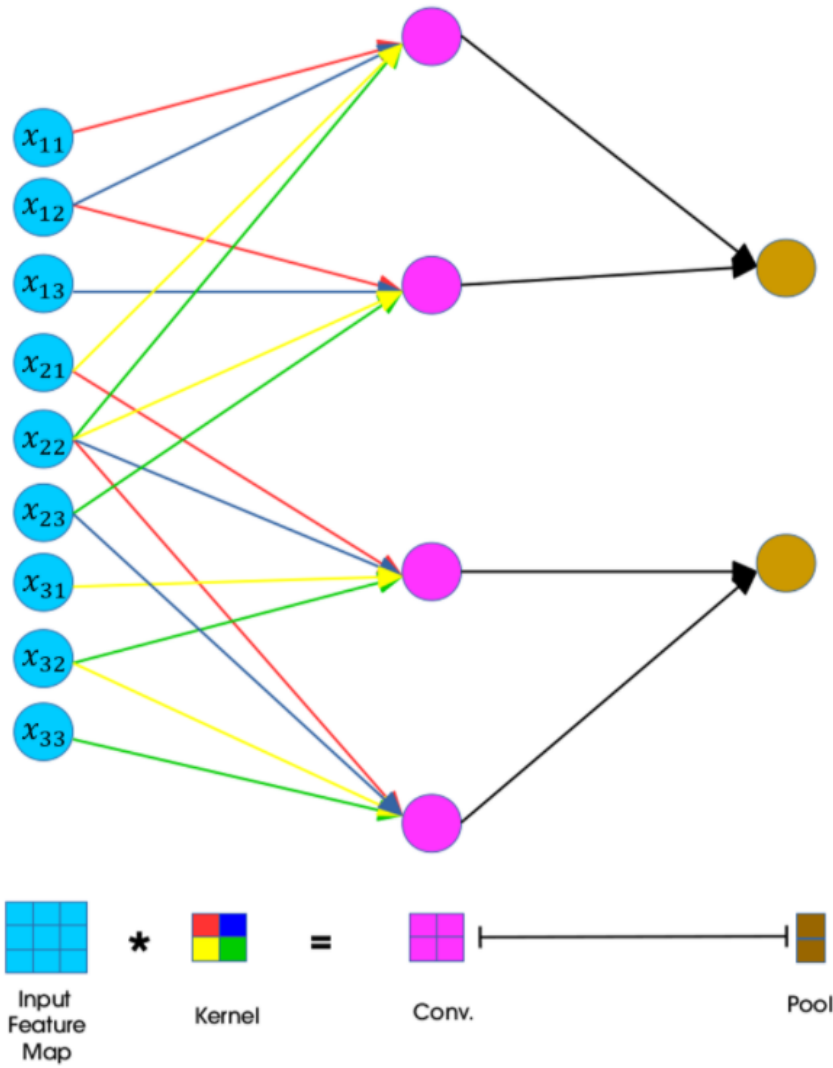
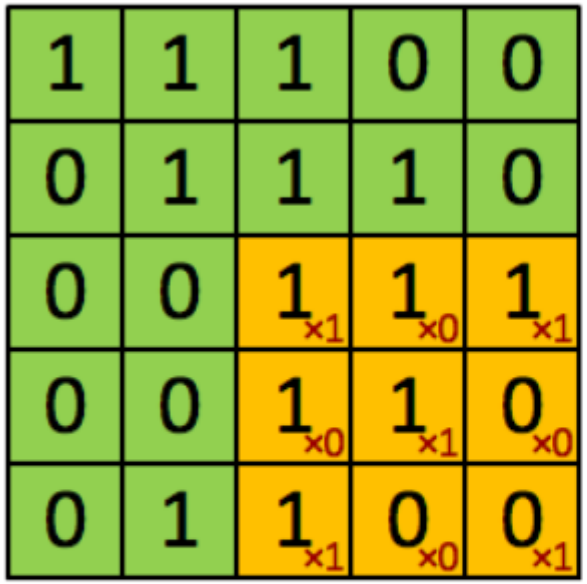
Ch07 Convolution Network

