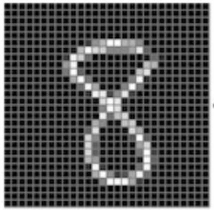
Convolutional Neural Networks

모두의연구소

박은수 Research Director

Gray Image



28 x 28
784 pixels

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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	4	62	146	182	254	254	181	176	139	15	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	34	186	253	217	208	136	136	136	166	232	99	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	61	242	208	111	3	0	0	0	0	0	18	32	107	43	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	3	111	244	169	19	0	14	131	249	117	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	59	241	235	72	142	229	66	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	25	218	254	231	36	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	133	253	221	33	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0	174	138	0	23	193	204	18	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	96	224	0	0	0	25	218	169	3	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	215	138	0	0	0	0	86	253	99	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	215	97	0	0	0	0	0	118	253	68	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	185	157	0	0	0	0	0	40	254	98	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0	174	251	142	59	83	167	244	111	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	6	133	253	253	253	169	61	3	0	0	0	0	0	0	0	0
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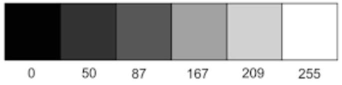

Color Image

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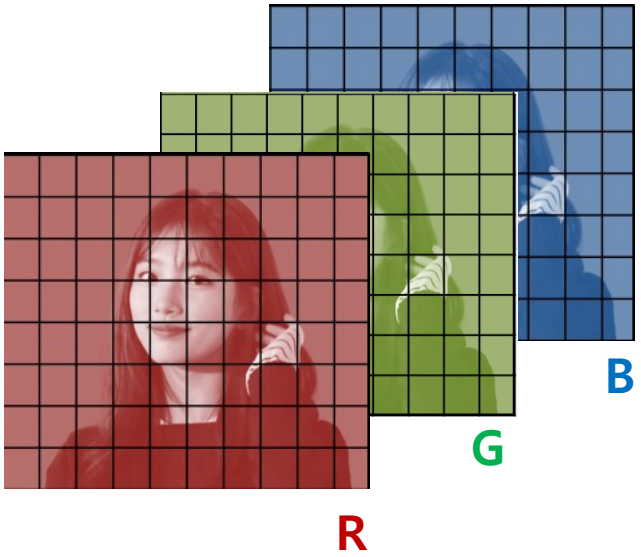
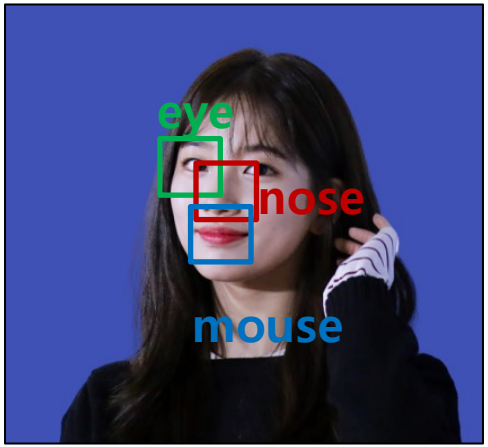


2D Image characteristics

모두의연구소

2D image



- Having 2D spatial features

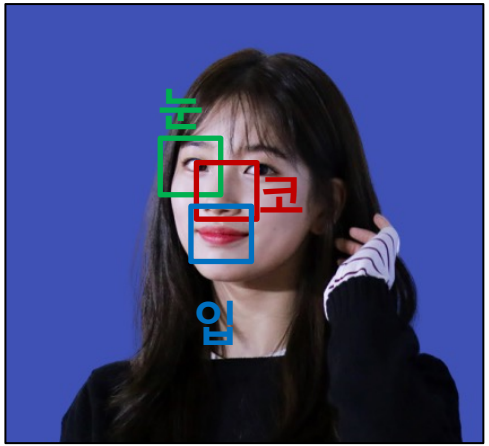
딥러닝의 이미지 인식 방법

모두의연구소

영상의 특징

이러한 특징을 잘 활용한
뉴럴 네트워크는 ?

