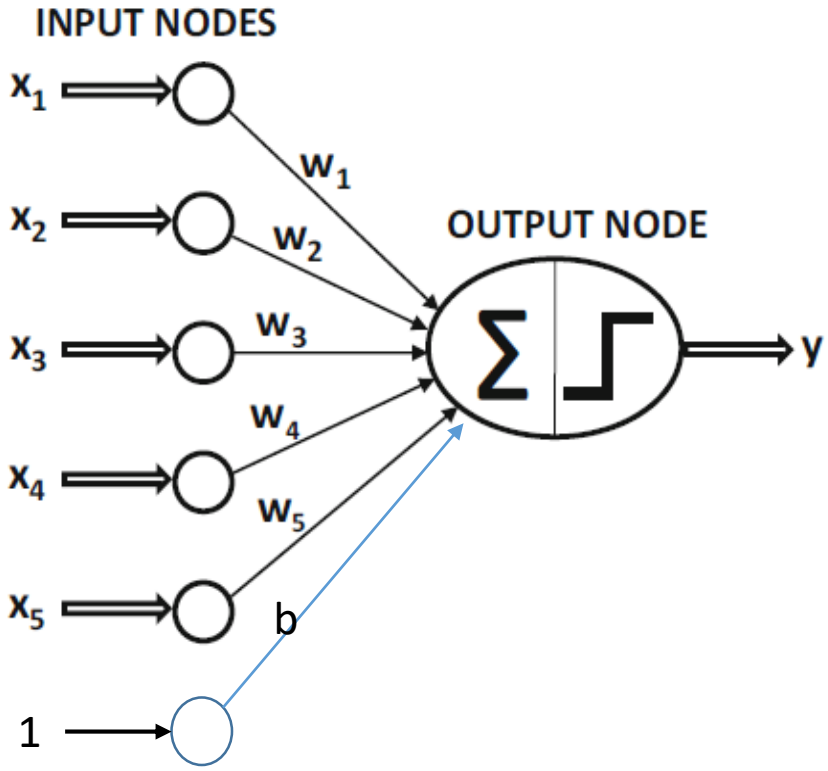
神经网络简述

A Simple Neural Network: Logistic Regression

supervised NN



训练样本 $(\overline{X}, y)$

$$\overline{X} = [x_1, \ldots x_d]$$
$$y \in \{-1, +1\}$$

线性部分

$$\overline{W} \cdot \overline{X} = \sum_{i=1}^{d} w_i x_i + b$$

非线性部分

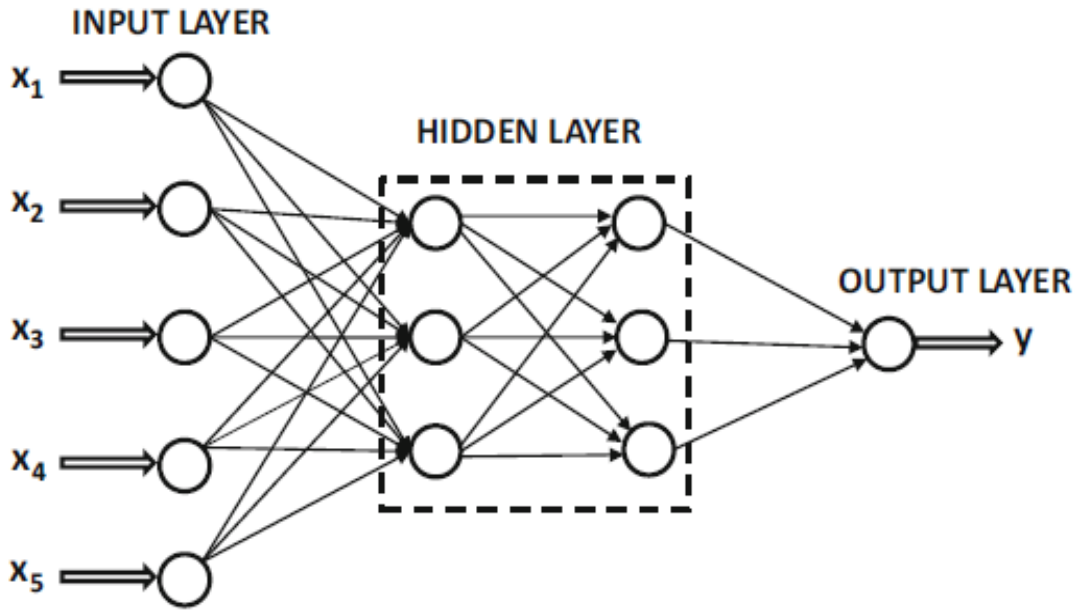
activation function.

