Convolutional Neural Networks

Overview

CNN Architectures and Parts

Why do they work?

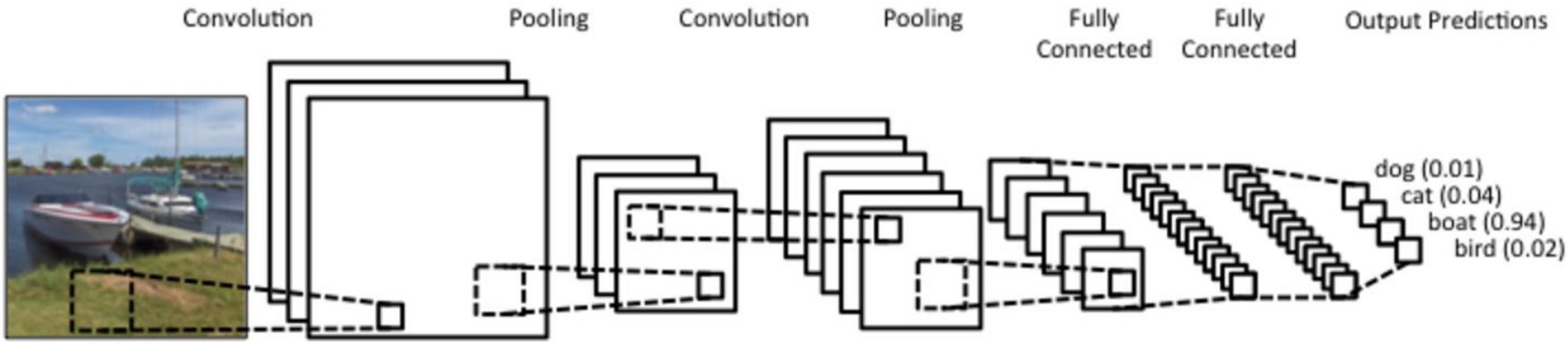
What are the benefits?