Convolutional Neural Networks (CNNs)

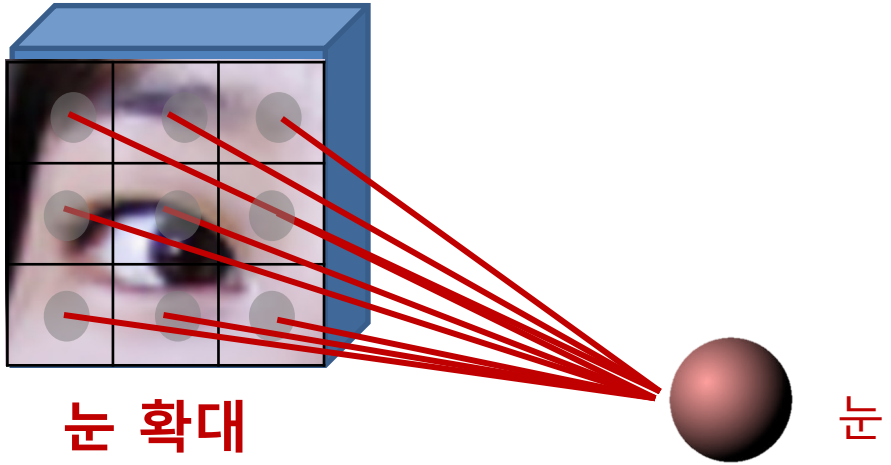


- 2차원 공간적 특징을 가짐
- 크기에 따라 같은 영역도 다른 특징을 가짐

눈, 코, 입 찾기

모두의연구소

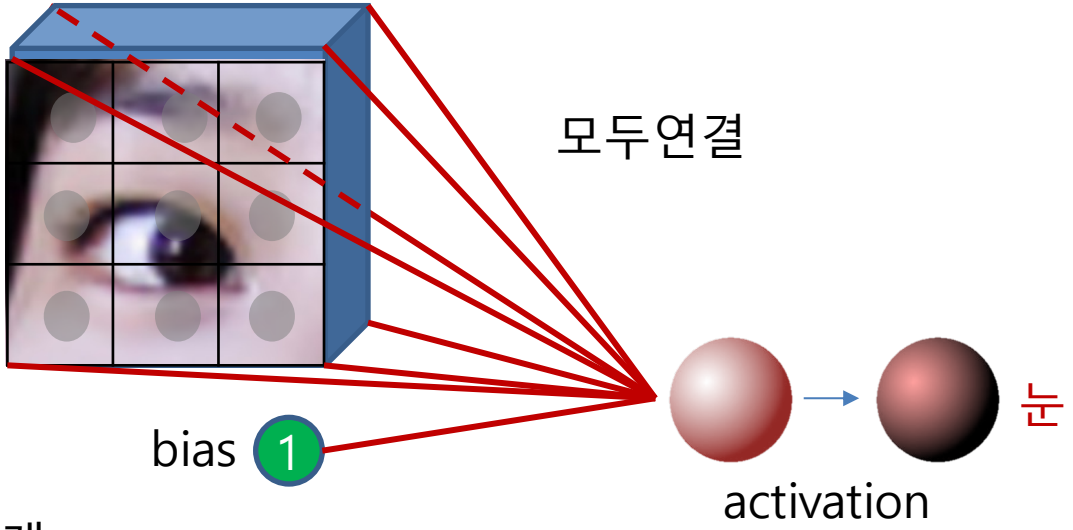
3x3x3 (height x width x channel)



눈, 코, 입 찾기

모두의연구소

3x3x3 (height x width x channel)

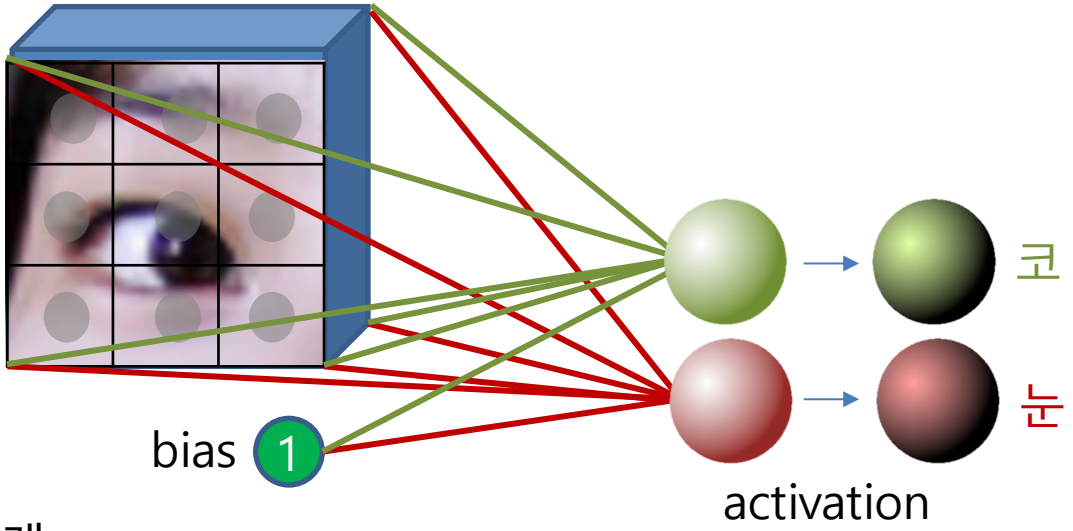


- 3x3 필터 1개
  - 파라미터(weight) 의 수 : 3x3x3(filter) + 1 (bias)