$$\text{sign}\{\overline{W} \cdot \overline{X}\}$$

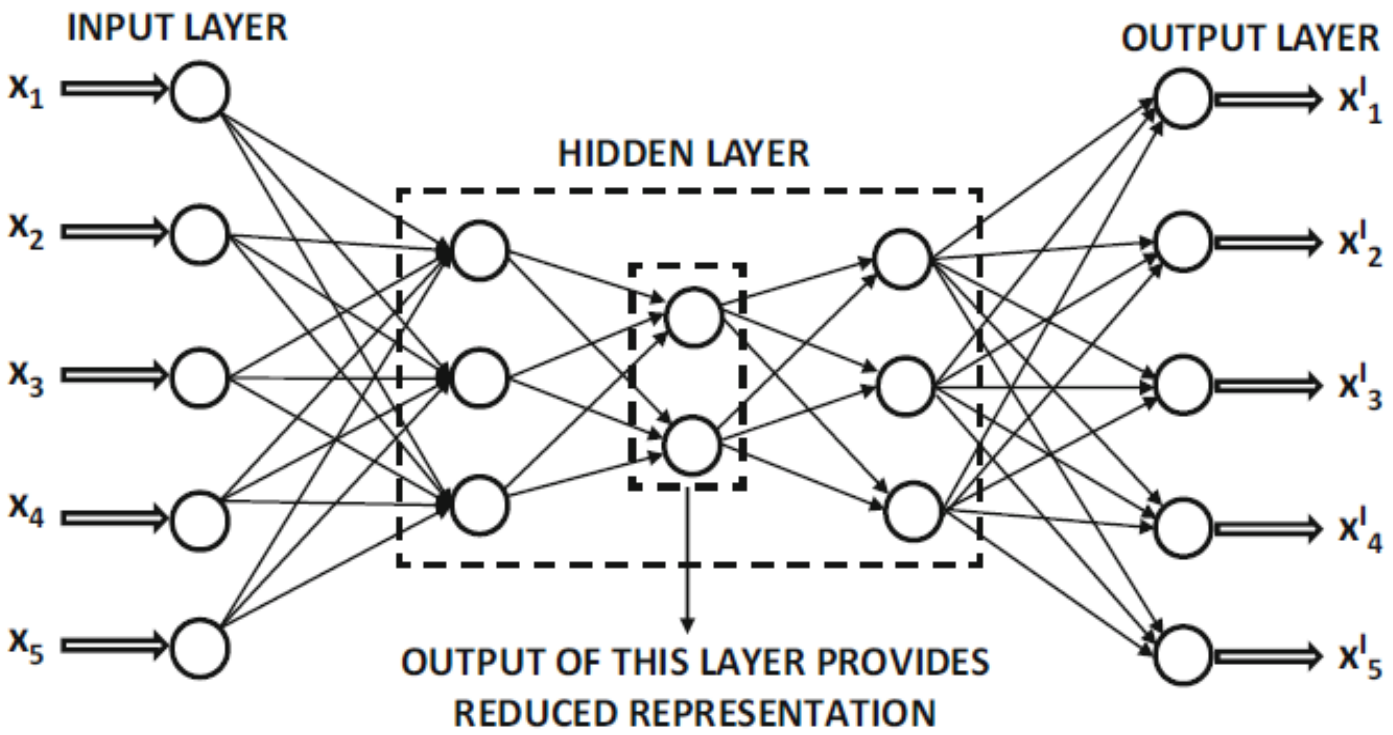
学习过程

$$\hat{y} = \text{sign}\{\overline{W} \cdot \overline{X}\} = \text{sign}\{\sum_{j=1}^{d} w_j x_j\} \Rightarrow y$$