Applications

CAFFE and Tensorflow

CNN Architecture and Parts

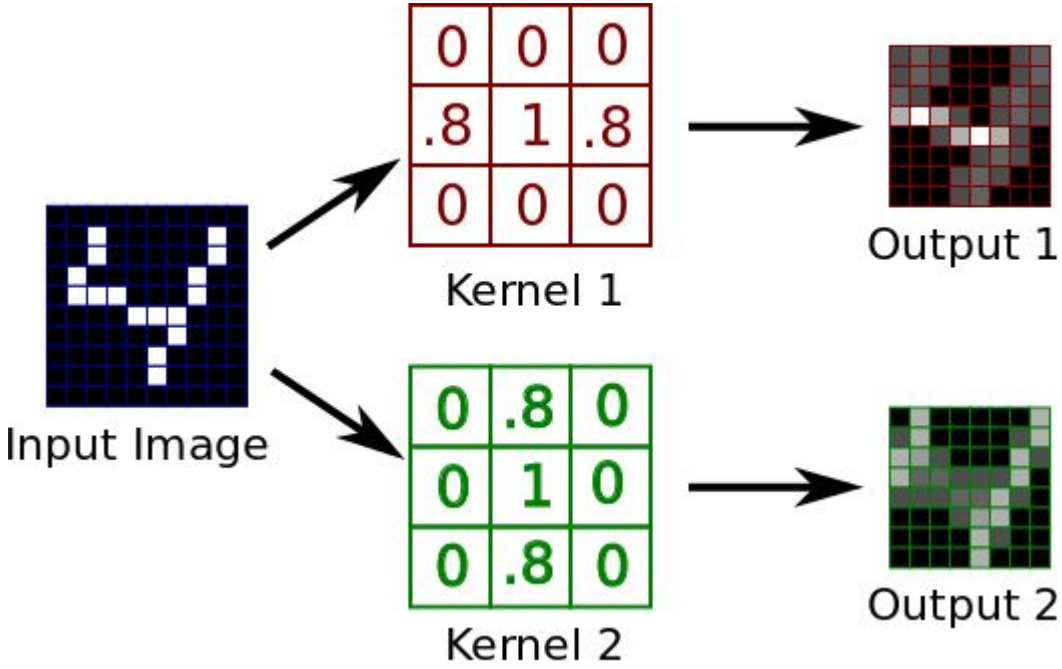
CNN Architecture



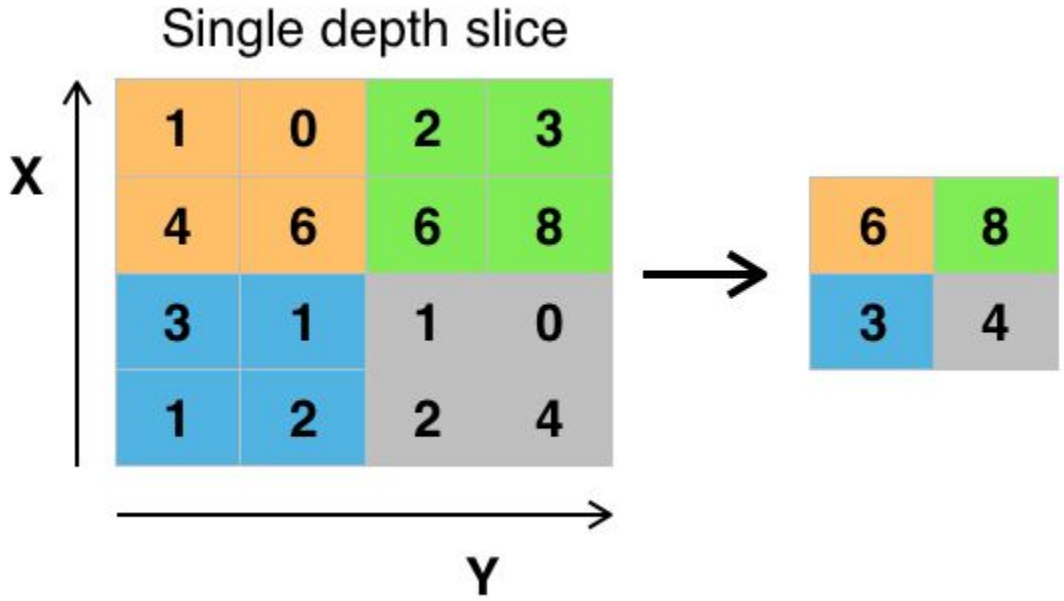
Typical architecture -

- Multiple convolutional & max pooling layers
- Fully connected layers
- Softmax prediction

