

Question 1

Kernel Size	Input Size	No of Kernels	Value	Output Size	Params
3x3	150x150x3	32	$\begin{aligned} \text{WE: } 3 \times 3 \times 3 &= 27 \\ 27 \times 32 &= 864 \\ \text{Bias: } 1 \times 32 &= 32 \\ \text{Total: } &896 \end{aligned}$	$\begin{aligned} (150 - 3 + 2) + 1 &= 149 \\ &= 150 \times 150 \times 32 \end{aligned}$	896
2x2	150x150x32			$\begin{aligned} (150 - 2) &+ 1 \\ &= 149 \\ 149 \times 149 \times 32 &= 73856 \end{aligned}$	
3x3	75x75x32	64	$\begin{aligned} \text{WE: } 3 \times 3 \times 3 &= 27 \\ 27 \times 64 &= 1728 \\ \text{Bias: } 1 \times 64 &= 64 \\ \text{Total: } &1792 \end{aligned}$	$\begin{aligned} (75 - 3) + 1 &= 73 \\ &= 75 \times 75 \times 64 \end{aligned}$	12996
2x2	75x75x64			$\begin{aligned} (75 - 2) &+ 1 \\ &= 74 \\ 74 \times 74 \times 64 &= 35536 \end{aligned}$	
3x3	37x37x64	128	$\begin{aligned} \text{WE: } 3 \times 3 \times 3 &= 27 \\ 27 \times 128 &= 3456 \\ \text{Bias: } 1 \times 128 &= 128 \\ \text{Total: } &3584 \end{aligned}$	$\begin{aligned} (37 - 3 + 2) + 1 &= 37 \\ &= 37 \times 37 \times 128 \end{aligned}$	73856
2x2	37x37x128			$\begin{aligned} (37 - 2) &+ 1 \\ &= 36 \\ 36 \times 36 \times 128 &= 165888 \end{aligned}$	

Kernel
size

Input
size

No of
channels
~~64~~

Calc

$$18 \times 18 \times 128 \\ = 41472$$

64

$$64 \times 41 \\ = 2656$$

$$64 \times 1 \\ = 64$$

Total = 2

657272

1

$$1 \times 64 \\ = 64$$

$$1 \times 1 \\ = 1$$

65

Total = 2717585

Output size

Params

2659272

65

Ques 4 on 2

Kernel size	Input size	No. of K	Calc	Outputs	Params
① 3x3	150x150x3	25	WE: 3x3x3 27x25 B: 1x25 Total: 700	$\begin{aligned} 3 \times 3 &= 27 \\ &= 6 + 5 \\ &= 79 \times 79 \times 25 \end{aligned}$	700
② 2x2	79x79x25			$\begin{aligned} &= 37 \times 37 \times 25 \end{aligned}$	
③ 3x3	37x37x25	35	WE: 3x3x25 = 225 225x35 B: 1x35 T: 7910	$\begin{aligned} &= 7875 \\ &= 18 \times 18 \times 35 \end{aligned}$	7910
④ 2x2	18x18x35			$\begin{aligned} &= 8 + 1 = 9 \\ &= 1 \times 9 \times 35 \end{aligned}$	
⑤ 3x3	9x9x35	50	WE: 3x3x35 315x50 B: 50 T: 15800	$\begin{aligned} &= 315 \\ &= 15750 \\ &= 7 \times 7 \times 50 \end{aligned}$	15800
⑥ 2x2	7x7x50			$\begin{aligned} &= 3 \times 3 \times 50 \end{aligned}$	

Ks Is Noth

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Calc

$$2 \times 2 \times 50 \\ = 950$$

1029

$$Wt: 950 \times 1029$$

$$B: 1 \times 1029$$

$$T: 961829$$

100

$$Wt: 101 \times 1029$$

$$B: 1 \times 10$$

$$102500$$

Total: ~~961829~~

Os

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Parans

$$960800$$

$$961829$$

$$= 102900 \\ = 100$$

$$10250$$

$$588739$$

Question 3

Kernel Size Input Size No of Kernels

7x7 224x224x3 32

3x3 55x55x32 -

3x3 27x27x32 64

3x3 25x25x64 -

3x3 12x12x64 128

Calculation

$$\text{Weights} = 7 \times 7 \times 3$$

$$= 147$$

$$147 \times 32 = 4704$$

$$\text{Bias} = 1 \times 32 = 32$$

$$\text{Total} = 4736$$

-

$$\text{Weights} = 3 \times 3 \times 32$$

$$= 288$$

$$288 \times 64 = 18432$$

$$\text{Bias} = 1 \times 64 = 64$$

$$\text{Total} = 18496$$

-

$$\text{Weights} = 3 \times 3 \times 64$$

$$= 576$$

$$576 \times 128 = 73728$$

$$\text{Bias} = 1 \times 128$$

$$\text{Total} = 73856$$

Output

$$Ow = \frac{224-7}{4} + 1$$

$$= 55$$

$$55 \times 55 \times 32$$

$$Ow = \frac{55-3}{2} + 1 = 27$$

$$27 \times 27 \times 32$$

$$Ow = \frac{27-3}{1} + 1$$

$$= 25$$

$$25 \times 25 \times 64$$

$$Ow = \frac{25-3}{2} + 1$$

$$= 12$$

$$12 \times 12 \times 64$$

$$Ow = \frac{12-3}{1} + 1$$

$$= 10$$

$$10 \times 10 \times 128$$

Params

4736

-

18496

-

73856

$$3 \times 3$$

$$10 \times 10 \times 128$$

$$4 \times 4 \times 128$$

$$= 2048$$

$$OW = \frac{10-3}{2} + 1$$

$$= 4$$

$$4 \times 4 \times 128$$

$$2048$$

$$Weight = 2048 \times 512$$

$$= 1048576$$

$$1049088$$

$$Bias = 1 \times 512$$

$$Total = 1049088$$

$$Weight = 100 \times 512$$

$$= 51200$$

$$51300$$

$$Bias = 1 \times 100$$

$$Total = 51300$$

$$Total = 1197476$$

Manual Parameter Calc

Kernel size	Input size	No of kernels	Calc
11x11	224x224x3	64	$Wts: 11 \times 11 \times 3$ $64 \times 363 = 23232$ $Bias: 1 \times 64$ $Total = 23296$