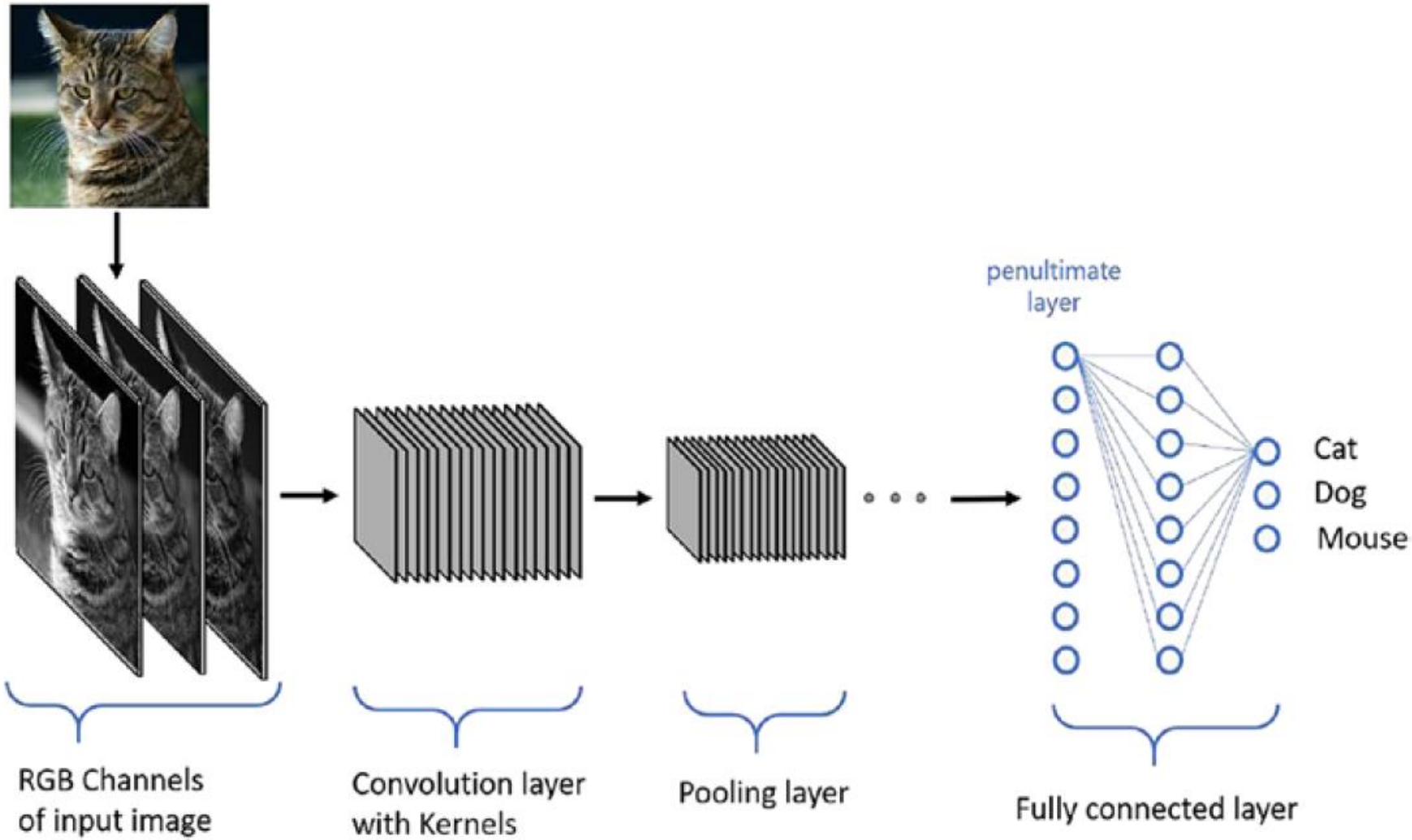
Multilayer Neural Networks



autoencoder

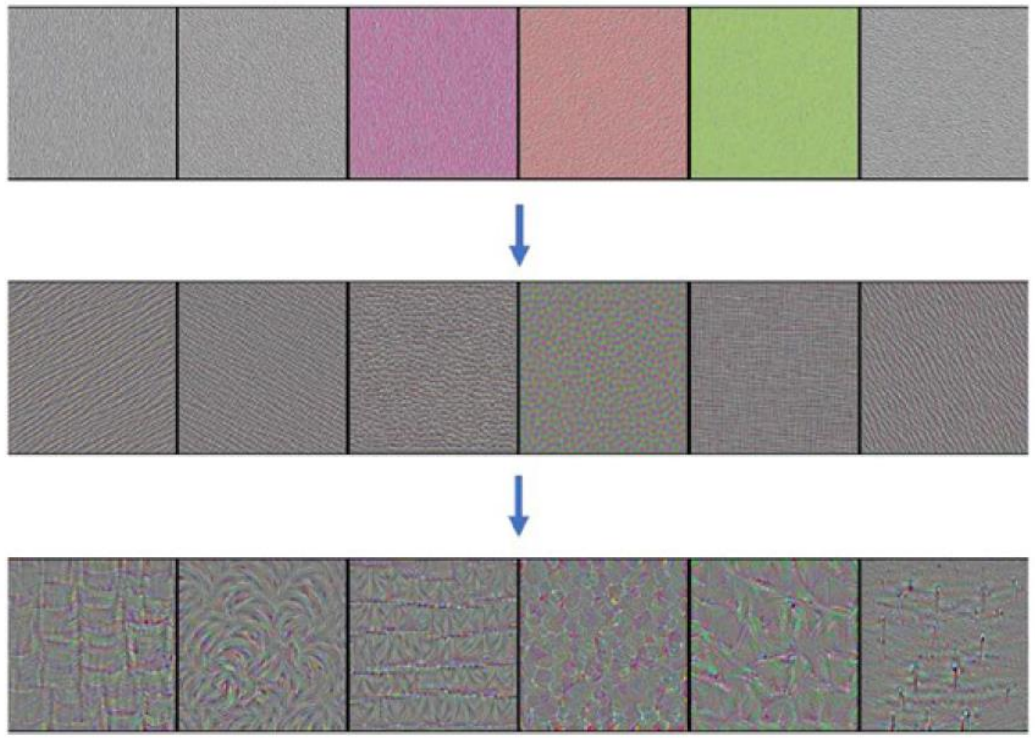


Convolutional Network



Convolution Layer

特征提取



First Convolution Laver

6	3	4	4	5	0	3
4	7	4	0	4	0	4
7	0	2	3	4	5	2
3	7	5	0	3	0	7
5	8	1	2	5	4	2
8	0	1	0	6	0	0
6	4	1	3	0	4	5

PAD

Padding

0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	6	3	4	4	5	0	3	0	0
0	0	4	7	4	0	4	0	4	0	0
0	0	7	0	2	3	4	5	2	0	0
0	0	3	7	5	0	3	0	7	0	0
0	0	5	8	1	2	5	4	2	0	0
0	0	8	0	1	0	6	0	0	0	0
0	0	6	4	1	3	0	4	5	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