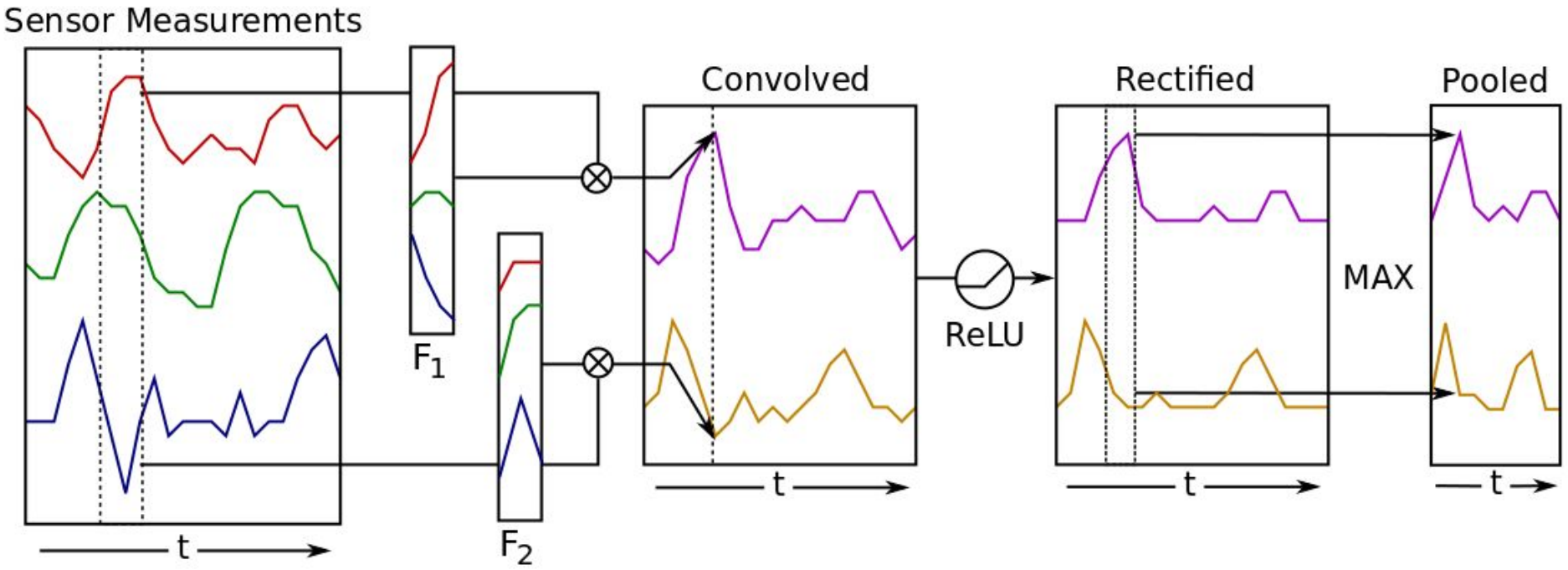
Parts - Convolutional Layer



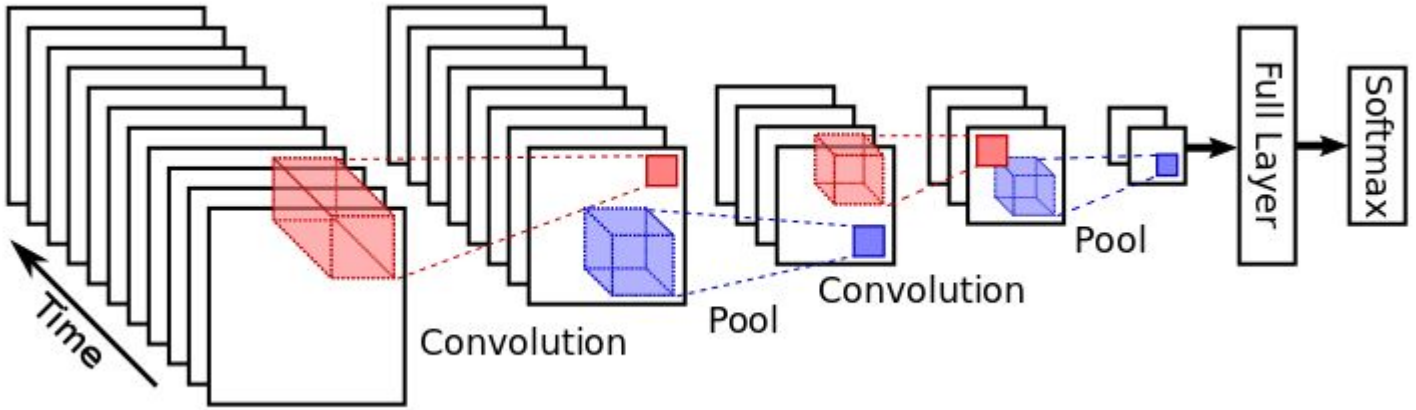
Parts - Max Pooling



1D CNN

