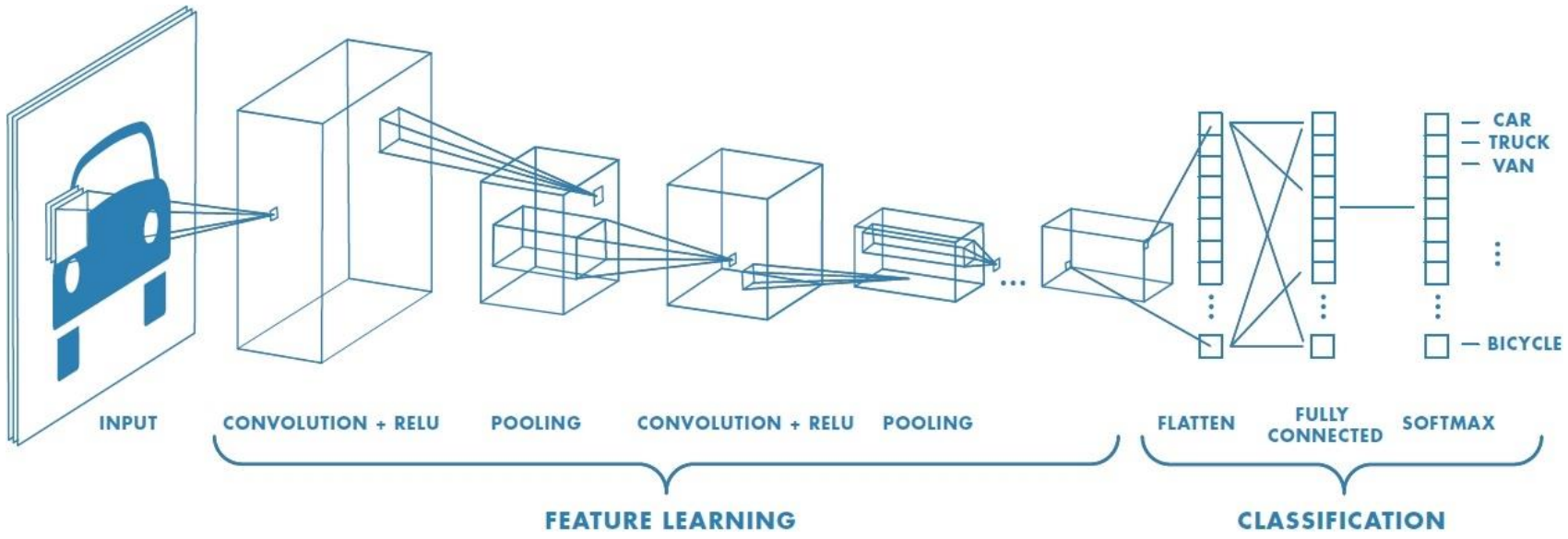
# CONVOLUTIONAL NEURAL NETWORKS

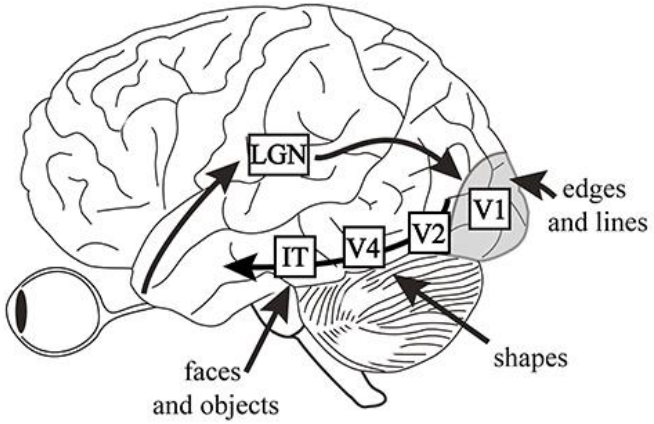
# What is CNN

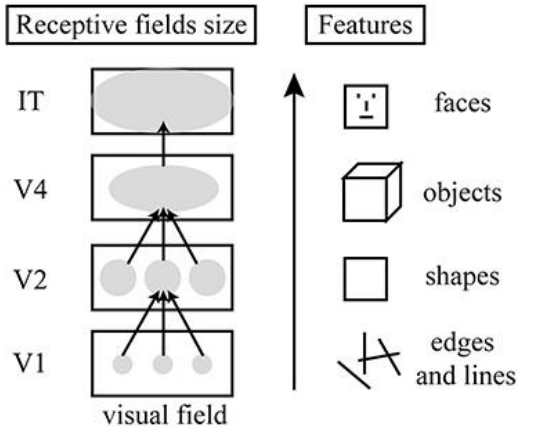
- Convolution + Activation
- Pooling
- Flattening
- Fully Connected