Convolution layer와 Pooling layer의 Backward pass 에 대하여

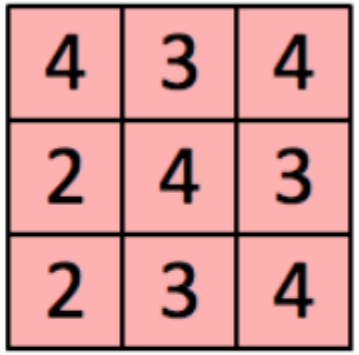
이미지 출처 및 참고 :
https://ratsgo.github.io/deep%20learning/2017/04/05/CNNbackprop/

합성곱





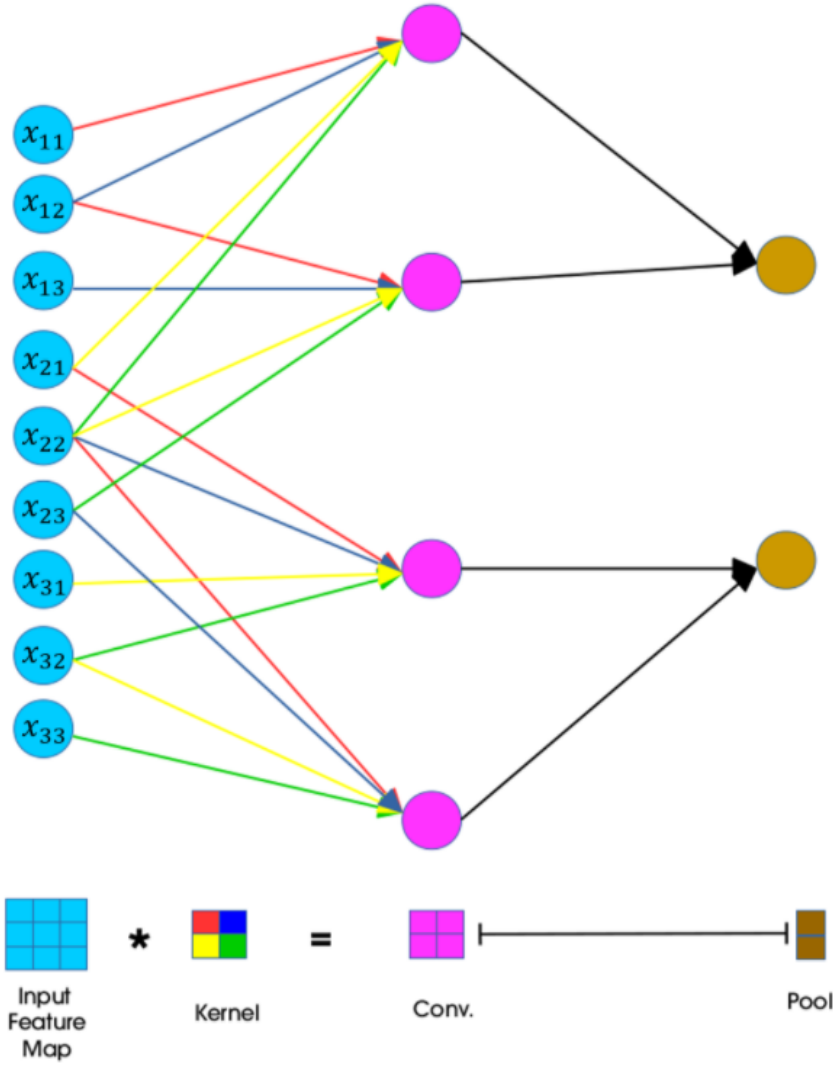
Image

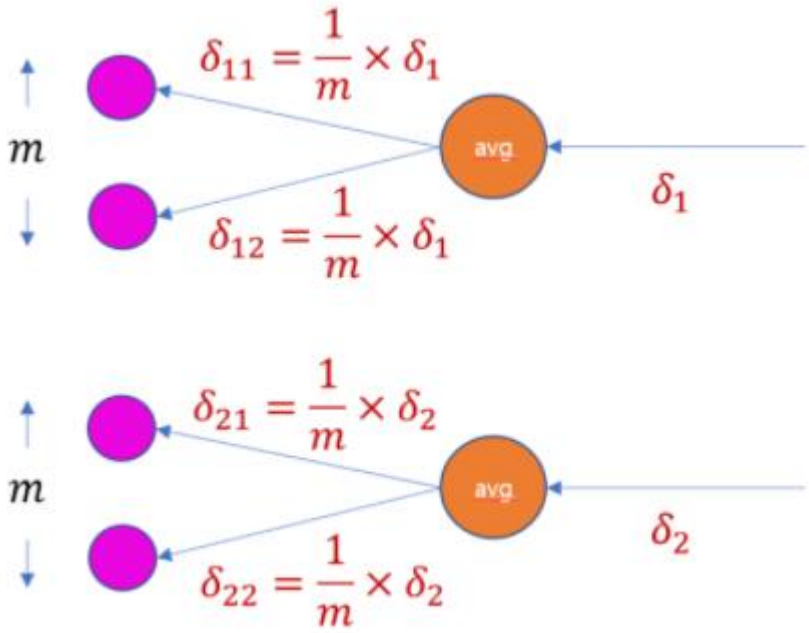


Convolved Feature

Stride=1, pad=0으로 설정했다고 가정하면,
필터가 입력벡터를 슬라이딩하면서 합성곱 연산을 수행