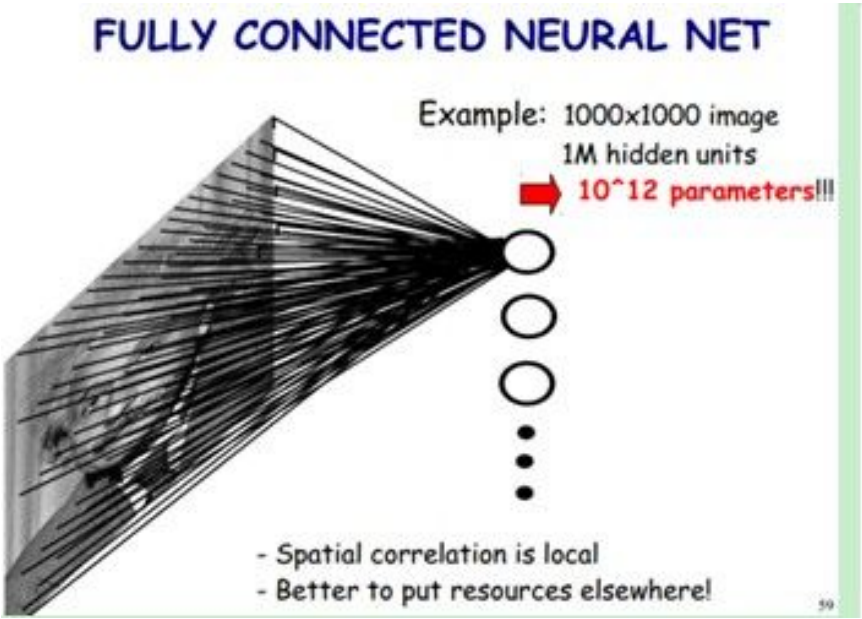

Sensor Measurements
t
F1
F2
Convolved
t
ReLU
Rectified
t
MAX
Pooled
t

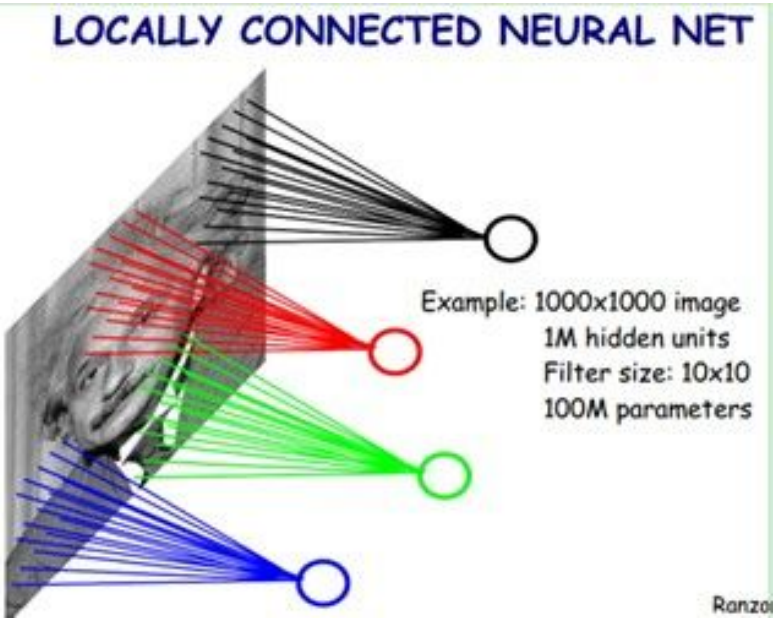