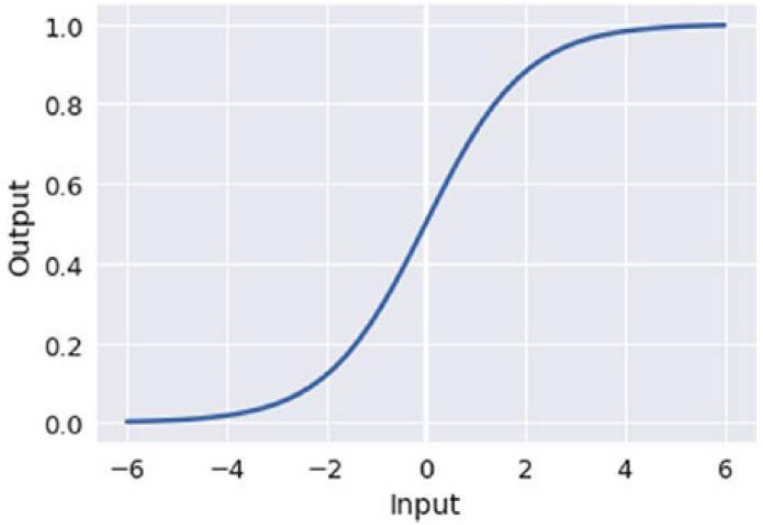
Last Convol

Strides

Activation Functions

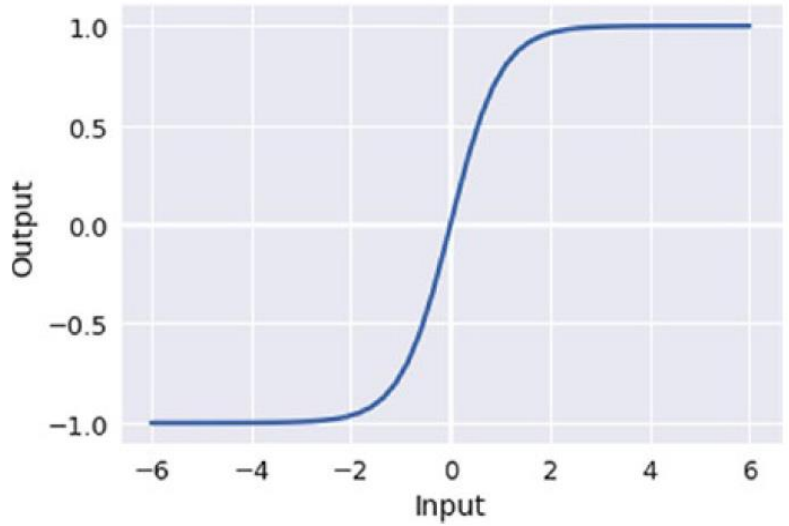
Sigmoid

$$f(x) = \frac{1}{1+e^{-x}}$$



Tanh

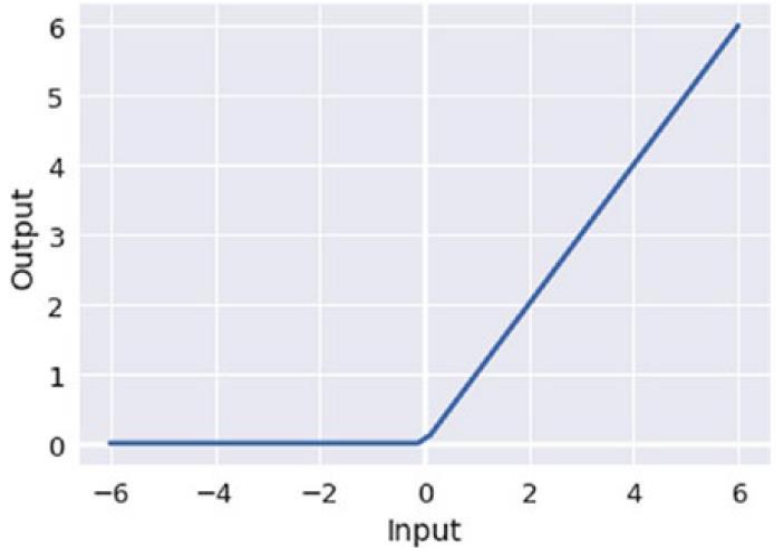
$$f(x) = \frac{1-e^{-2x}}{1+e^{-2x}}$$



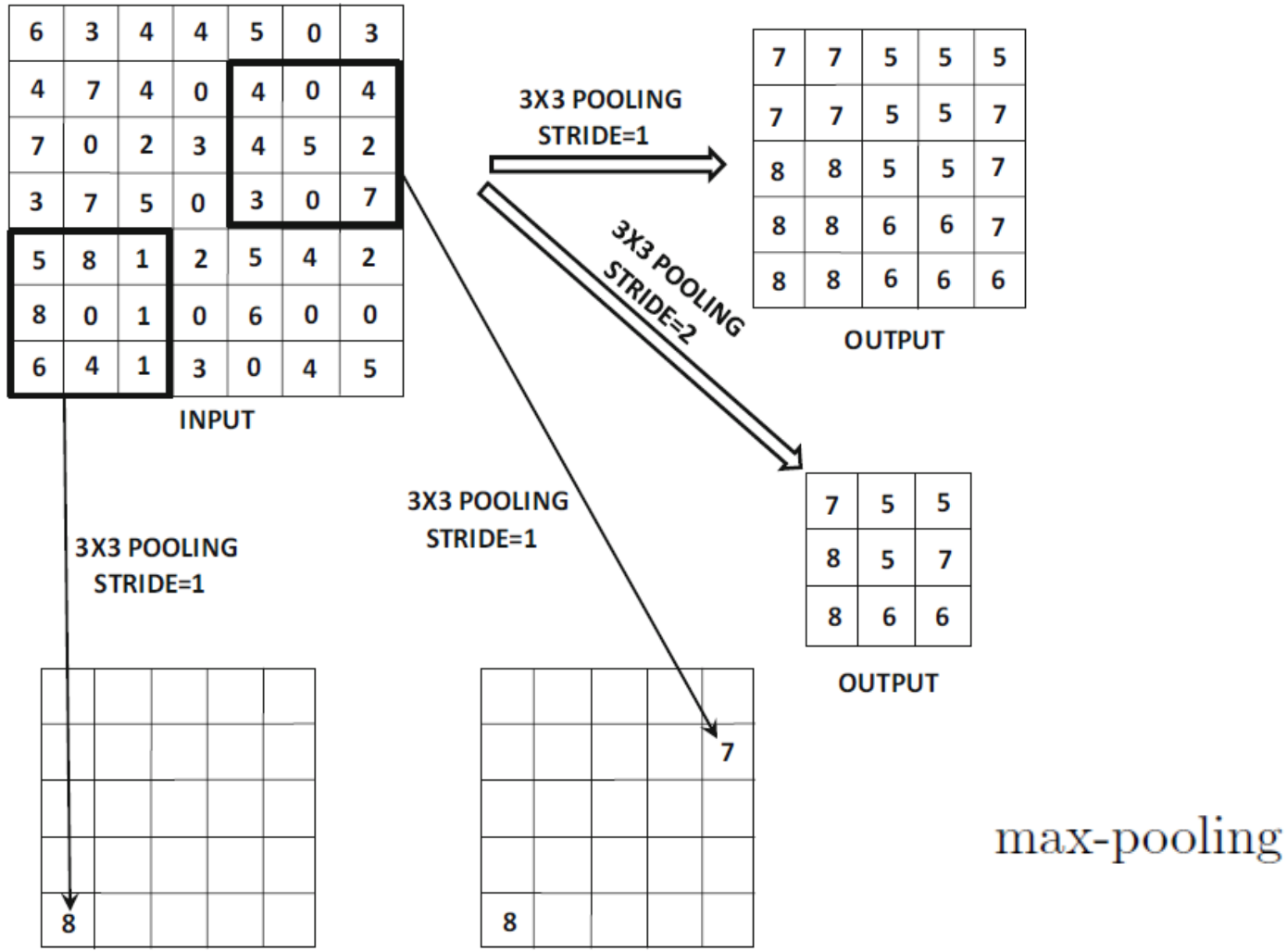
Rectified Linear Unit

(ReLU)