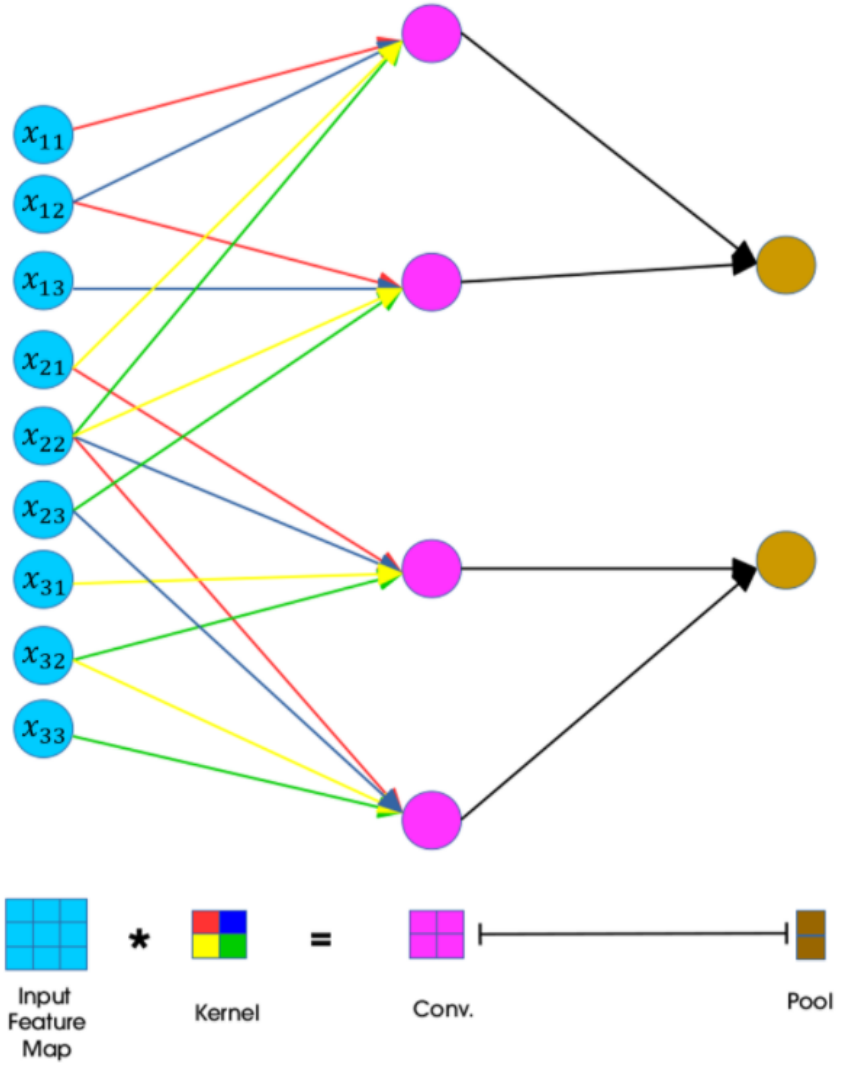
Backward pass : Average Pooling

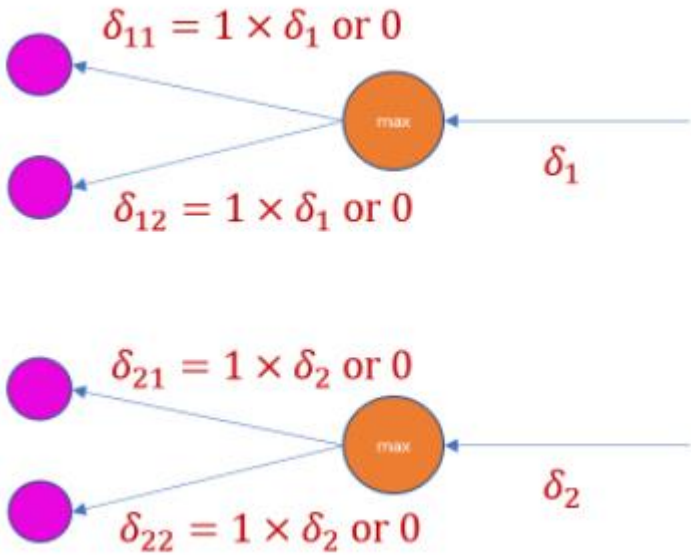




δ_1, δ_2는 FC에서 전파된 그레디언트라고 가정했을 때,
Average Pooling은 avg을 이용했으므로 1/m을 δ_1, δ_2에 곱해줌