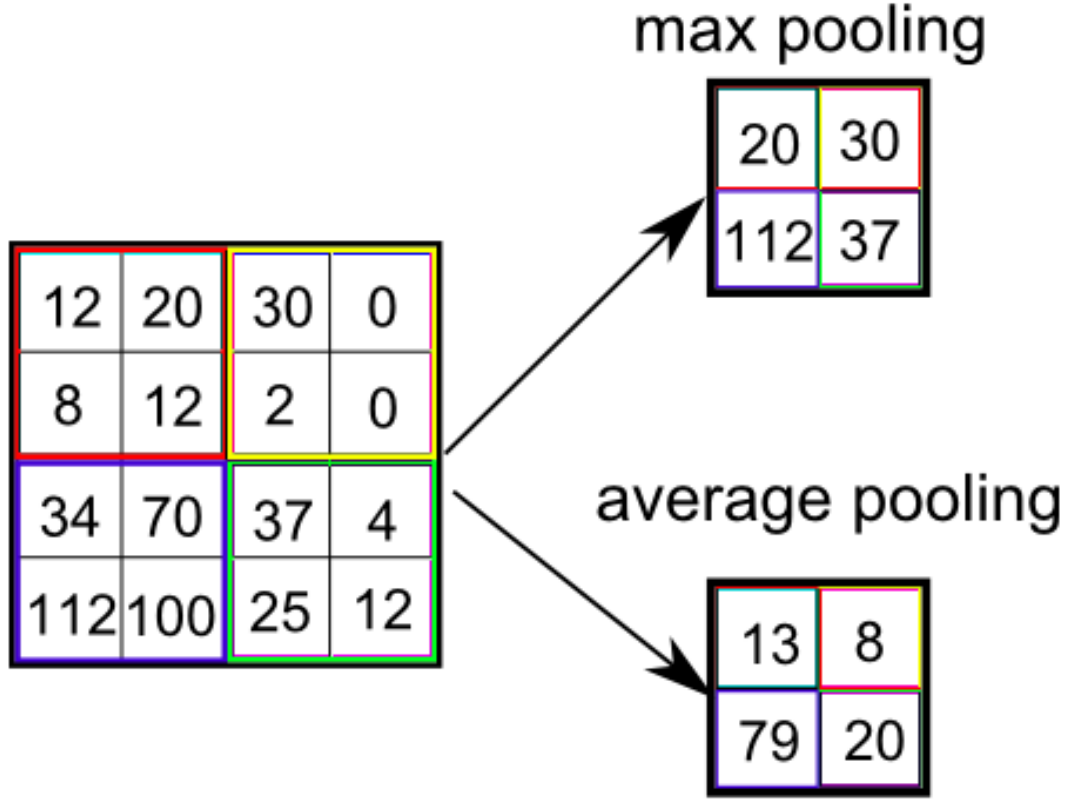
# Why CNN

- Inspired from Biological Visual System
- Performs better than simple feed forward ANNs

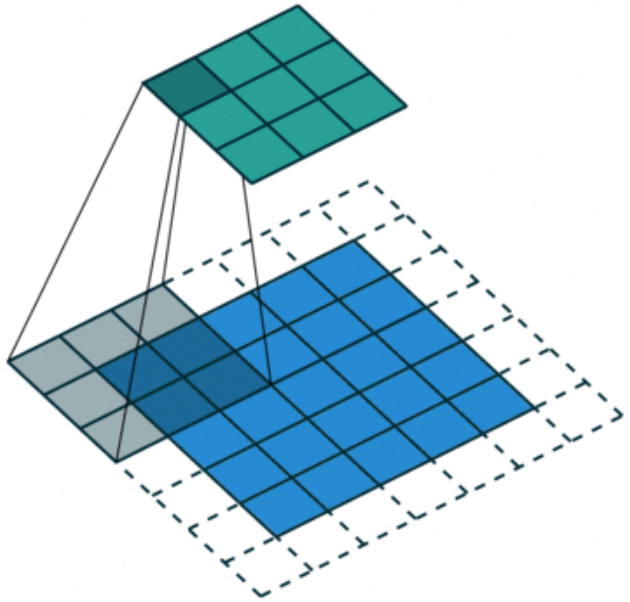


# Pooling


max pooling
average pooling
12 20 30 0
8 12 2 0
34 70 37 4
112 100 25 12
20 30
112 37
13 8
79 20