$$f(x) = \max(0, x)$$

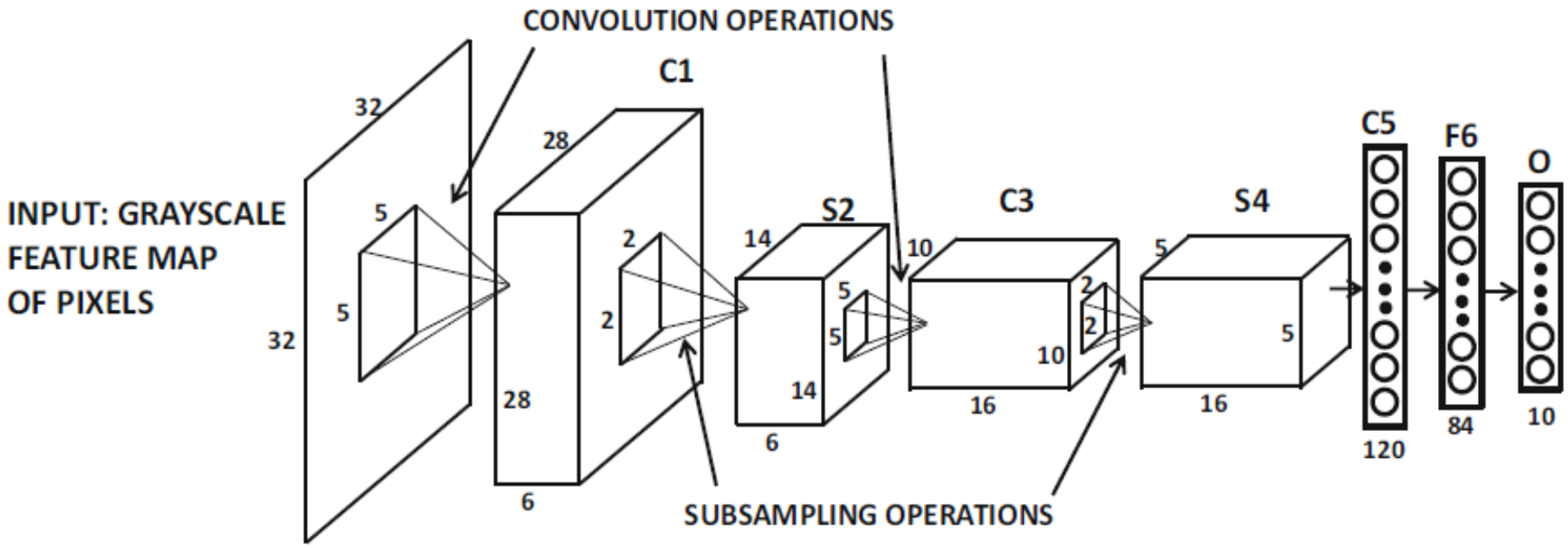


Pooling Layer

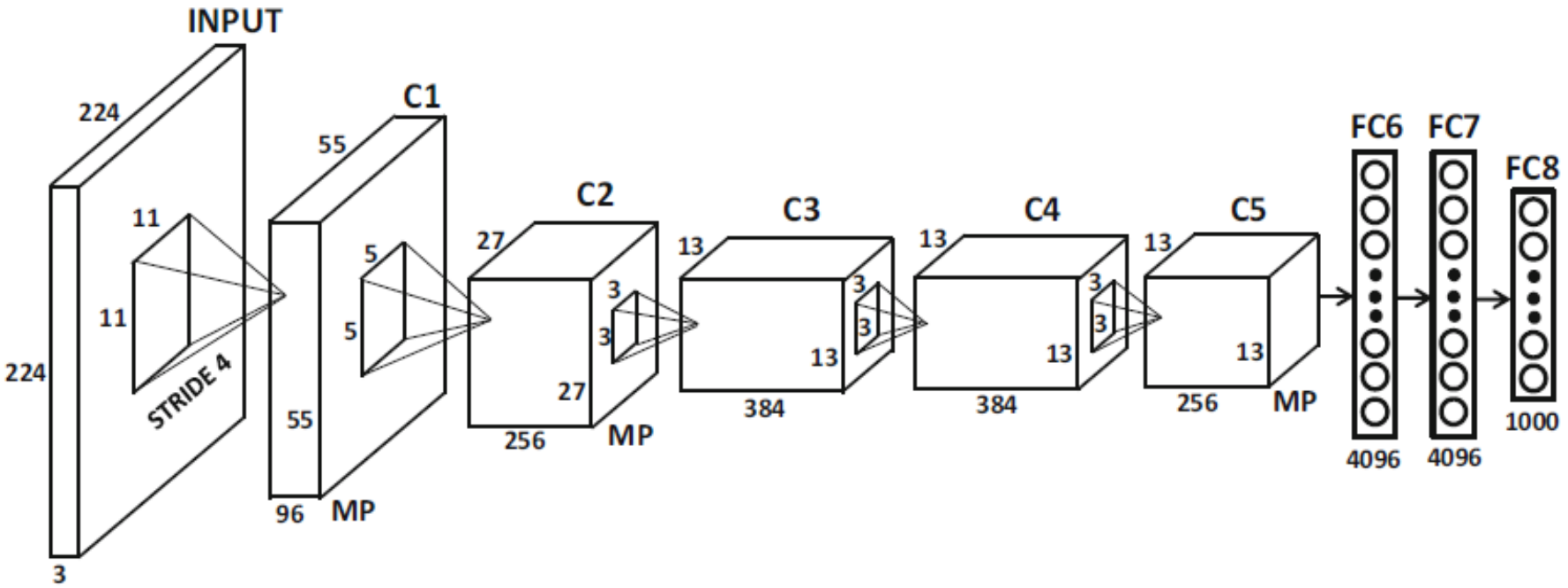


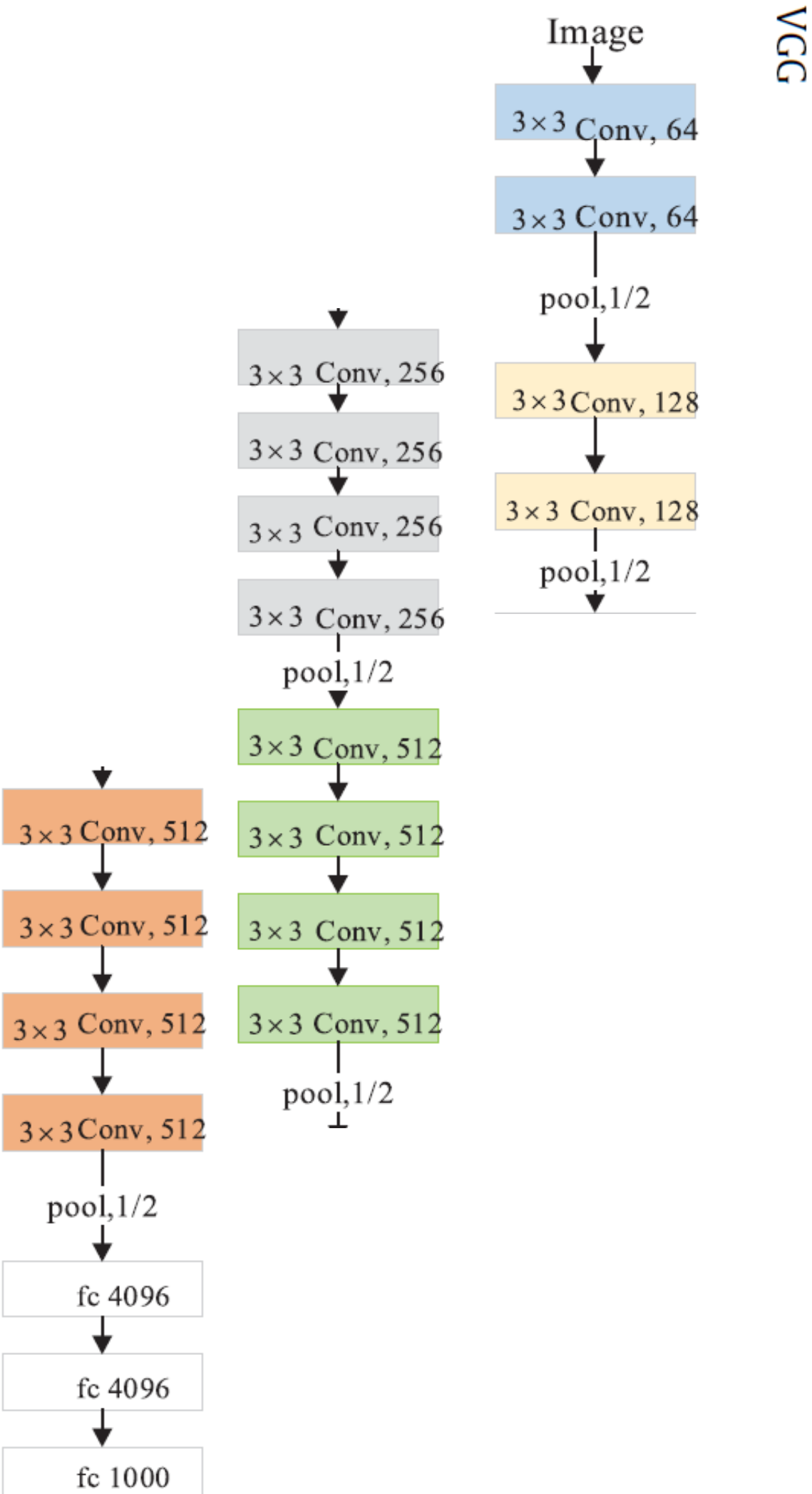
max-pooling

LeNet-5