3D CNN


Time
Convolution
Pool
Convolution
Pool
Full Layer
Softmax

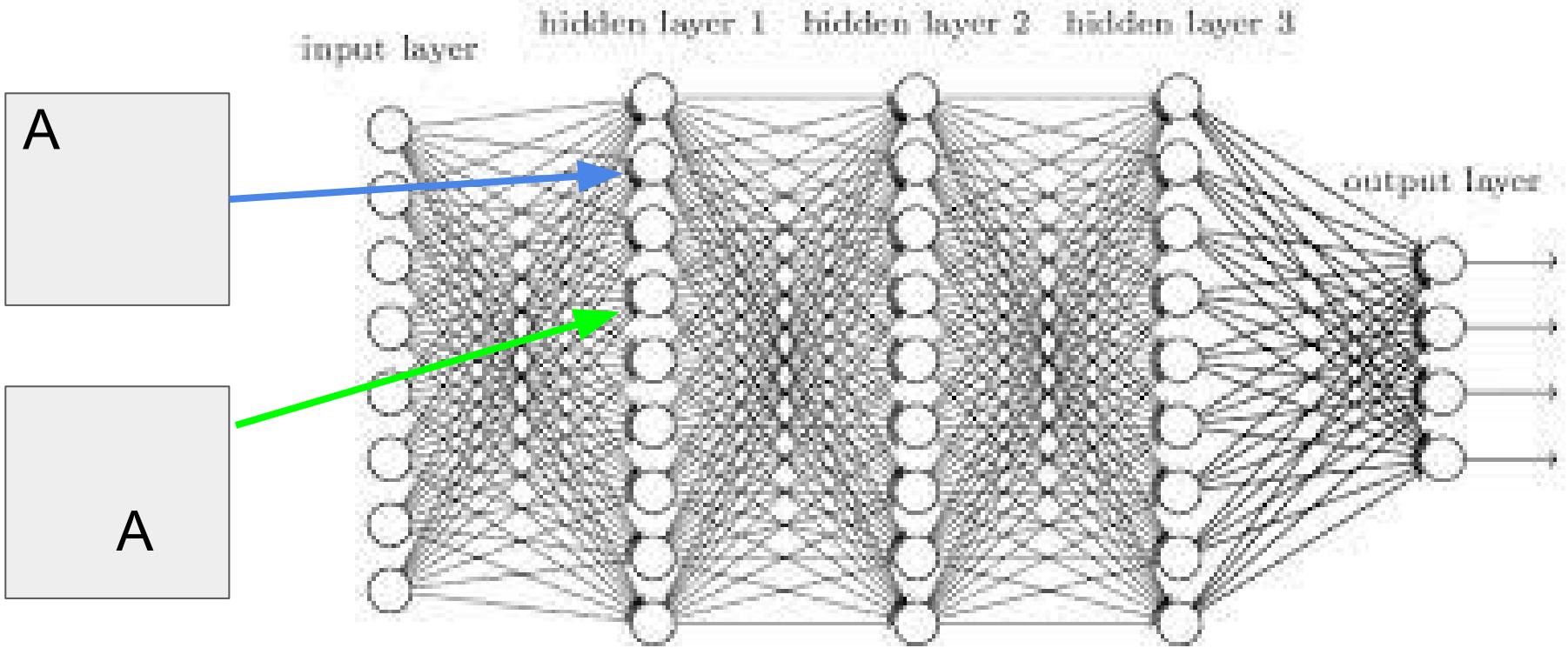
Why do they work?

