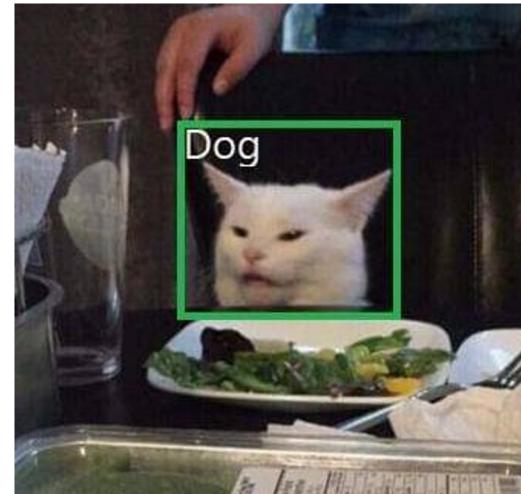
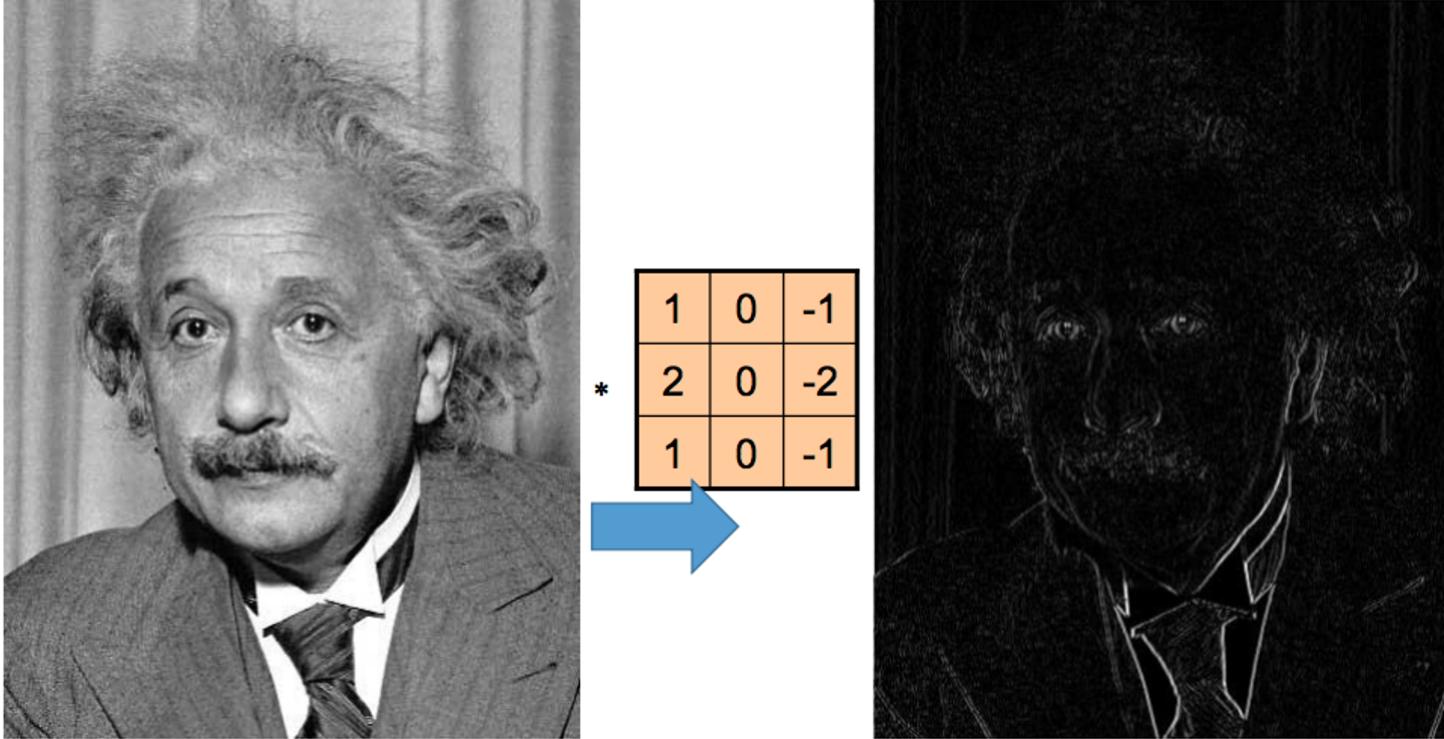


