

# CNNs - Stanford CS231N

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- **Spatial Arrangement**

- **Depth**

- \* Depth of output volume is a hyperparameter
    - \* It corresponds to the number of filters we use (each one looking for something different)
    - \* **Depth Column:** set of neurons looking at the same region of input

- **Stride**

- \* Stride is how many pixels you move each filter after each convolution with the input
    - \* Larger stride will produce smaller output volumes

- **Zero Padding**

- \* Hyperparameter for padding input volume with zeros
    - \* Allows for controlling the size of the output volume

- Output volume of a convolution is given as:

$$\frac{W - F + 2P}{S} + 1$$

- Where  $W$  is the input volume size,  $F$  is the filter size,  $P$  is zero padding size, and  $S$  is stride
  - Example with input size  $7 \times 7$  filter size  $3 \times 3$ , stride 1 and pad 0 giving an output size of  $5 \times 5 \times 3$ :

$$W = 7, F = 3, S = 1, P = 0$$

$$\frac{W - F + 2P}{S} + 1 = \frac{7 - 3 + 0}{1} + 1 = 5$$

- Setting zero-padding to:  $P = \frac{F-1}{2}$  when  $S = 1$  keeps input and output as the same dimension