눈, 코, 입 찾기

모두의연구소

3x3x3 (height x width x channel)

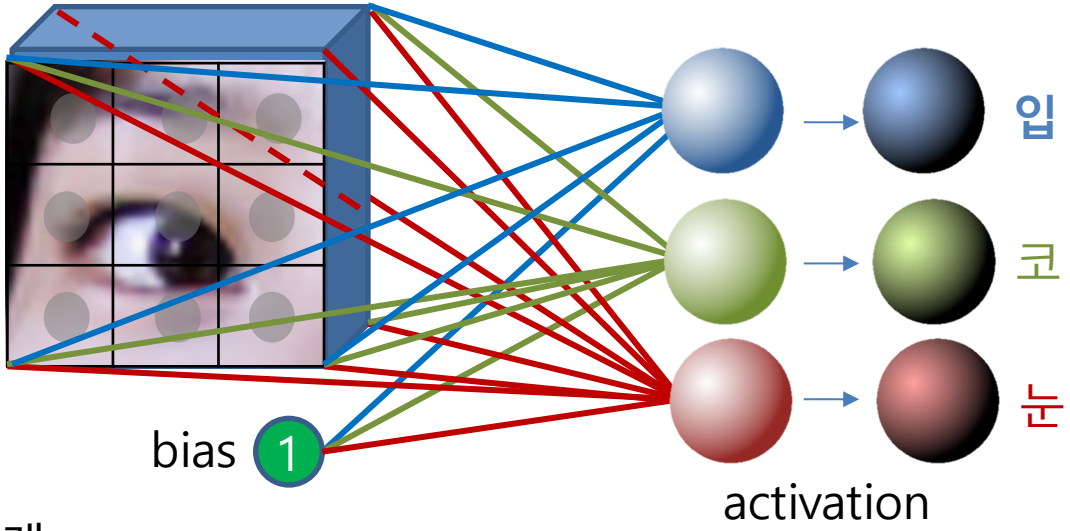


- 3x3 필터 2개
  - 파라미터(weight) 의 수 : (3x3x3+1)x2

눈, 코, 입 찾기

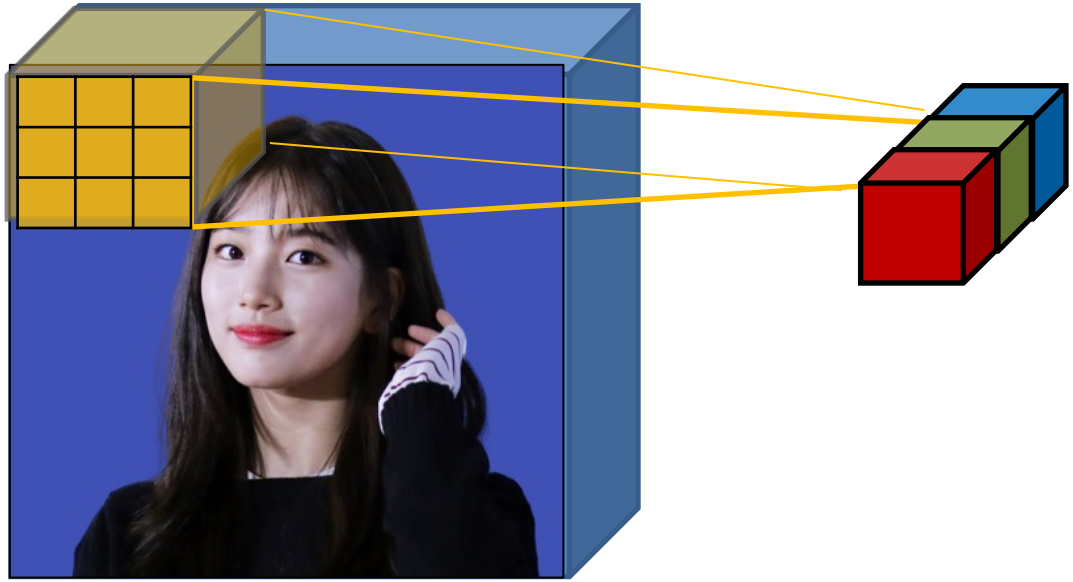
모두의연구소

3x3x3 (height x width x channel)