CNN vs Fully Connected

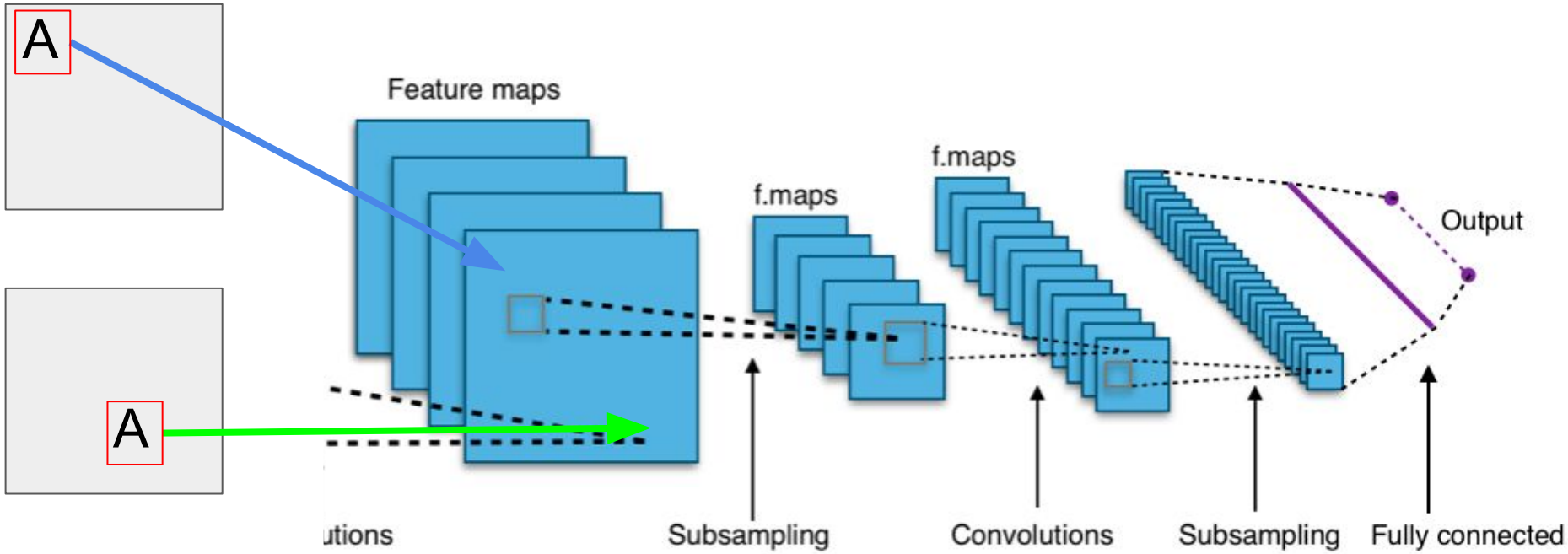




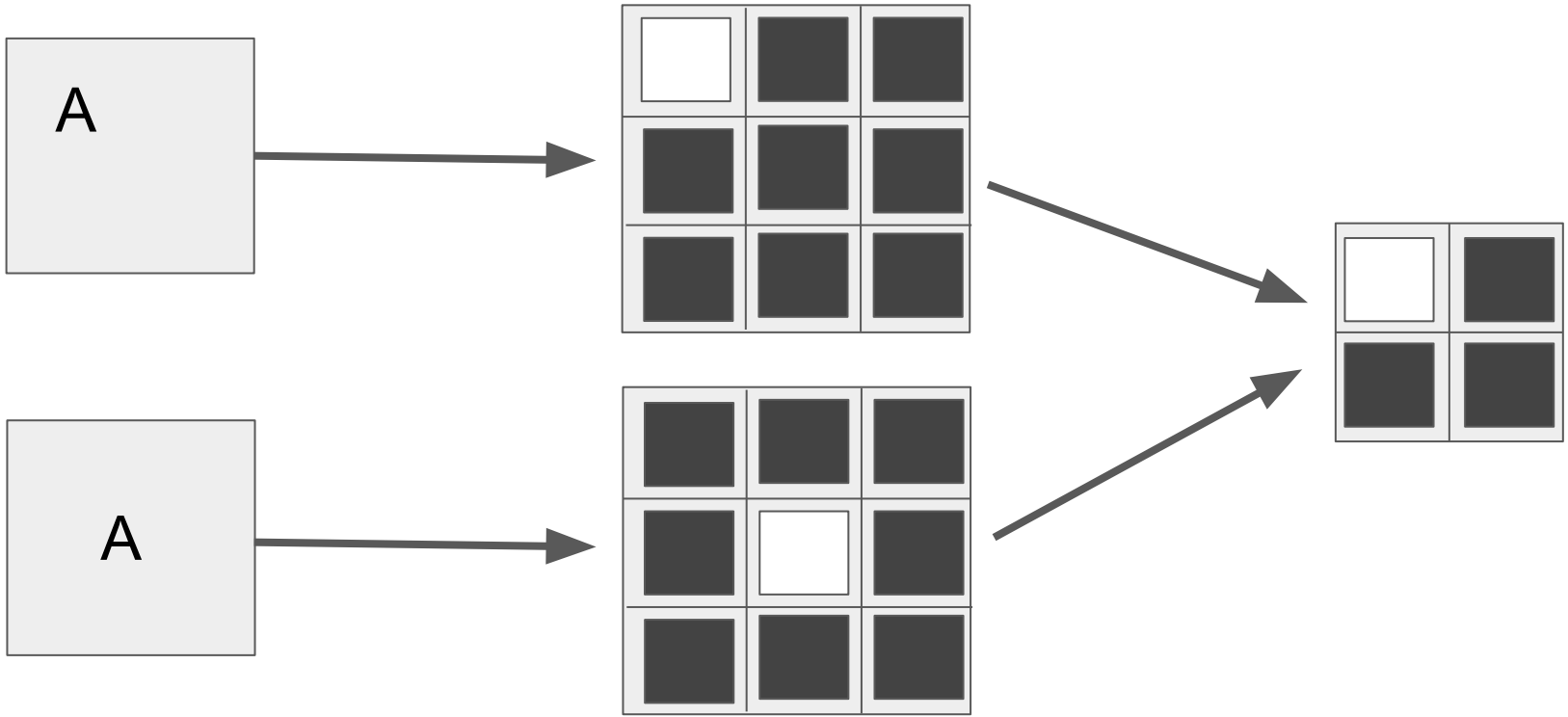
CNN vs. Fully Connected



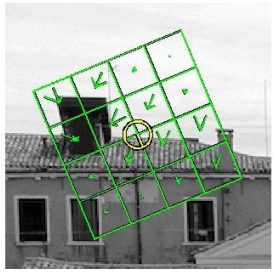
