Convolutional Neural Networks (CNNs)

- handles image data well
  - ↳ image classification CIFAR-10
  - ↳ object detection
  - ↳ neural style transfer
- pass filters over pixels
- CNNs work well when structure exists in our data
  - ↳ spatial, temporal, semantic

CNNs Structure

goal: reduce # of params needed to learn in FC layers.

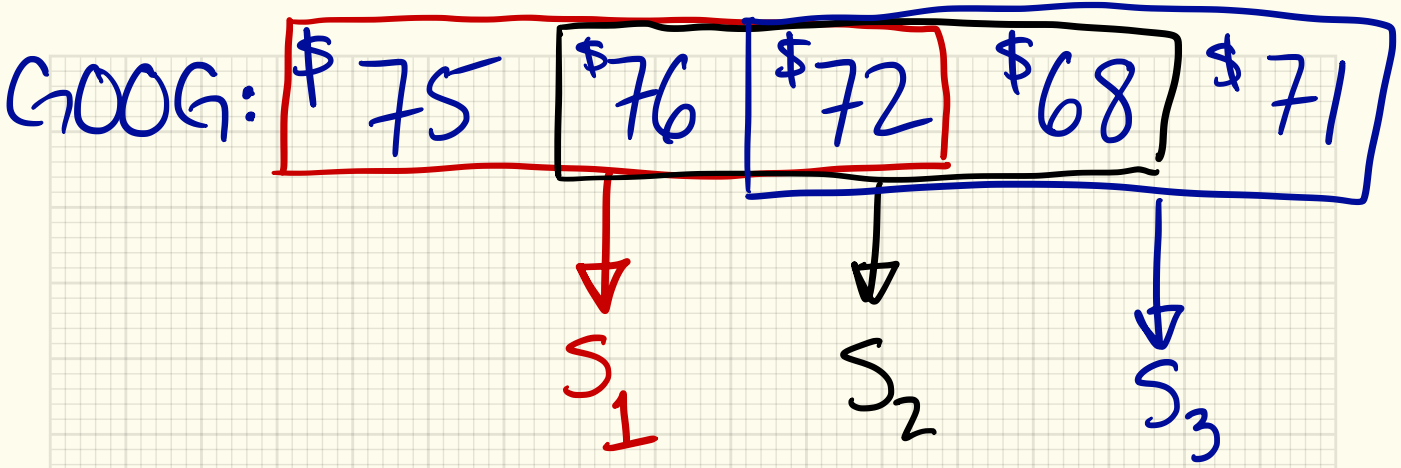
1) Convolutional
   - ↳ # of filters
     - ↳ as # of filters ↑, # of params ↑, level of detail ↑
   - ↳ size of filters
     - ↳ as size of filters increases, # of params ↑, level of detail ↓.
   - ↳ padding / stride
2) Pooling

Flatten(·)

3) Fully / Densely Connected
   - ↳ (FC)

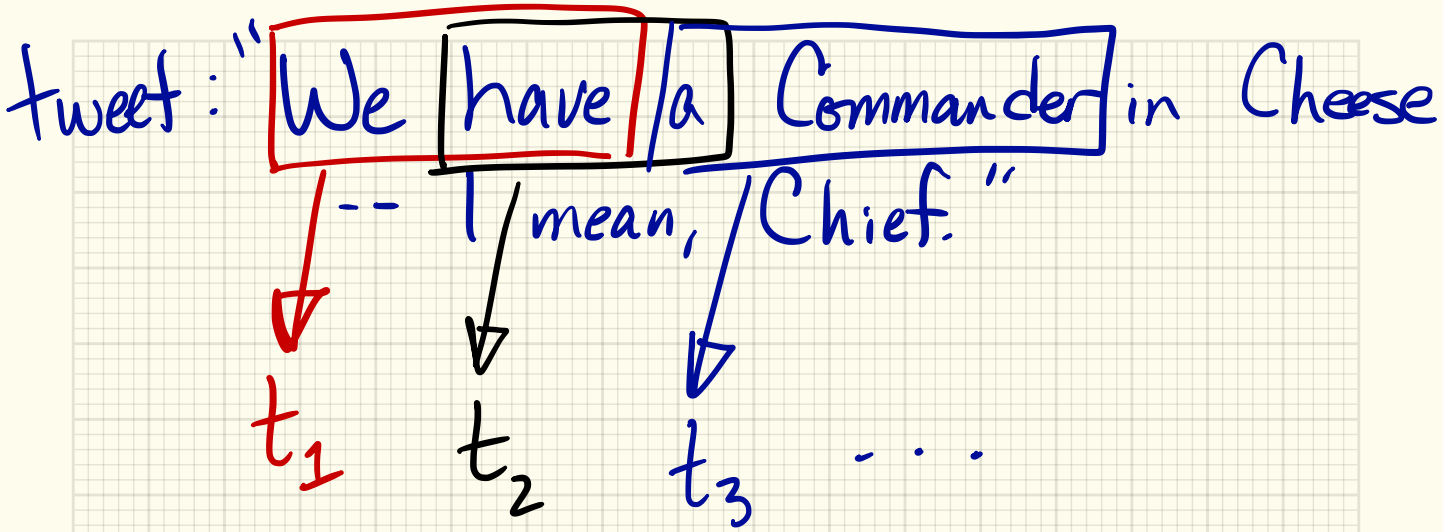
$$\begin{bmatrix} w_1 & w_2 & w_3 \\ w_4 & w_5 & w_6 \\ w_7 & w_8 & w_9 \end{bmatrix}$$

"Parameter Sharing"

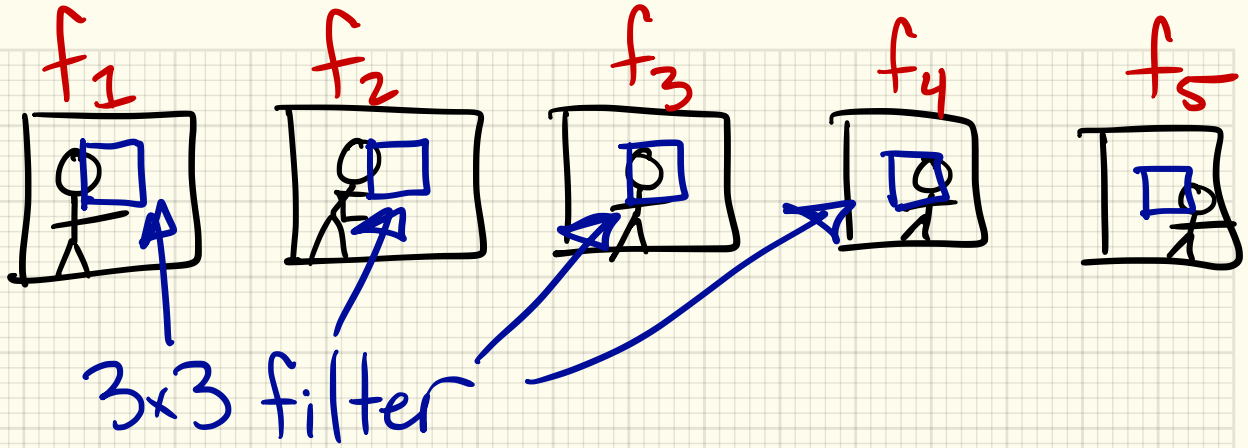


1D convolution / filter of length 3.

$$\text{filter} = [w_1 \quad w_2 \quad w_3]$$



1D Convolution w/ filter of size 2.



3D Convolution → 3 × 3 × 5

filter ⇒ $\underline{a} \times \underline{b} \times \underline{c}$