

Convolution arithmetics

3 ₀	3 ₁	2 ₂	1	0
0 ₂	0 ₂	1 ₀	3	1
3 ₀	1 ₁	2 ₂	2	3
2	0	0	2	2
2	0	0	0	1

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

3	3 ₀	2 ₁	1 ₂	0
0	0 ₂	1 ₂	3 ₀	1
3	1 ₀	2 ₁	2 ₂	3
2	0	0	2	2
2	0	0	0	1

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

3	3	2 ₀	1 ₁	0 ₂
0	0	1 ₂	3 ₂	1 ₀
3	1	2 ₀	2 ₁	3 ₂
2	0	0	2	2
2	0	0	0	1

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

3	3	2	1	0
0 ₀	0 ₁	1 ₂	3	1
3 ₂	1 ₂	2 ₀	2	3
2 ₀	0 ₁	0 ₂	2	2
2	0	0	0	1

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

3	3	2	1	0
0	0 ₀	1 ₁	3 ₂	1
3	1 ₂	2 ₂	2 ₀	3
2	0 ₀	0 ₁	2 ₂	2
2	0	0	0	1

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

3	3	2	1	0
0	0	1 ₀	3 ₁	1 ₂
3	1	2 ₂	2 ₂	3 ₀
2	0	0 ₀	2 ₁	2 ₂
2	0	0	0	1

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

3	3	2	1	0
0	0	1	3	1
3 ₀	1 ₁	2 ₂	2	3
2 ₂	0 ₂	0 ₀	2	2
2 ₀	0 ₁	0 ₂	0	1

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

3	3	2	1	0
0	0	1	3	1
3	1 ₀	2 ₁	2 ₂	3
2	0 ₂	0 ₂	2 ₀	2
2	0 ₀	0 ₁	0 ₂	1

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

3	3	2	1	0
0	0	1	3	1
3	1	2 ₀	2 ₁	3 ₂
2	0	0 ₂	2 ₂	2 ₀
2	0	0 ₀	0 ₁	1 ₂

12.0	12.0	17.0
10.0	17.0	19.0
9.0	6.0	14.0

0 ₀	0 ₁	0 ₂	0	0	0	0
0 ₂	3 ₂	3 ₀	2	1	0	0
0 ₀	0 ₁	0 ₂	1	3	1	0
0	3	1	2	2	3	0
0	2	0	0	2	2	0
0	2	0	0	0	1	0
0	0	0	0	0	0	0

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

0	0	0 ₀	0 ₁	0 ₂	0	0
0	3	3 ₂	2 ₂	1 ₀	0	0
0	0	0 ₀	1 ₁	3 ₂	1	0
0	3	1	2	2	3	0
0	2	0	0	2	2	0
0	2	0	0	0	1	0
0	0	0	0	0	0	0

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

0	0	0	0	0	0 ₀	0 ₁	0 ₂
0	3	3	2	1 ₂	0 ₂	0	0
0	0	0	1	3 ₀	1 ₁	0 ₂	
0	3	1	2	2	3	0	
0	2	0	0	2	2	0	
0	2	0	0	0	1	0	
0	0	0	0	0	0	0	0

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

0	0	0	0	0	0	0
0	3	3	2	1	0	0
0 ₀	0 ₁	0 ₂	1	3	1	0
0 ₂	3 ₂	1 ₀	2	2	3	0
0 ₀	2 ₁	0 ₂	0	2	2	0
0	2	0	0	0	1	0
0	0	0	0	0	0	0

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

0	0	0	0	0	0	0
0	3	3	2	1	0	0
0	0	0 ₀	1 ₁	3 ₂	1	0
0	3	1 ₂	2 ₂	2 ₀	3	0
0	2	0 ₀	0 ₁	2 ₂	2	0
0	2	0	0	0	1	0
0	0	0	0	0	0	0

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

0	0	0	0	0	0	0
0	3	3	2	1	0	0
0	0	0	1	3 ₀	1 ₁	0 ₂
0	3	1	2	2 ₂	3 ₂	0 ₀
0	2	0	0	2 ₀	2 ₁	0 ₂
0	2	0	0	0	1	0
0	0	0	0	0	0	0

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

0	0	0	0	0	0	0
0	3	3	2	1	0	0
0	0	0	1	3	1	0
0	3	1	2	2	3	0
0 ₀	2 ₁	0 ₂	0	2	2	0
0 ₂	2 ₂	0 ₀	0	0	1	0
0 ₀	0 ₁	0 ₂	0	0	0	0