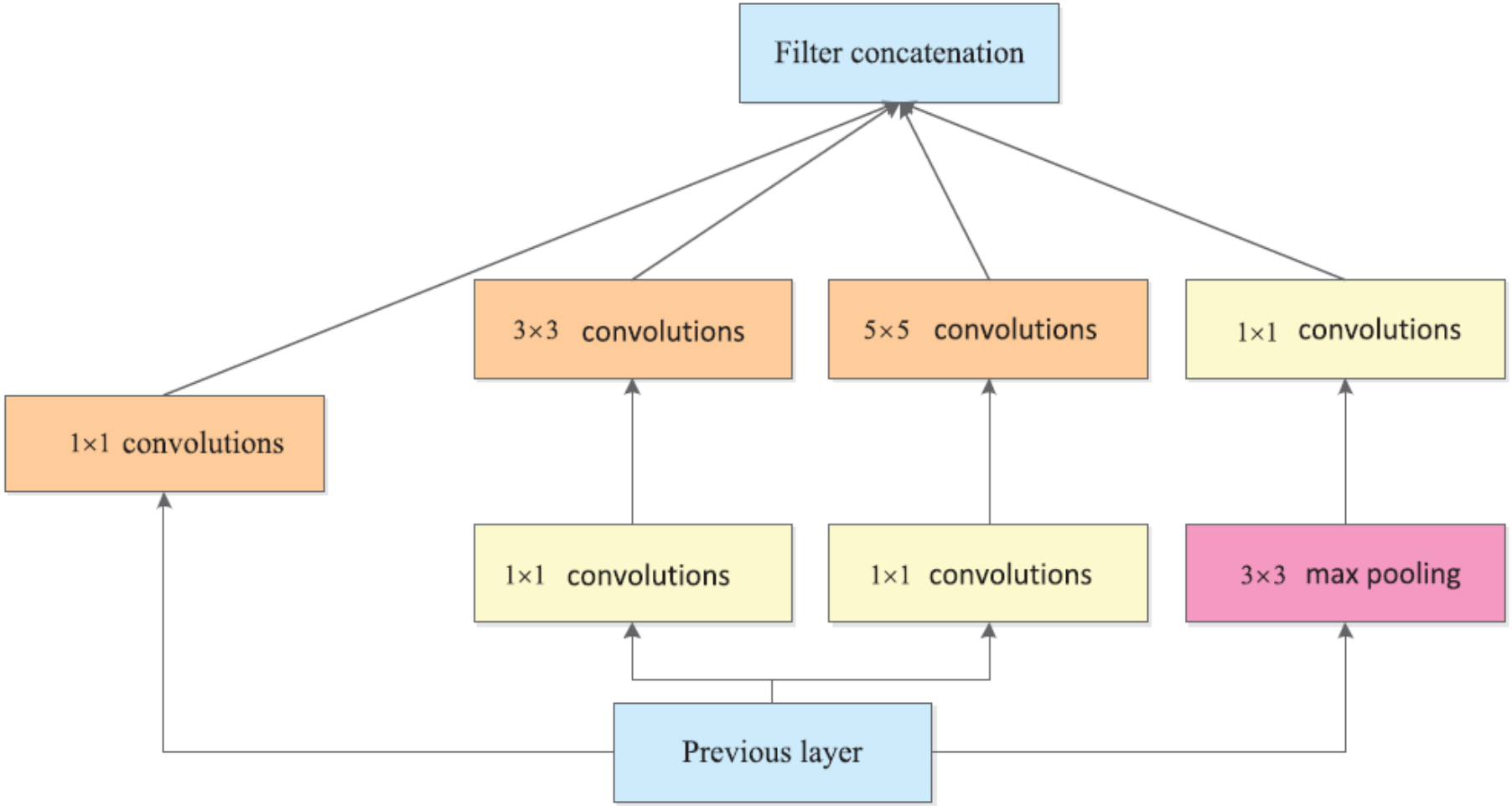

CONVOLUTION OPERATIONS
C1
INPUT: GRAYSCALE
FEATURE MAP
OF PIXELS
32
32
5
5
28
28
6
2
2
S2
14
14
6
5
5
C3
10
10
16
2
2
S4
5
5
16
C5
120
F6
84
O
10
SUBSAMPLING OPERATIONS