Seminar 3: CNN

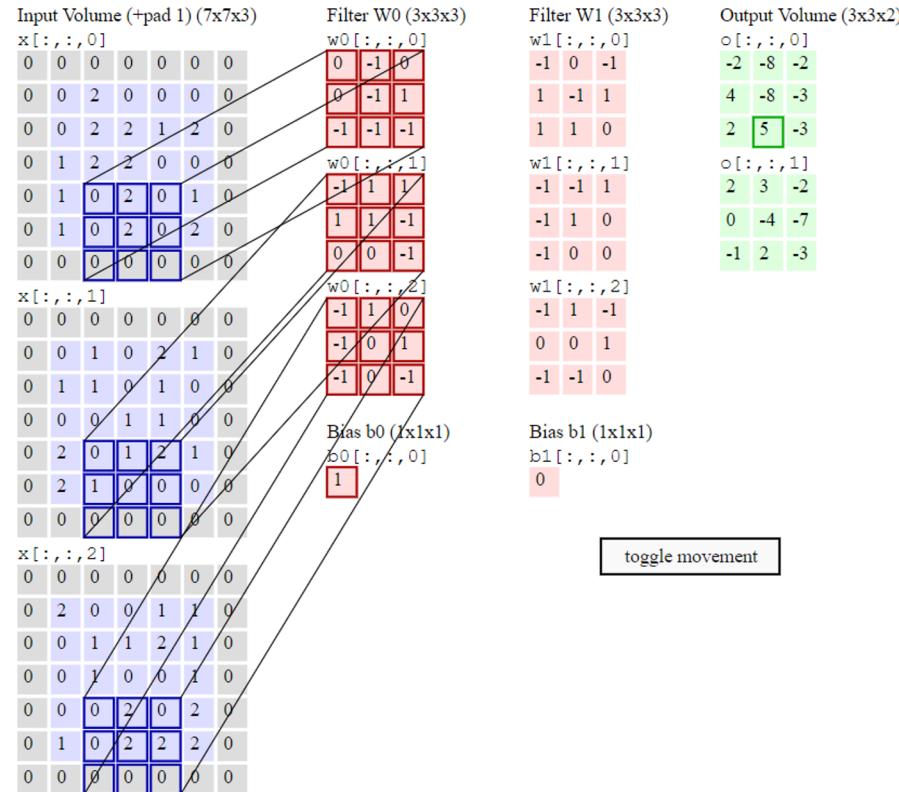


Filters is CV



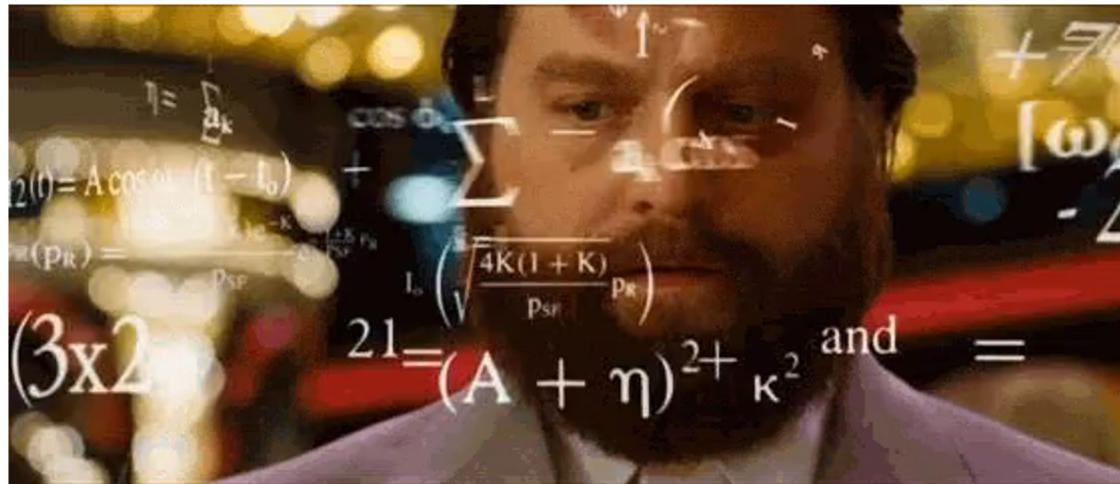
Vertical Edge
(absolute value)⁷

Convolution Layer



Why conv nets is better than fc?