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

0	0	0	0	0	0	0
0	3	3	2	1	0	0
0	0	0	1	3	1	0
0	3	1	2	2	3	0
0	2	0 ₀	0 ₁	2 ₂	2	0
0	2	0 ₂	0 ₂	0 ₀	1	0
0	0	0 ₀	0 ₁	0 ₂	0	0

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

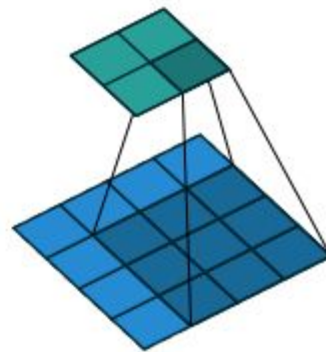
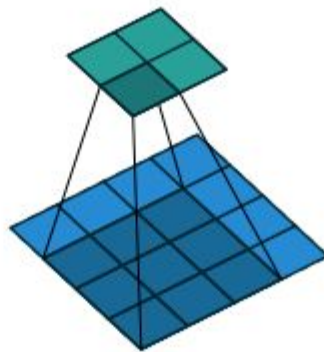
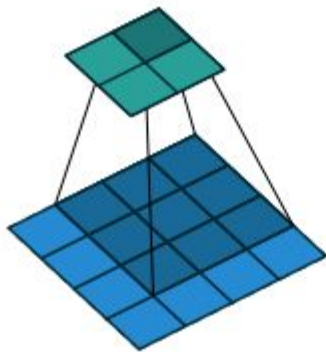
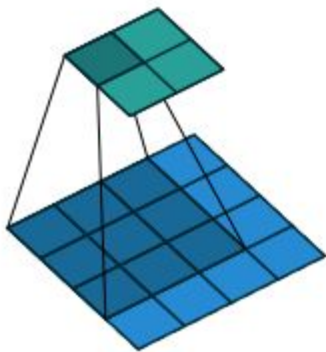
0	0	0	0	0	0	0
0	3	3	2	1	0	0
0	0	0	1	3	1	0
0	3	1	2	2	3	0
0	2	0	0	2 ₀	2 ₁	0 ₂
0	2	0	0	0 ₂	1 ₂	0 ₀
0	0	0	0	0 ₀	0 ₁	0 ₂

6.0	17.0	3.0
8.0	17.0	13.0
6.0	4.0	4.0

Settings

- 2-D discrete convolutions ($N = 2$)
- Square inputs ($i_1 = i_2 = i$)
- Square kernel size ($k_1 = k_2 = k$)
- Same strides along both axes ($s_1 = s_2 = s$)
- Same zero padding along both axes ($p_1 = p_2 = p$).

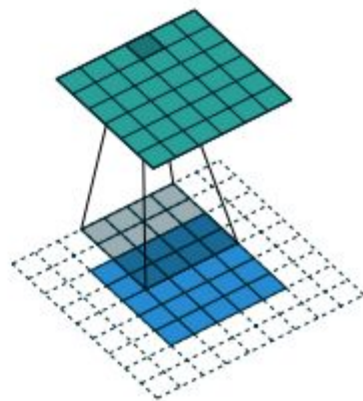
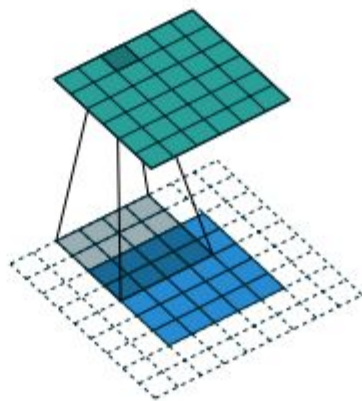
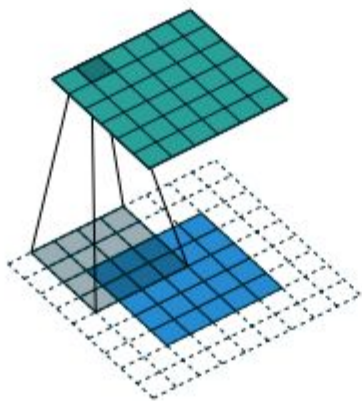
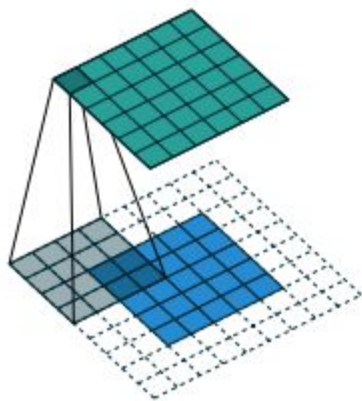
$k = (k, k)$, $p = (0, 0)$, $s = (1, 1)$