AlexNet

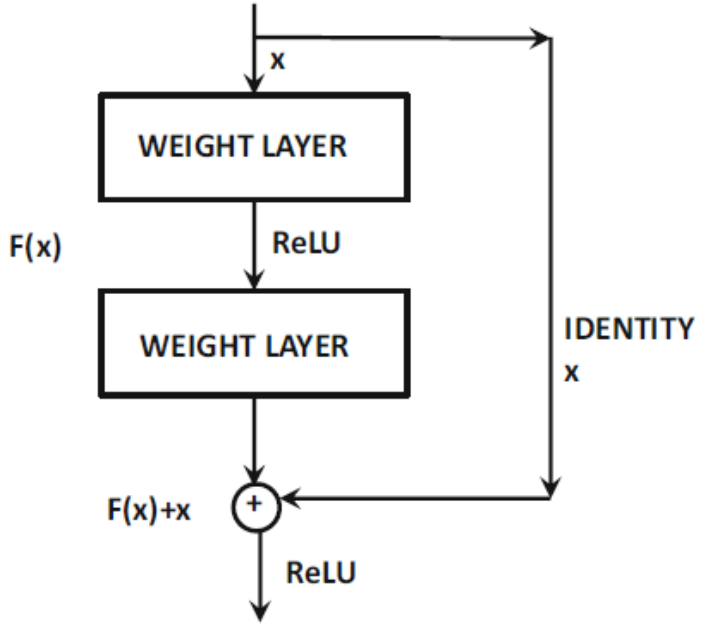

INPUT
224
224
3
11
11
STRIDE 4
C1
55
55
96
MP
5
5
C2
27
27
256
MP
3
3
C3
13
13
384
3
3
C4
13
13
384
3
3
C5
13
13
256
MP
FC6
4096
FC7
4096
FC8
1000


VGG
Image
3×3 Conv, 64
3×3 Conv, 64
pool,1/2
3×3 Conv, 128
3×3 Conv, 128
pool,1/2
3×3 Conv, 256
3×3 Conv, 256
3×3 Conv, 256
3×3 Conv, 256
pool,1/2
3×3 Conv, 512
3×3 Conv, 512
3×3 Conv, 512
3×3 Conv, 512
pool,1/2
3×3 Conv, 512
3×3 Conv, 512
3×3 Conv, 512
3×3 Conv, 512
pool,1/2
fc 4096
fc 4096
fc 1000