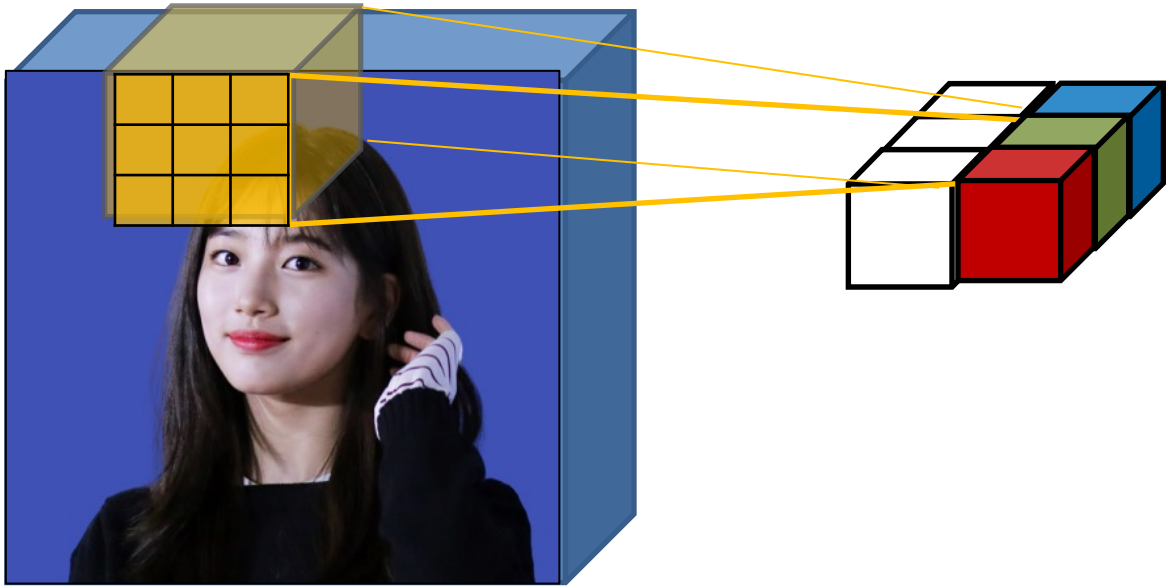
- 3x3 필터 3개
  - 파라미터(weight) 의 수 : (3x3x3+1)x3