Got it? Let's calculate parameters!



More convolutions!

$$\begin{bmatrix} 3 & 6 & 9 \\ 4 & 8 & 12 \\ 5 & 10 & 15 \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix} \times [1 \ 2 \ 3]$$

Image 1: Separating a 3x3 kernel spatially

Spatial Separable Convolutions =

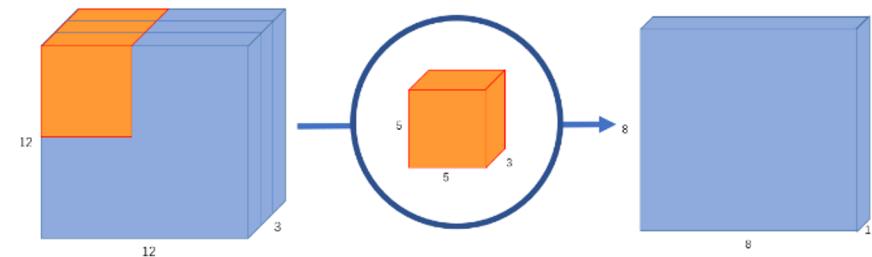


Image 4: A normal convolution with 8x8x1 output

Depthwise Separable Convolutions =

depthwise convolution + pointwise convolution

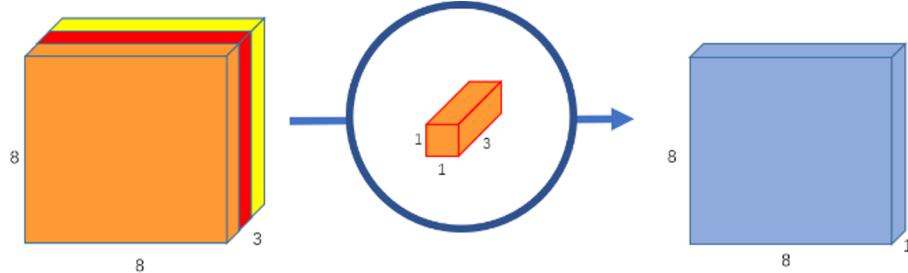


Image 7: Pointwise convolution, transforms an image of 3 channels to an image of 1 channel

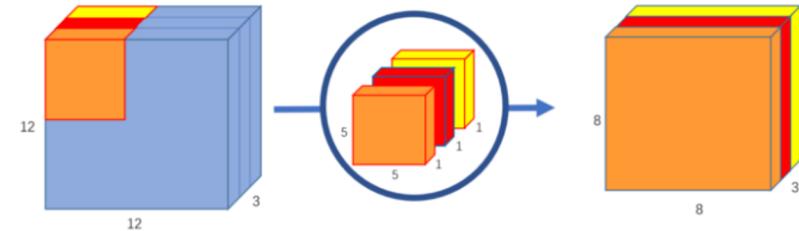
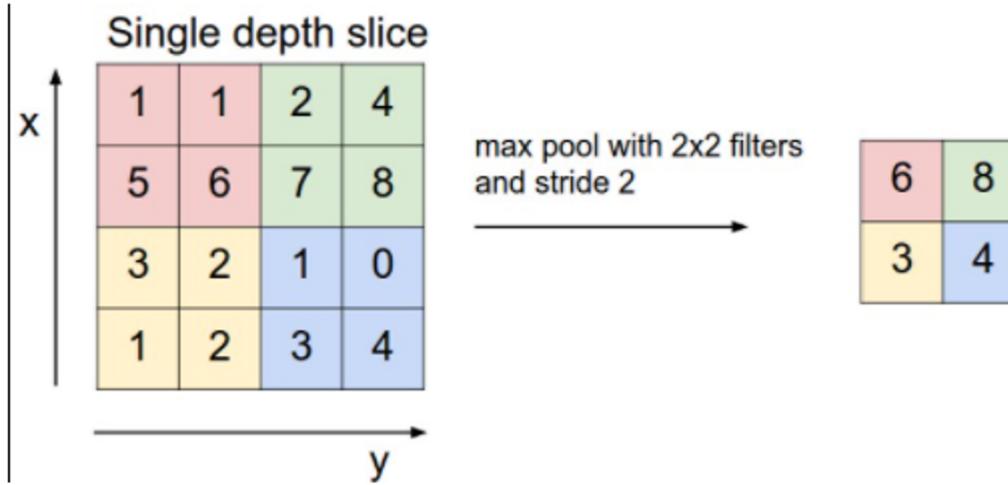