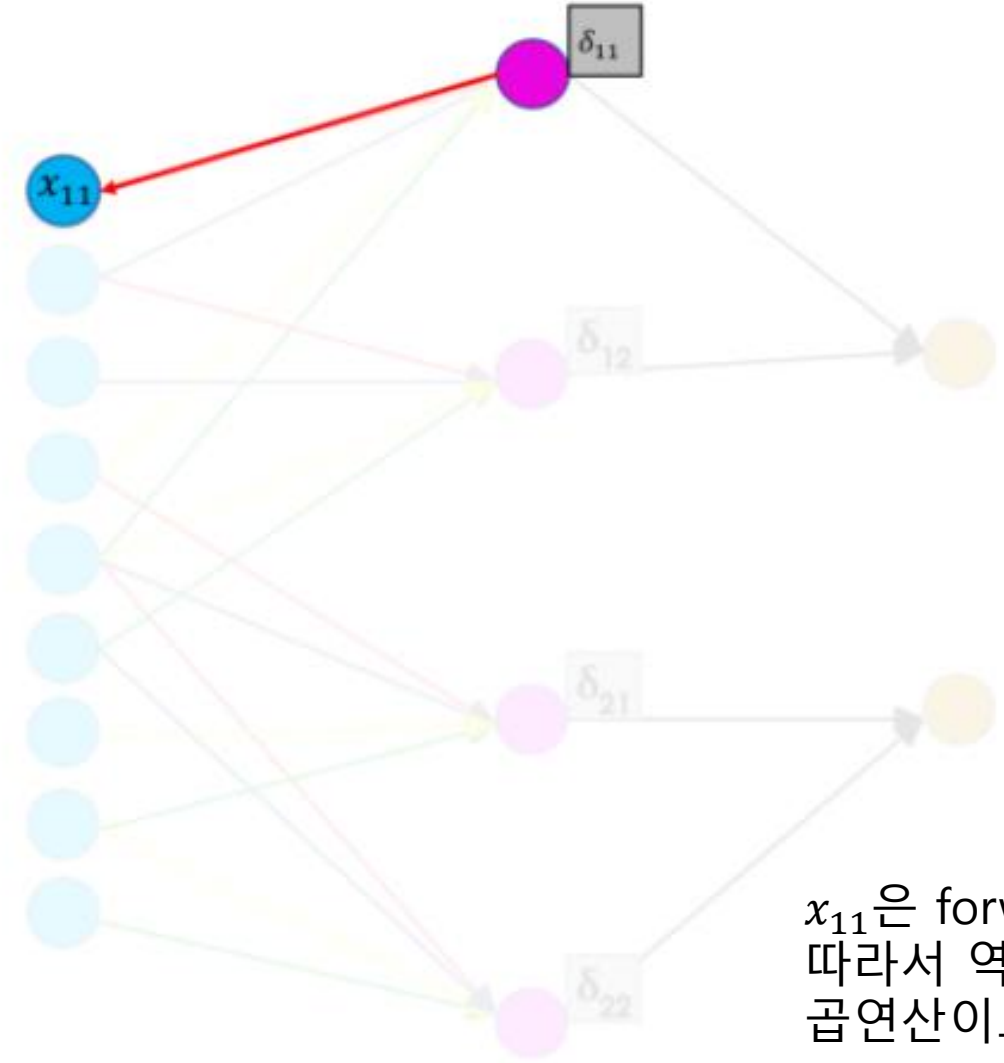
Backward pass : Max Pooling

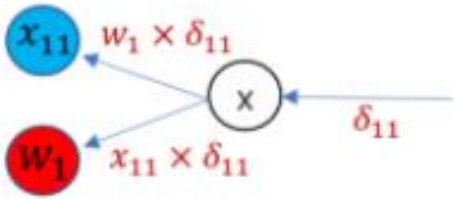


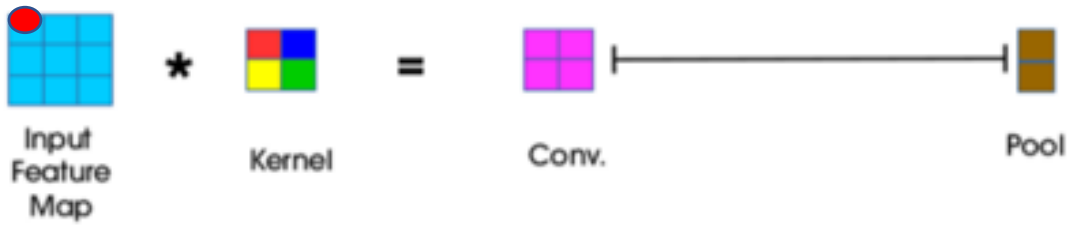


ReLU에서와 마찬가지로
최대값이 속해 있는 요소의 로컬 그레디언트는 1,나머지는 0으로
δ_1, δ_2 와 곱함

Backward pass : conv layer