$$\mathbf{k} = (k, k), \mathbf{p} = (0, 0), \mathbf{s} = (1, 1)$$

$$o = (i - k) + 1$$

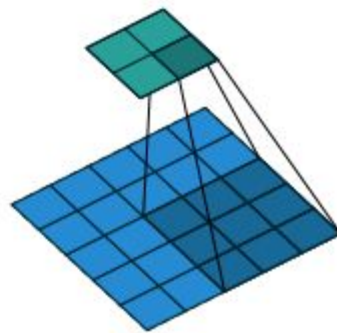
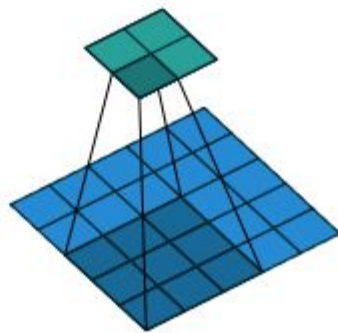
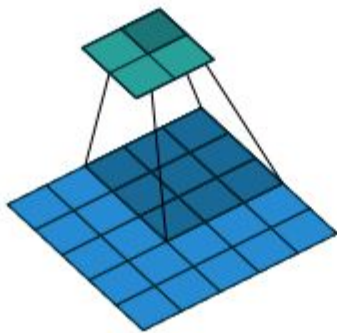
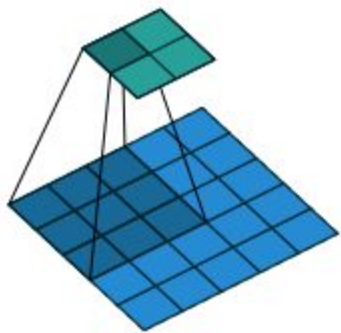
$k = (k, k)$, $p = (p, p)$, $s = (1, 1)$



$$k = (k, k), p = (p, p), s = (1, 1)$$

$$o = (i - k) + 2 * p + 1$$

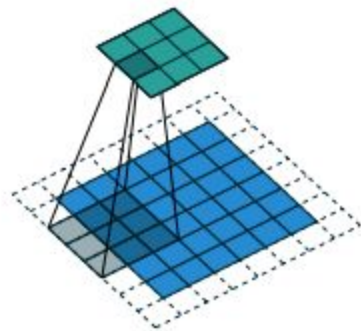
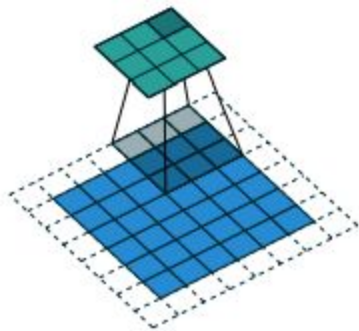
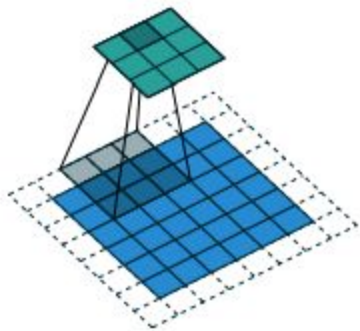
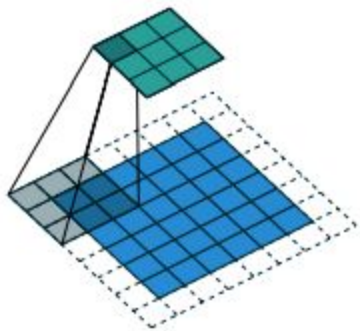
$$k = (k, k), p = (0, 0), s = (s, s)$$



$$\mathbf{k} = (k, k), \mathbf{p} = (0, 0), \mathbf{s} = (s, s)$$

$$o = \left\lfloor \frac{(i - k)}{s} \right\rfloor + 1$$

$k = (k, k)$, $p = (p, p)$, $s = (s, s)$



$$k = (k, k), p = (p, p), s = (s, s)$$

$$o = \left\lfloor \frac{(i + 2 * p - k)}{s} \right\rfloor + 1$$

$$k = (2n + 1, 2n + 1), s = (1, 1), i = 0, p - ?$$