CNN vs Fully Connected

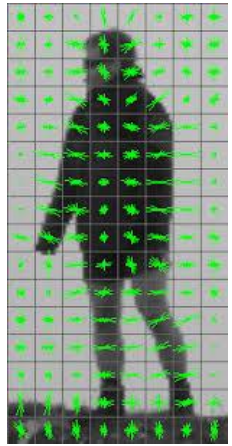


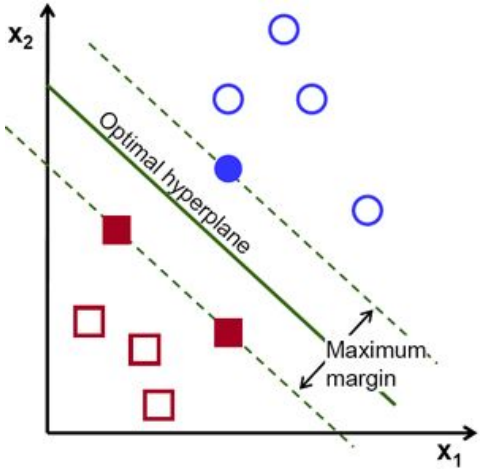
Pooling



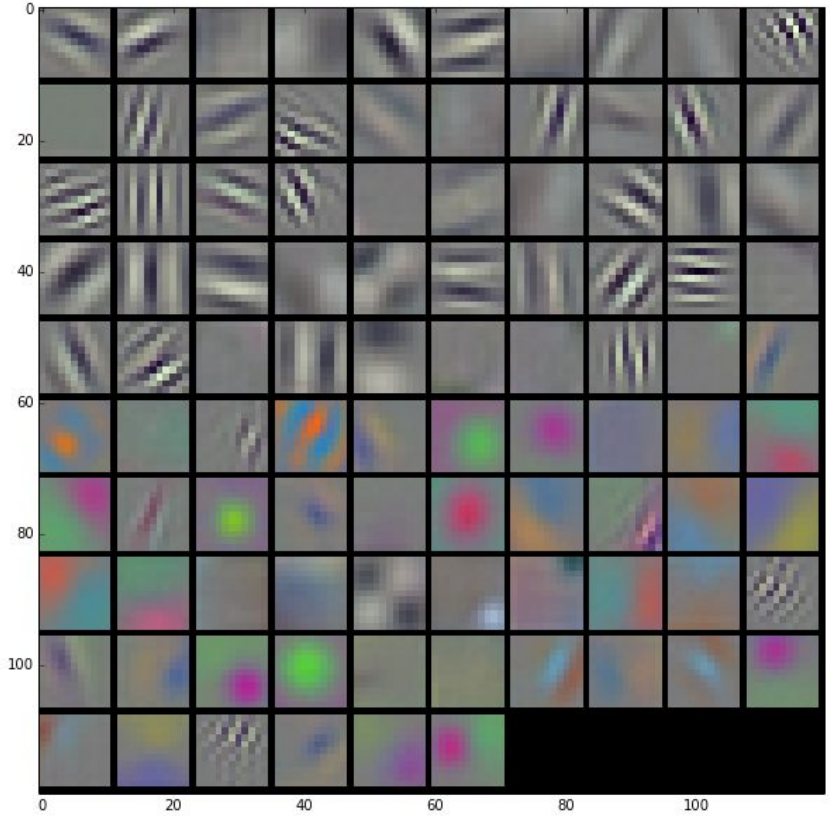