Sliding Window



- 3x3 필터 3개
  - 파라미터(weight) 의 수 : (3x3x3+1)x3

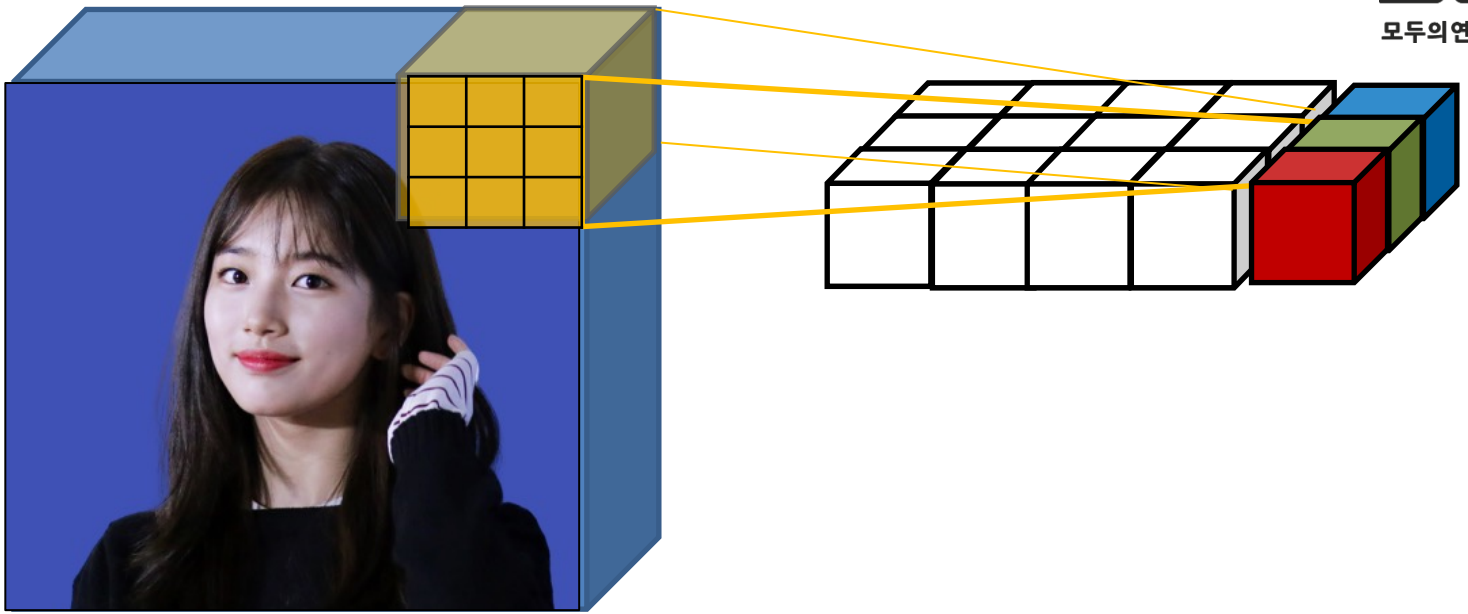
Sliding Window



- 3x3 필터 3개
  - 파라미터(weight) 의 수 : (3x3x3+1)x3

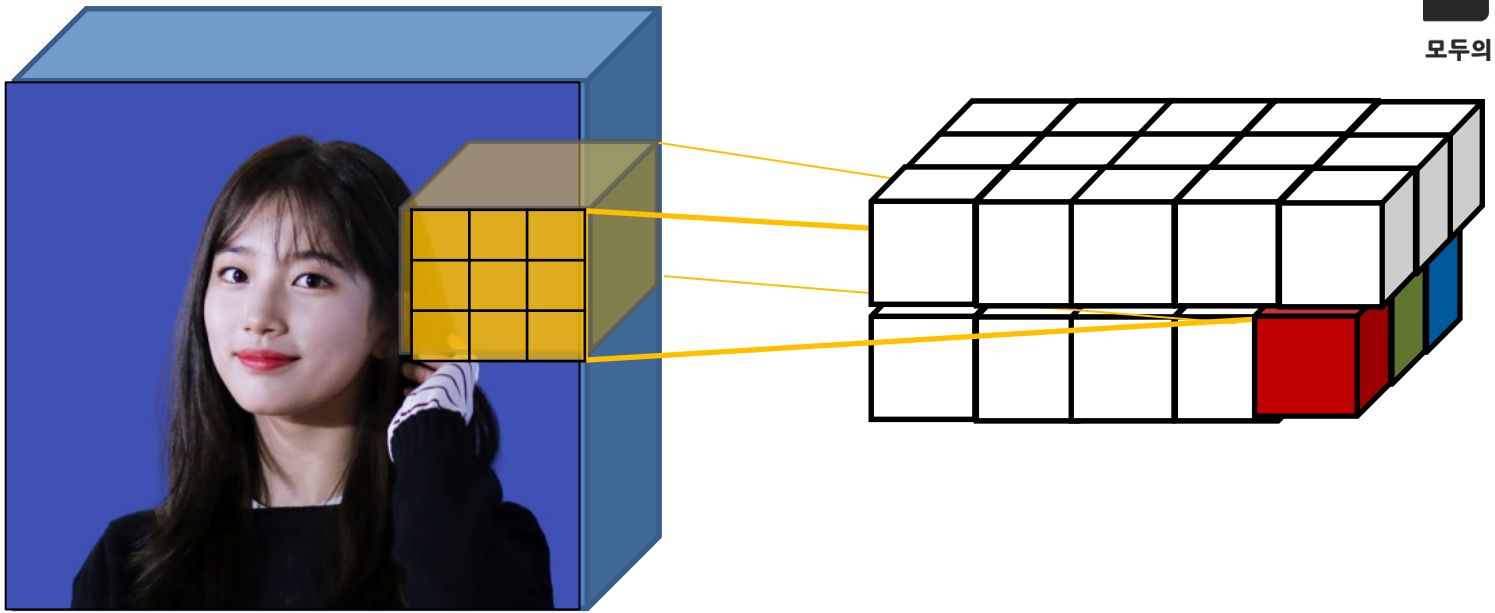
Sliding Window

모두의연구소