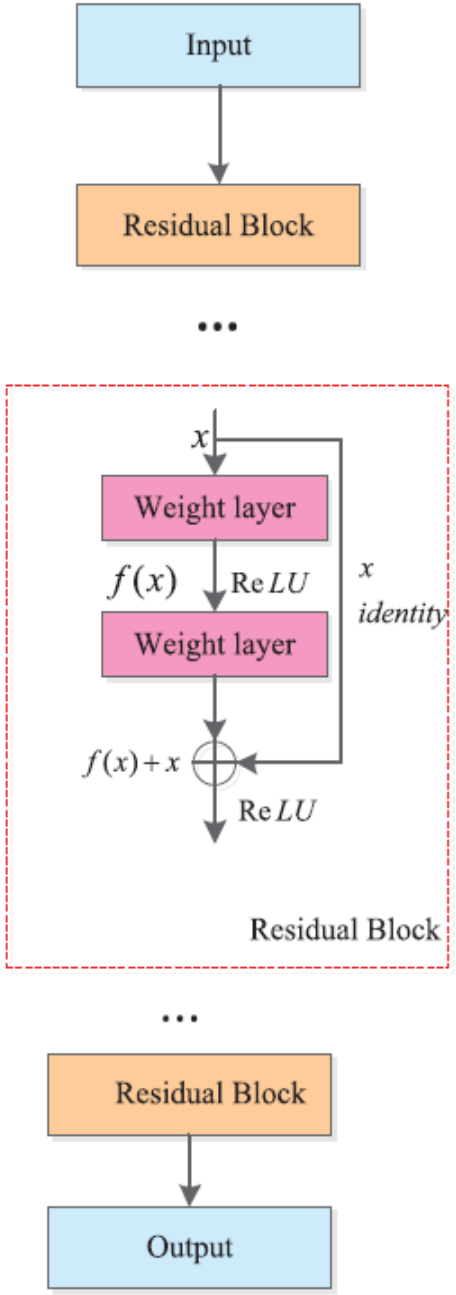
GoogLeNet

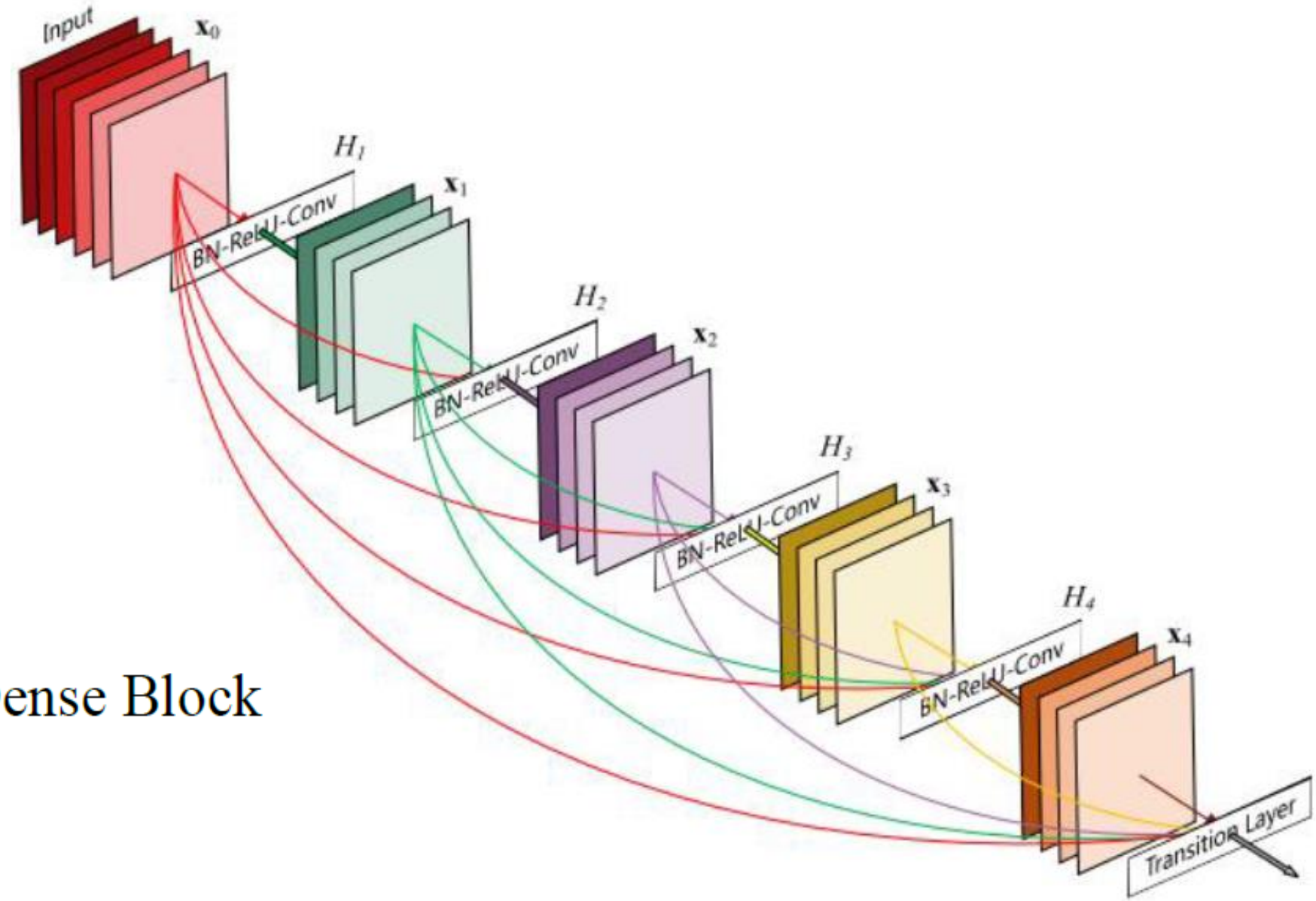

Filter concatenation
3×3 convolutions
5×5 convolutions
1×1 convolutions
1×1 convolutions
1×1 convolutions
1×1 convolutions
3×3 max pooling
Previous layer

ResNet



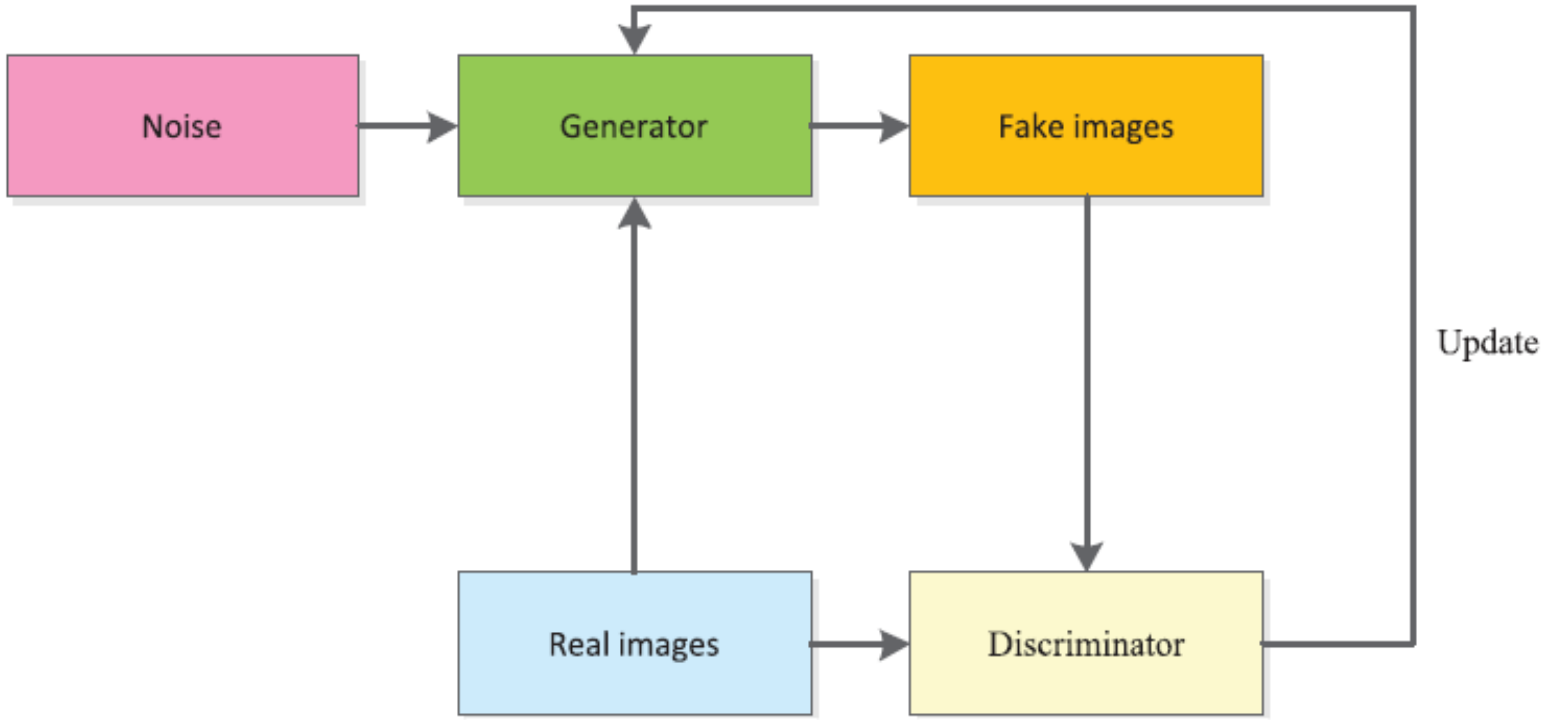
Skip-connections




Input
x_0
H_1
BN-ReLU-Conv
x_1
H_2
BN-ReLU-Conv
x_2
H_3
BN-ReLU-Conv
x_3
H_4
BN-ReLU-Conv
x_4
Transition Layer

Dense Block

GAN


Noise
Generator
Fake images
Update
Real images
Discriminator