3x3 107x107x64

5x5	53x53x64	128	$Wts: 5 \times 5 \times 64 = 1600$ $1600 \times 128 = 204800$ $Bias: 1 \times 128 = 128$ $Total = 204928$
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3x3 53x53x128

3x3	26x26x128	256	$Wts: 3 \times 3 \times 128 = 1152$ $256 \times 1152 = 294912$ $Bias: 1 \times 256$ $Total = 295168$
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Output size Parameters

$$\begin{aligned}
 O_w &= \left(\frac{W - F + 2P}{S} \right) + 1 \\
 &= \left(\frac{224 - 11 + 0}{2} \right) + 1 \\
 &= 107 \\
 &107 \times 107 \times 64
 \end{aligned}$$

$$\begin{aligned}
 O_s &= \left(\frac{O_w - F + 0}{2} \right) + 1 \\
 &= 52 + 1 \\
 &= 53 \times 53 \times 64
 \end{aligned}$$

$$\begin{aligned}
 O_w &= \left(\frac{53 - 5 + 2 \times 2}{2} \right) + 1 \\
 &= 26 \\
 &26 \times 26 \times 128
 \end{aligned}$$

$$\begin{aligned}
 O_s &= \left(\frac{26 - 3 + 2}{2} \right) + 1 \\
 &= 13 \\
 &13 \times 13 \times 128
 \end{aligned}$$

$$\begin{aligned}
 &(26 - 3 + 2) - 1 \\
 &= 24 \\
 &24 \times 24 \times 128
 \end{aligned}$$

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 Kernel size: 3x3
 Input size: 26x26x256
 No. of kernels: 256
 Weights: 3x3 = 230
 2309 x 256
 Bias: 1x256
 Total = 590080

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 Output size: (26-3+1) + 1 = 24
 26x26x256
 256
 Params: 590080

3x3 26x26x256
 512
 Weights: 3x3 = 230
 2309 x 512
 Bias: 1x512
 Params: 1180

3x3 26x26x512
 1180160
 160

3x3 26x26x512

$$\left(\frac{26-3}{2}\right) + 1 = 12$$

12 x 12 x 512

12x12x512

2048 12x12x512 = 73728

15099692

Weights: 2048 x 73728 = 15099692

Bias: 1x2048

Total: 15099692

2048176

1024 Weights: 1024 x 2048 = 2097152

Total: 2098176

10

$$\begin{aligned} \text{WT} &: 10 \times 1024 \\ &= 10240 \end{aligned}$$

$$\begin{aligned} \text{Bias} &: 1 \times 108 \\ &= 108 \end{aligned}$$

$$\text{Total} = 10240$$

$$\text{TOTAL} : 155399050$$

10250

§ 5

kernel size	Input size	No of kernels	Calc
7x7	224x224x3	32	WT: 7x7 = 147

$$147 \times 32 = 4704$$

$$B: 1 \times 32$$

$$T = 4736$$

② 2x2 104x104x32

③ 5x5 51x51x32 32 W: 5x5 = 800

$$800 \times 32 = 25600$$

$$B: 1 \times 32$$

$$T = 25632$$

⑤ 2x2 51x51x32

⑥ 3x3 27x27x32 32 W = 3x3 = 288

$$288 \times 32 = 9216$$

$$B: 3 \times 32$$

$$T = 9248$$

⑦ 2x2 27x27x32

Output size Params

$$\left(\frac{224-7}{2} \right) + 1 = 104 \times 104 \times 32$$

$$\left(\frac{104-2}{2} \right) + 1 = 51 \times 51 \times 32$$

$$\left(\frac{51-5+1}{2} \right) + 1 = 51 \times 51 \times 32$$

$$\left(\frac{51-2}{2} \right) + 1 = 27 \times 27 \times 32$$

$$\left(\frac{27-3+1}{2} \right) + 1 = 27 \times 27 \times 32$$

$$\left(\frac{27-2}{2} \right) + 1 = 13 \times 13 \times 32$$

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Neuron size
①
 3×3

Input size
 $13 \times 13 \times 32$

No. of kernels
 32

Calculation
 $N: 3 \times 3 \times 32 = 288$
 $288 \times 32 = 9216$
 $B: 1 \times 32$
 $TP: 9216$

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Output size
 $(13 - 3 + 1) + 1$
 $= 13 \times 13 \times 32$

Params
 9218

Neuron size
②
 2×2

Input size
 $13 \times 13 \times 32$

Output size
 $(\frac{13-2}{2}) + 1$
 $= 6 \times 6 \times 32$

Params
 1152

$6 \times 6 \times 32 = 1152$
 $1024 : N = 1152 \times 1024 = 1179648$
 $B: 1 \times 1024$
 $T = 1180672$

Params
 1180672

10
 $N: 1024 \times 10 = 10240$
 $B = 10$
 $TP = 10250$

Params
 10250

TOTAL params: 1239786