CNNs - Stanford CS231N

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- **Gradient Formulas**
  - $\frac{\partial L}{\partial x} = (\frac{\partial L}{\partial y})w^T$
  - $\frac{\partial L}{\partial w} = x^T(\frac{\partial L}{\partial y})$
- **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 7×7 filter size 3×3, 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