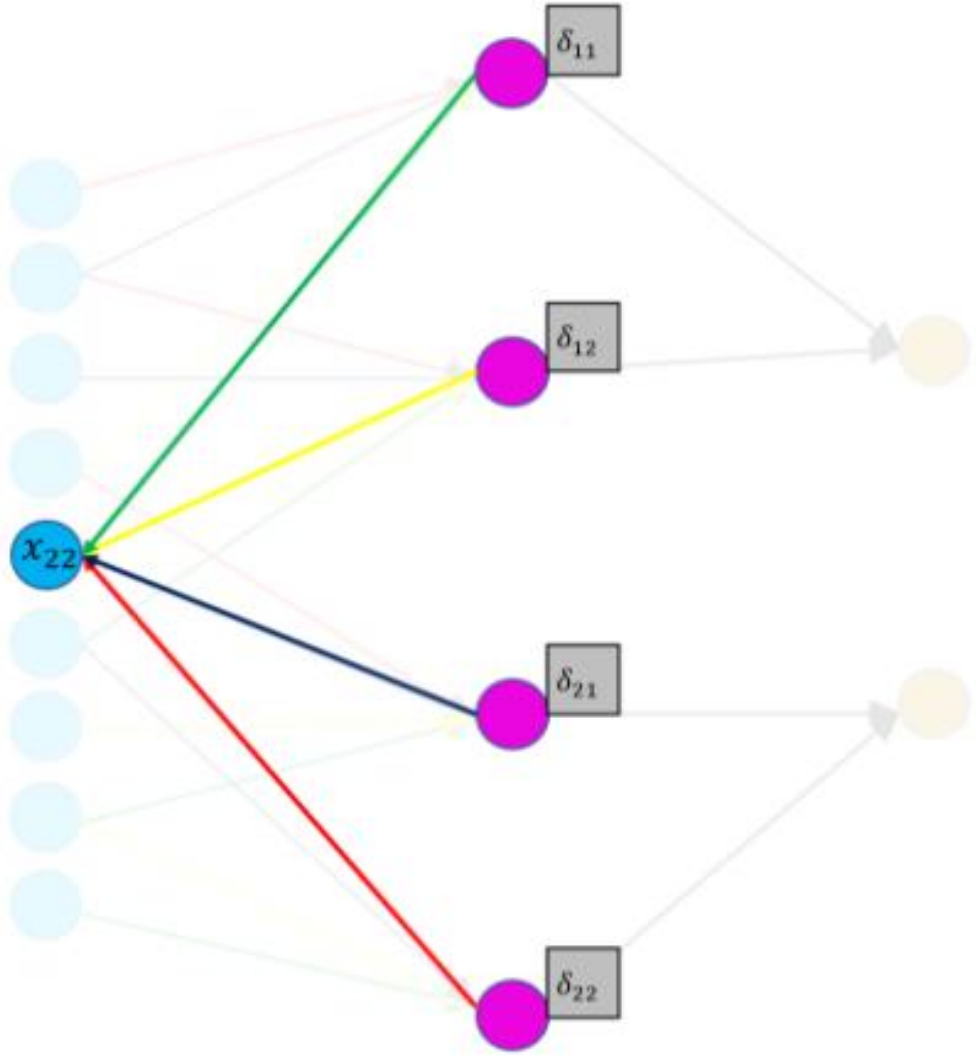


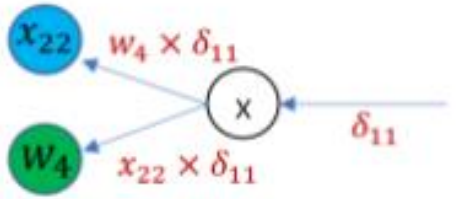


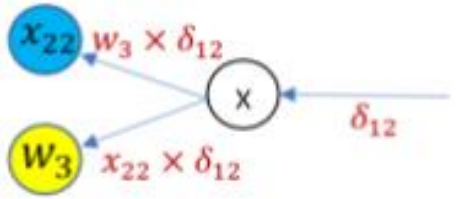


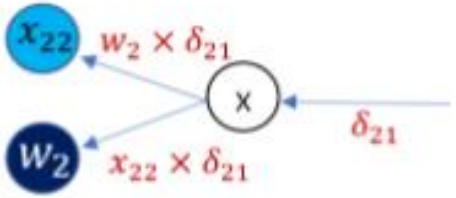
x_{11}은 forward 과정에서 빨간색 가중치하고만 합성곱이 수행되었다.
따라서 역전파도 딱 한 번만 일어나며,
곱연산이므로 위 사진과 같은 식이 나오게 됨..