- 3x3 필터 3개
  - 파라미터(weight) 의 수 : (3x3x3+1)x3

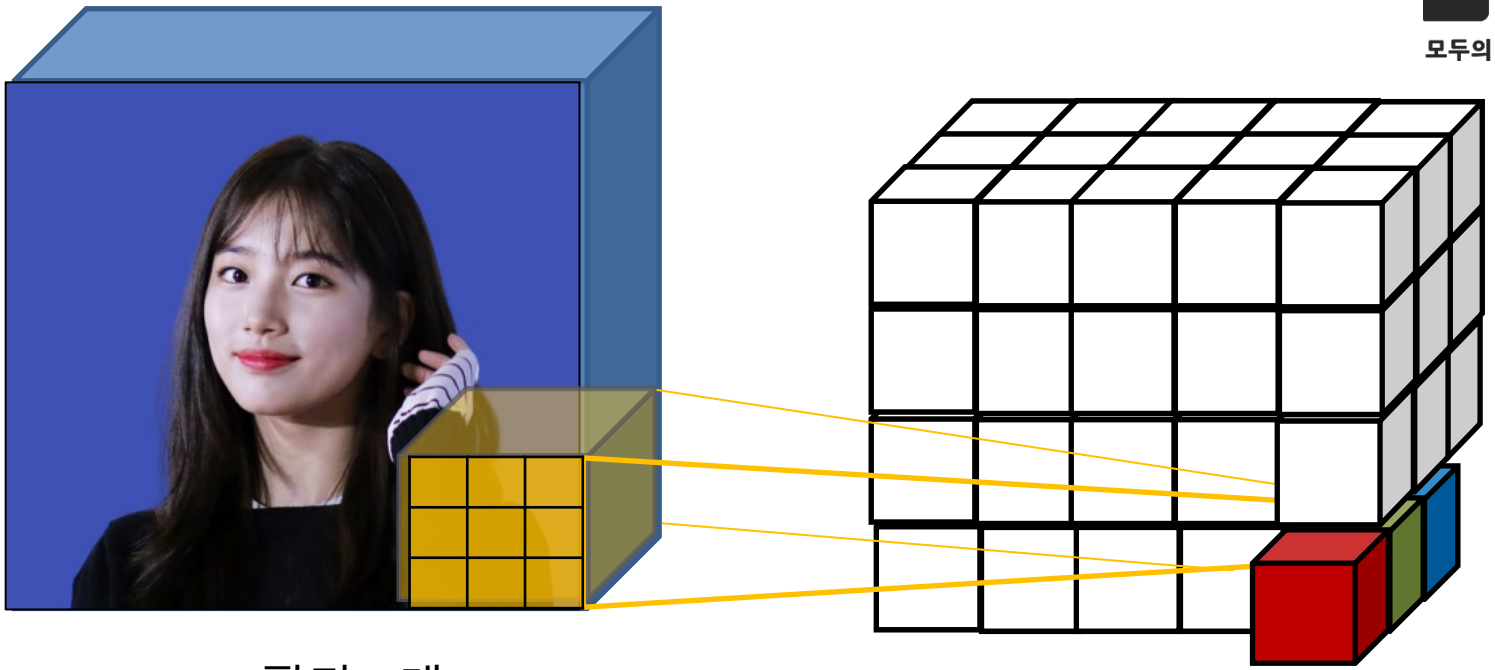
Sliding Window



- 3x3 필터 3개
  - 파라미터(weight) 의 수 : (3x3x3+1)x3

Sliding Window

모두의연구소



- 3x3 필터 3개
  - 파라미터(weight) 의 수 : (3x3x3+1)x3

2차원 특성을 유지하려면