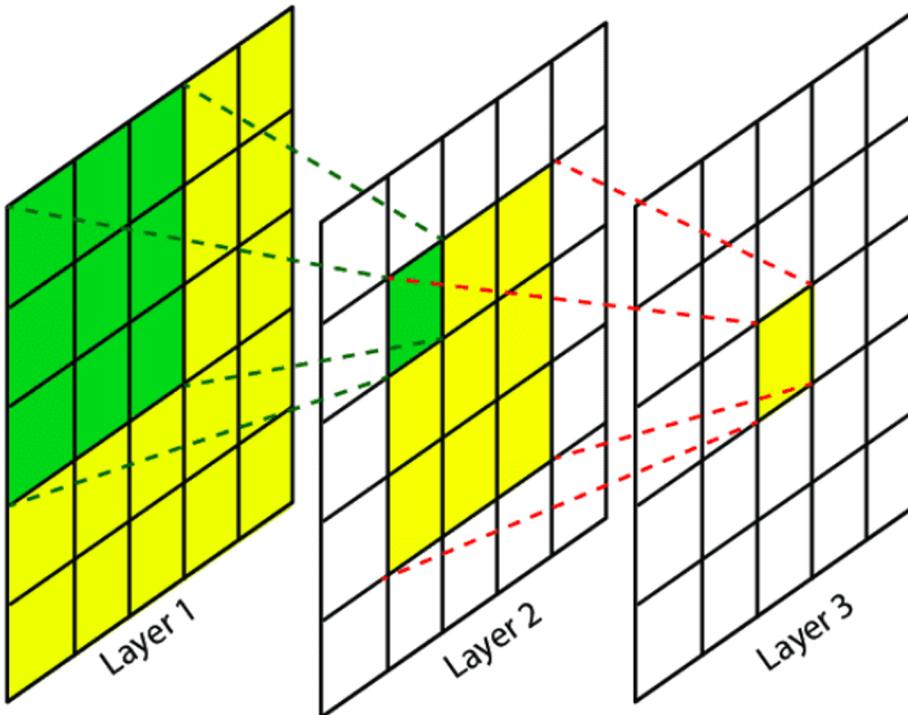
Image 6: Depthwise convolution, uses 3 kernels to transform a 12x12x3 image to a 8x8x3 image

Max Pooling

“The pooling operation used in convolutional neural networks is a big mistake and the fact that it works so well is a disaster.”



Idea of receptive field



more info: <https://theaisummer.com/receptive-field/>

Invariance

Translation Invariance



Rotation/Viewpoint Invariance



Size Invariance

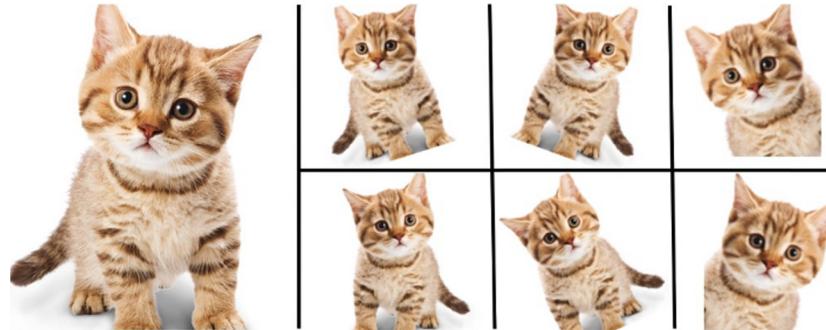


Illumination Invariance



<https://stats.stackexchange.com/questions/208936/what-is-translation-invariance-in-computer-vision-and-convolutional-neural-netwo>