# Convolution



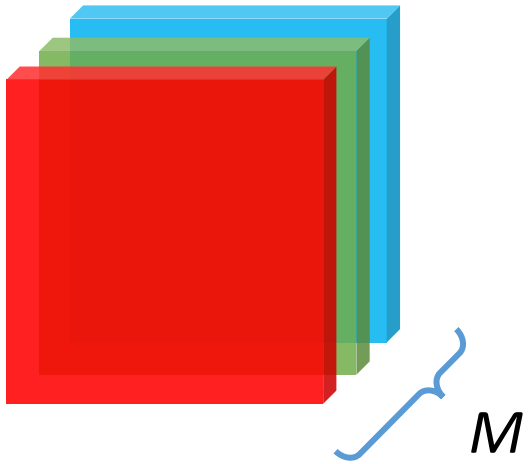
| | | | | |
|---|---|---|---|---|
| $1_{\times 1}$ | $1_{\times 0}$ | $1_{\times 1}$ | 0 | 0 |
| $0_{\times 0}$ | $1_{\times 1}$ | $1_{\times 0}$ | 1 | 0 |
| $0_{\times 1}$ | $0_{\times 0}$ | $1_{\times 1}$ | 1 | 1 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 |

Image

| | | |
|---|---|---|
| 4 | | |
| | | |
| | | |

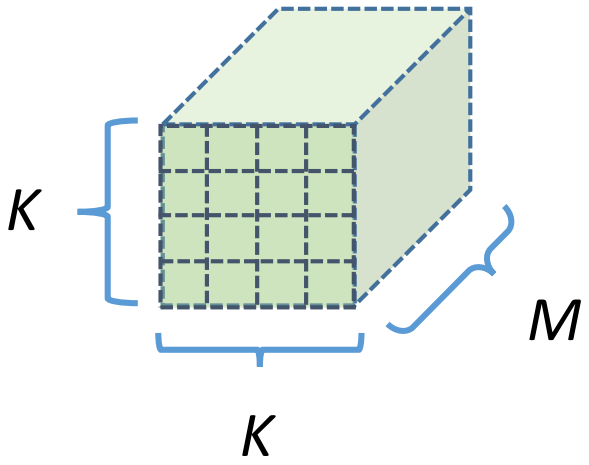
Convolved Feature

# 3D Convolution



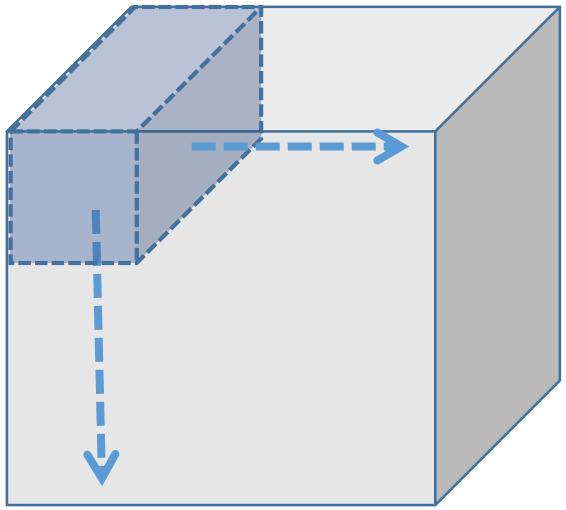

Input Image

# 3D Convolution

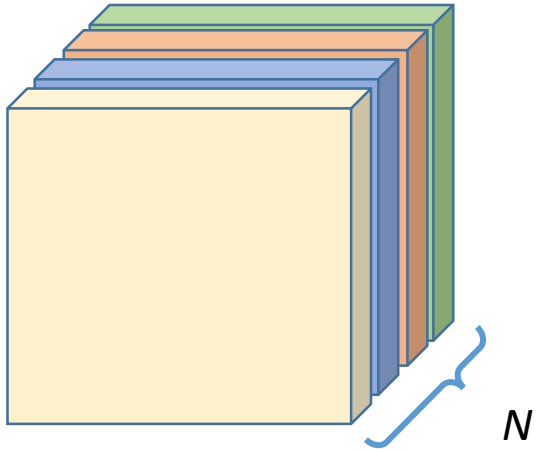



Kernel

# 3D Convolution



N Kernels




Feature Map

# 3D Convolution

Fully Connected
Neural Network