32 : 높이

32 : 너비

3 : 채널

w

5 : 높이는 우리가 설정

5 : 너비도 우리가 설정

3 : 채널

$W^T X + b$

Convolution Layer

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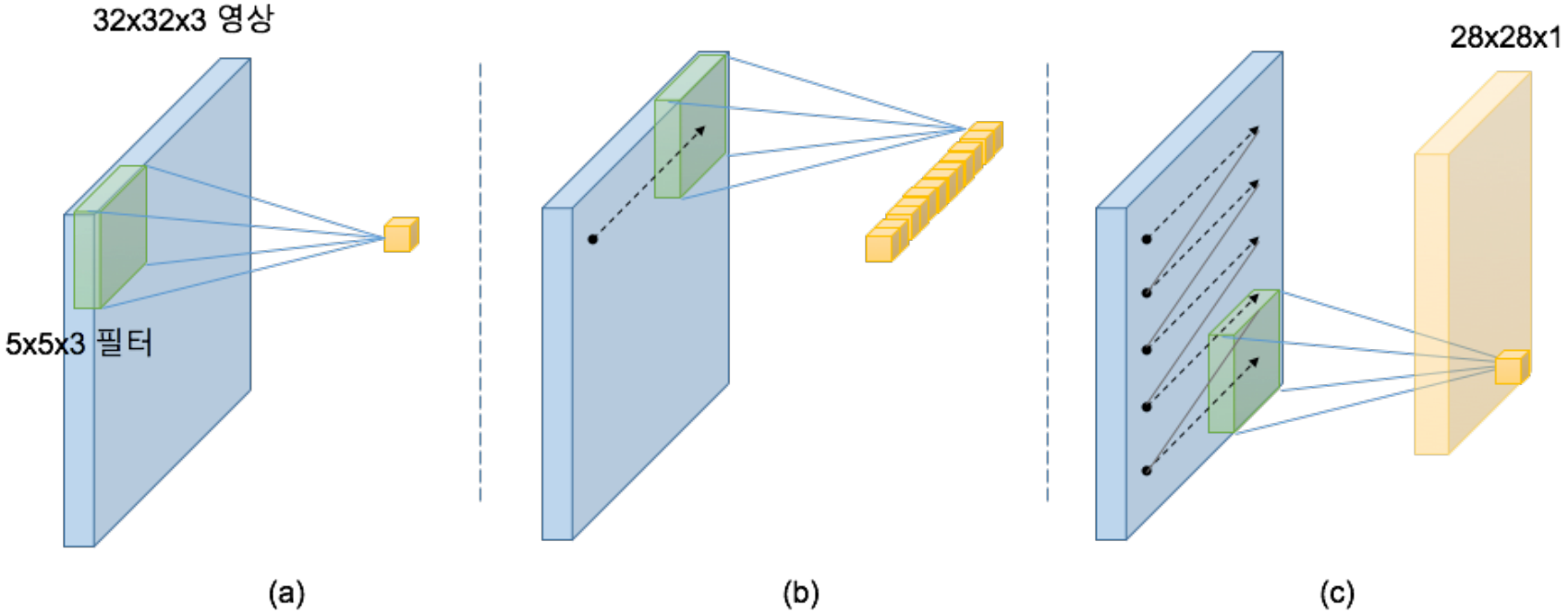
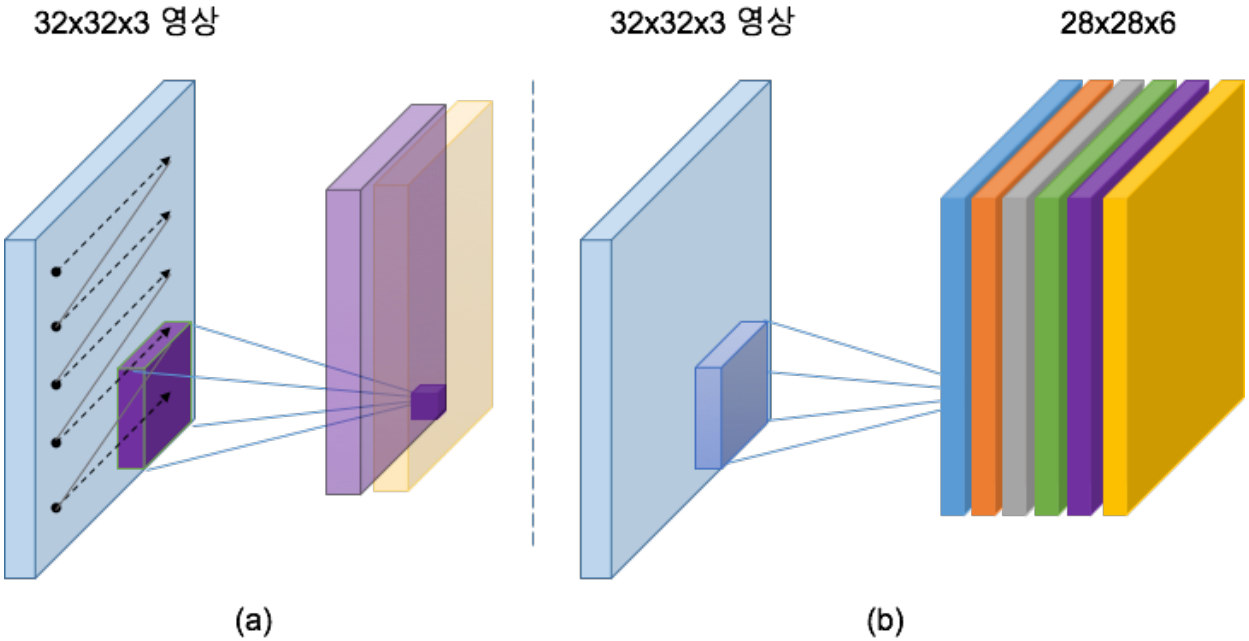