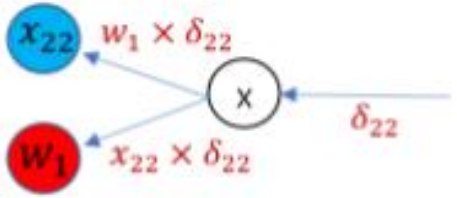
Backward pass : conv layer



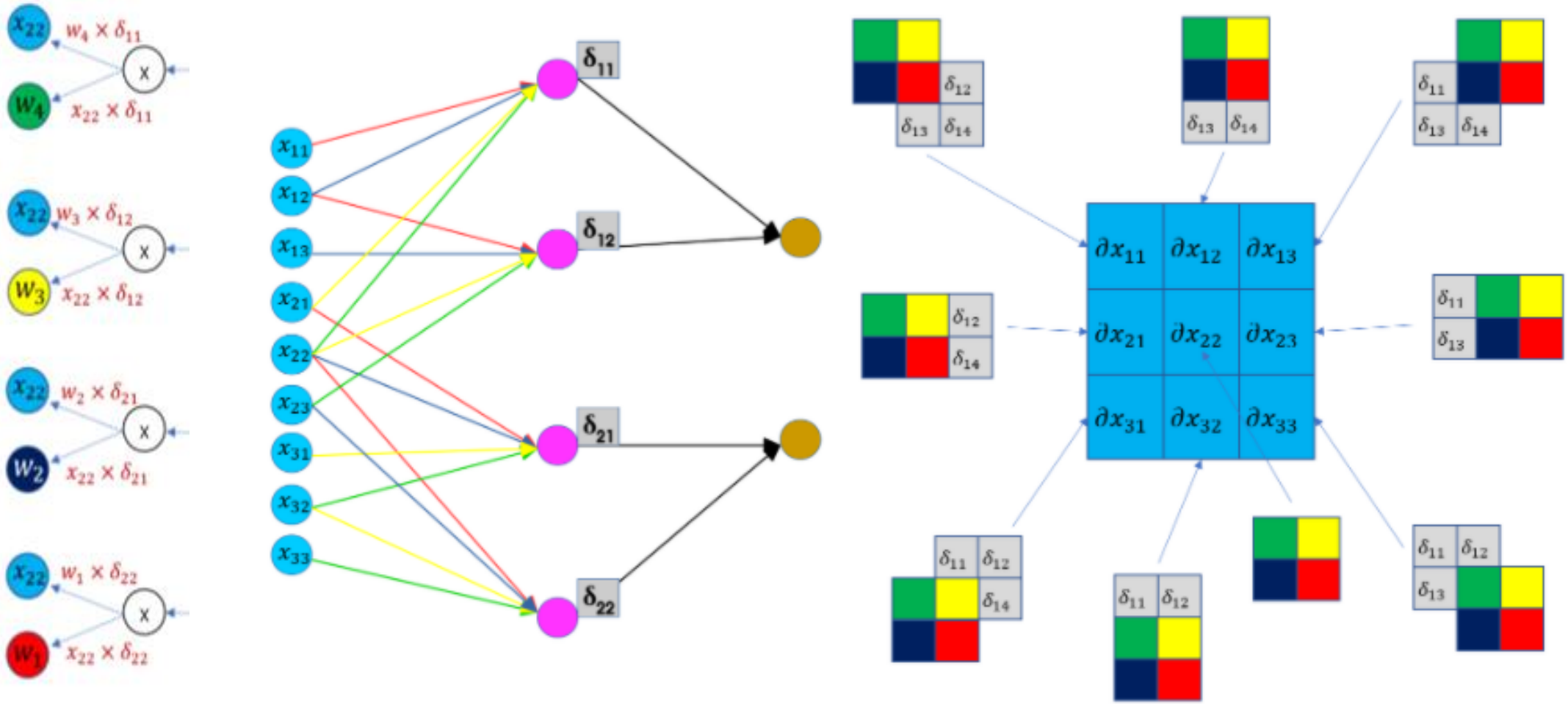






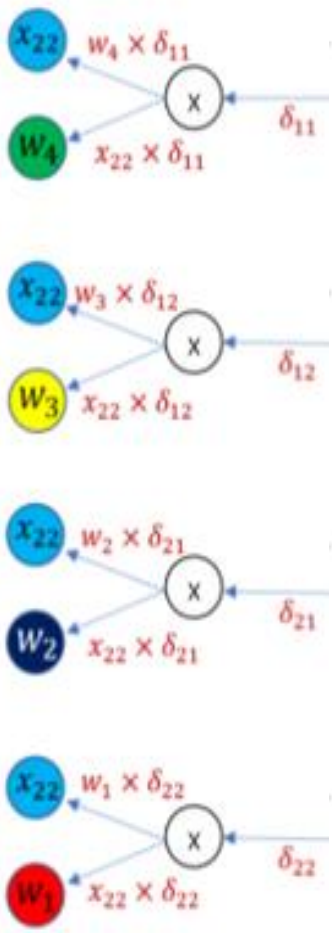


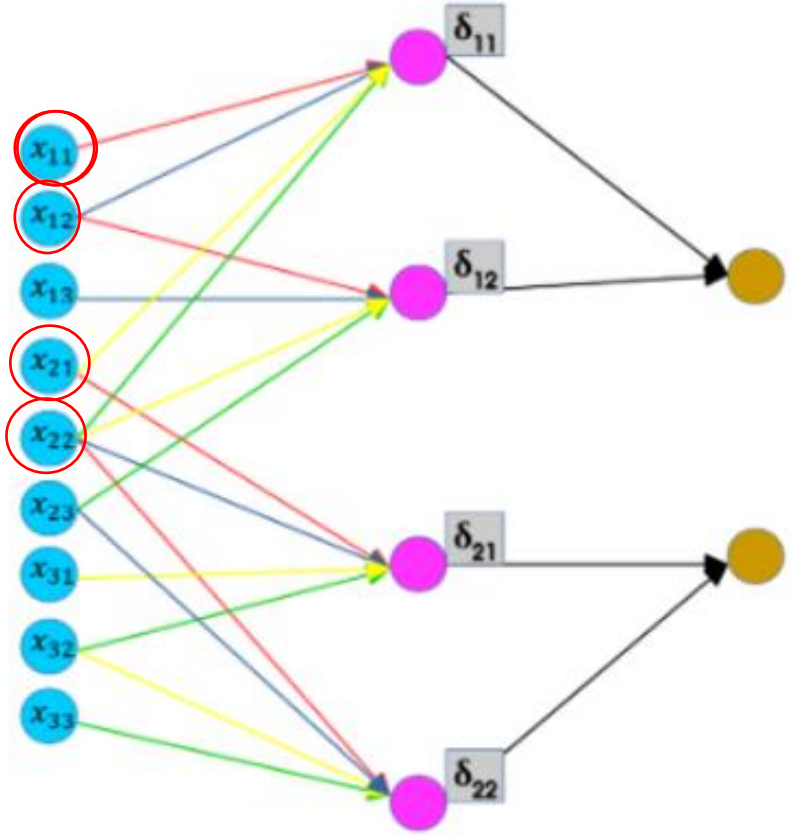
Backward pass : conv layer

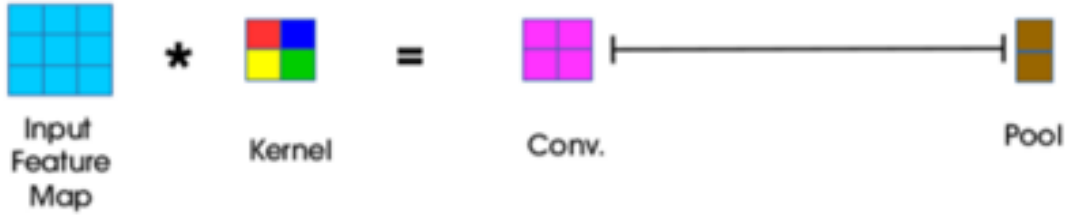


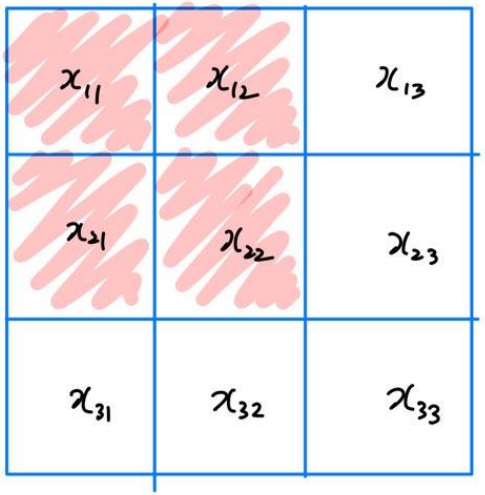
흘러들어온 그래디언트 행렬(2x2 크기)을 conv layer를 만들 때 썼던 필터가 슬라이딩하면서 값을 구하는 것

Backward pass : conv layer->W에 대하여









$$\Rightarrow \partial W_{11} = x_{11}\delta_{11} + x_{12}\delta_{12} + x_{21}\delta_{21} + x_{22}\delta_{22}$$