Augmentation



Enlarge your Dataset



Flipping



Colour Jittering



Rotating



Original



Edge Enhancement

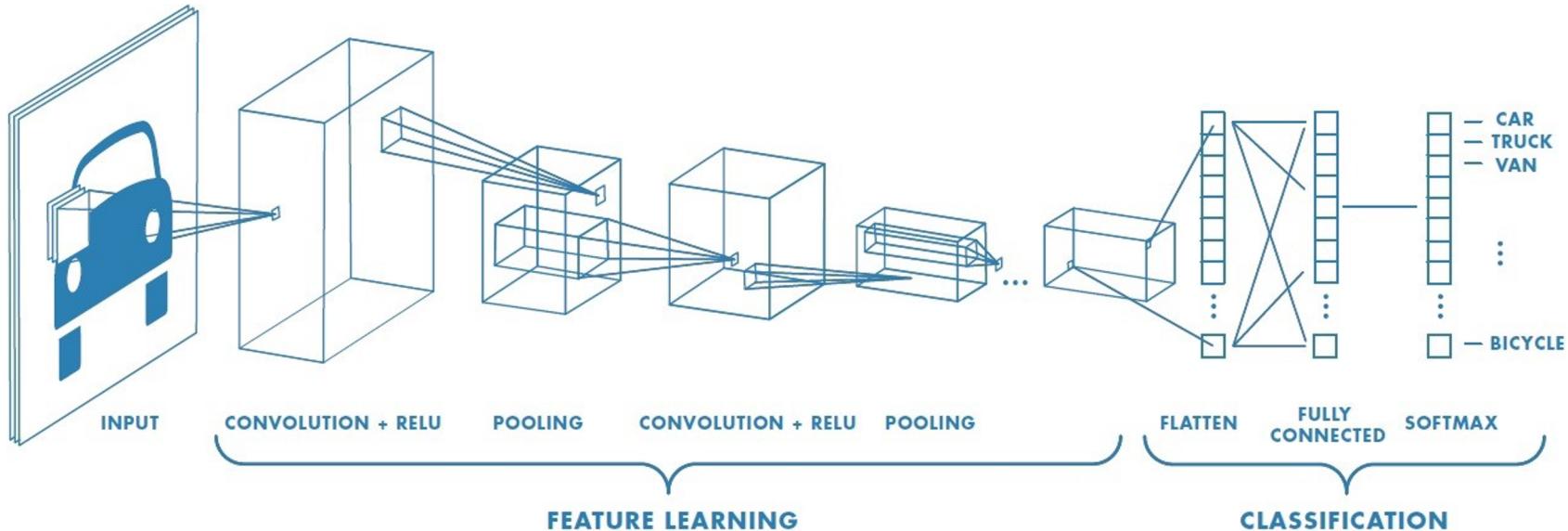


Cropping

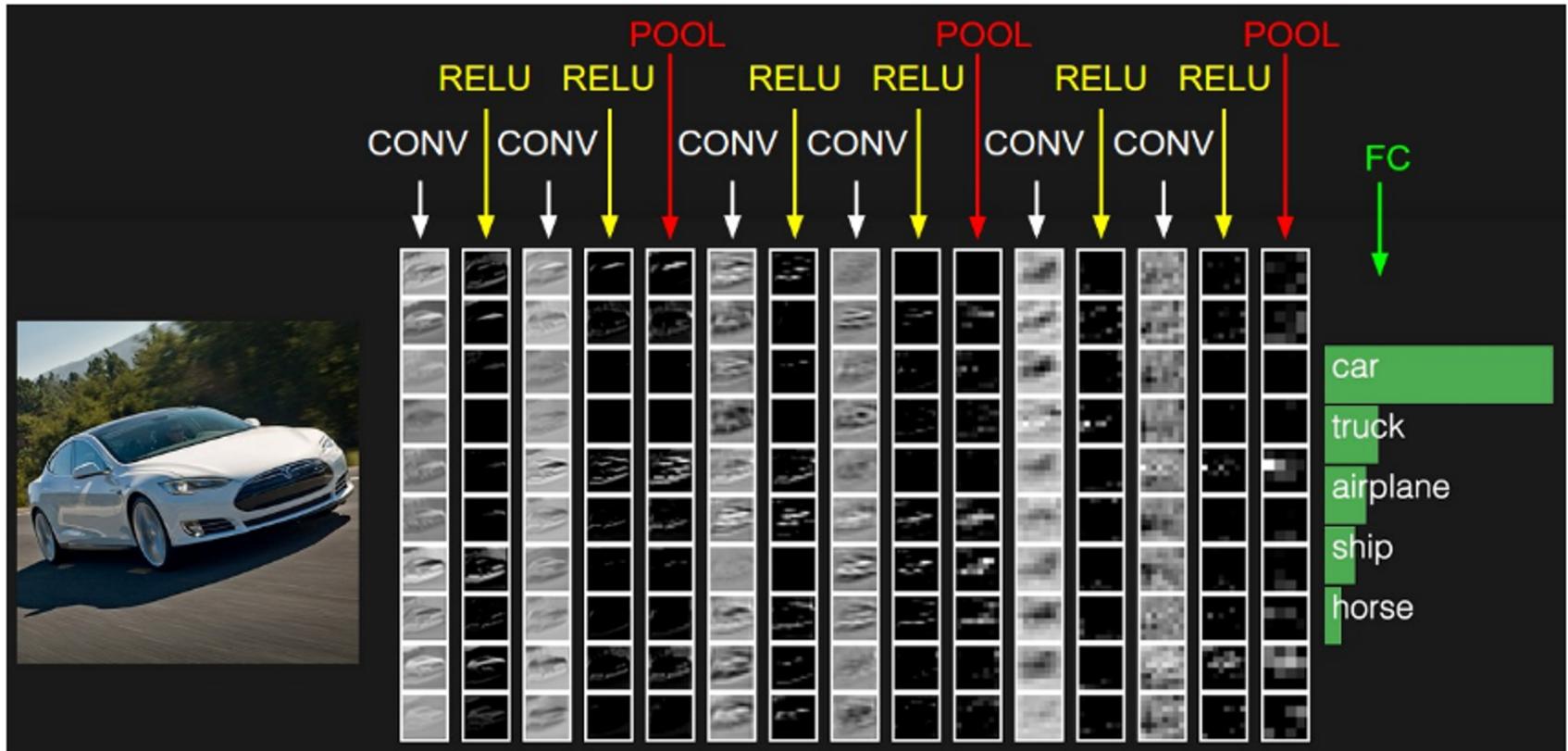


Fancy PCA

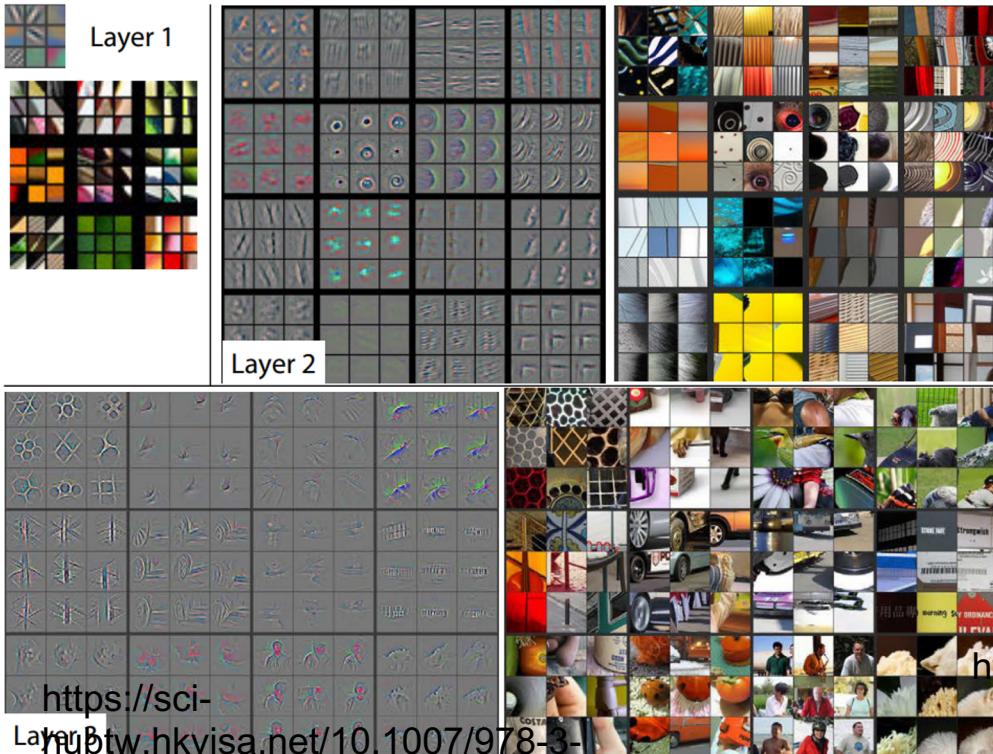
Convolutional NN



Convolutional NN



What CNN actually learn?



Dataset Examples show us what neurons respond to in practice



<https://distill.pub/2017/feature-visualization/>

https://science-hub.tw.hkvisa.net/10.11007/978-3-319-10590-1_53