Convolution Layer

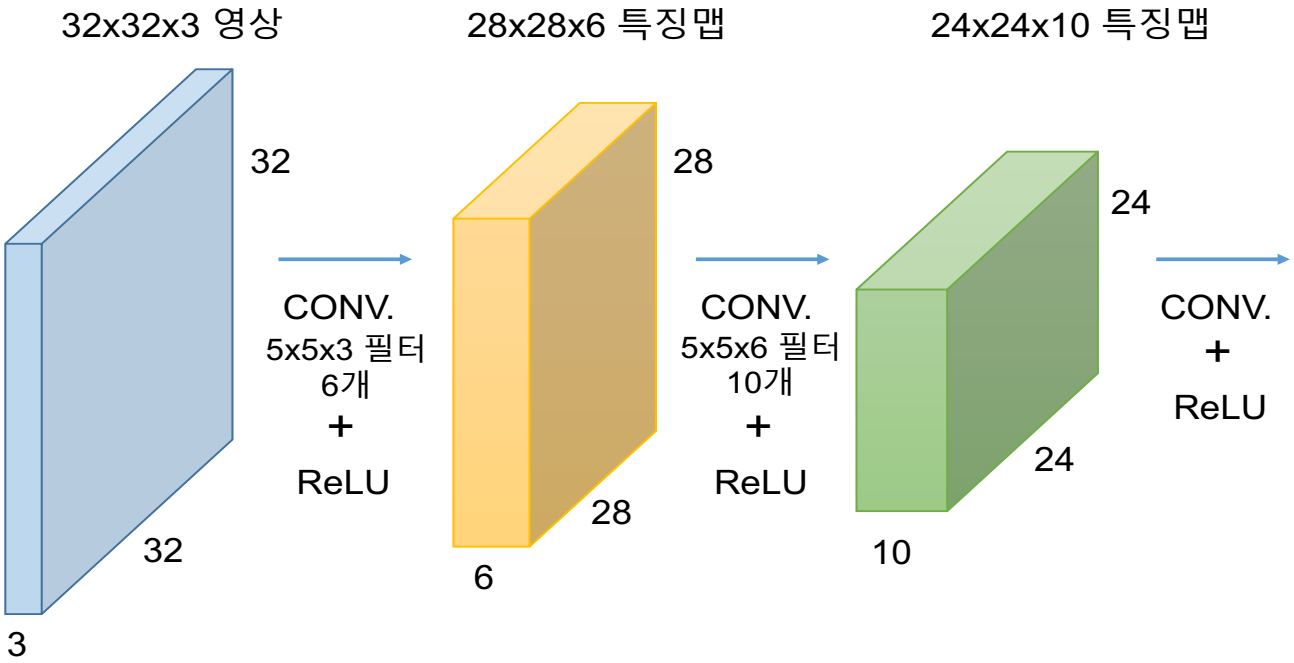
모두의연구소

똑같은 크기의 필터 6개를 더 만들어 봅시다

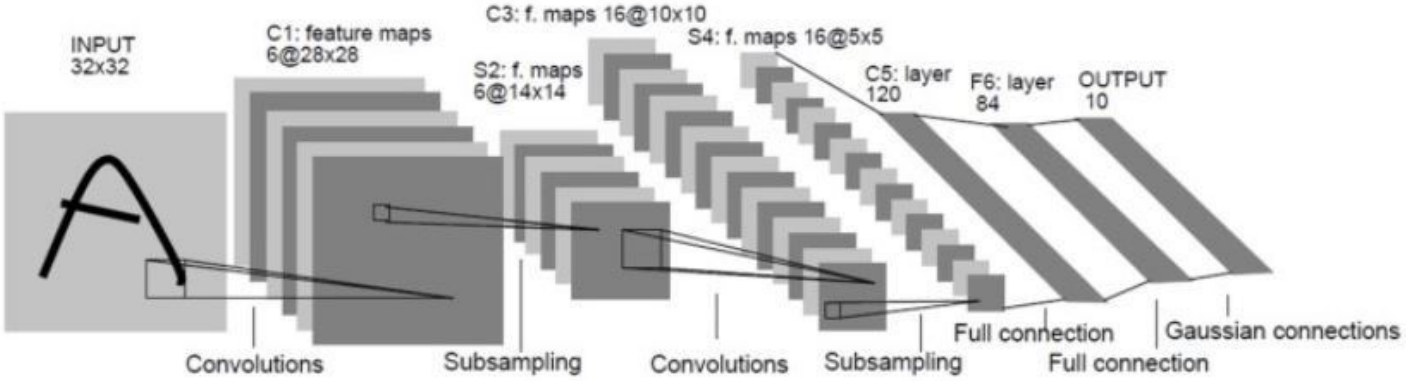


Convolution Layer

컨볼루션 네트워크는 활성화 함수를 포함한 컨볼루션 레이어의 연결 입니다



Convolutional Neural Networks



LeNet-5

이미지 출처 : Lecun 1998, Gradient-based learning applied to document recognition

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