Hand Engineered Features

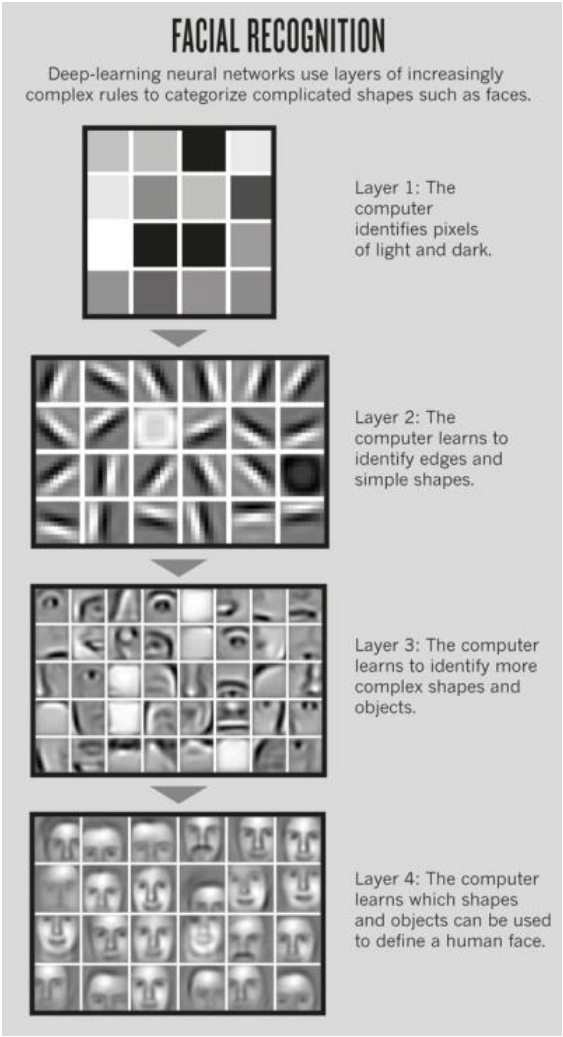






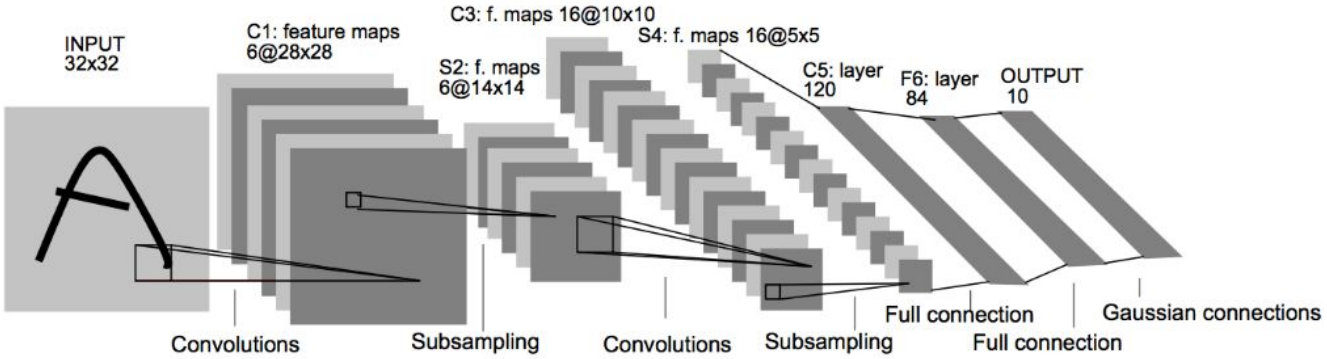
Automatic Feature Extraction





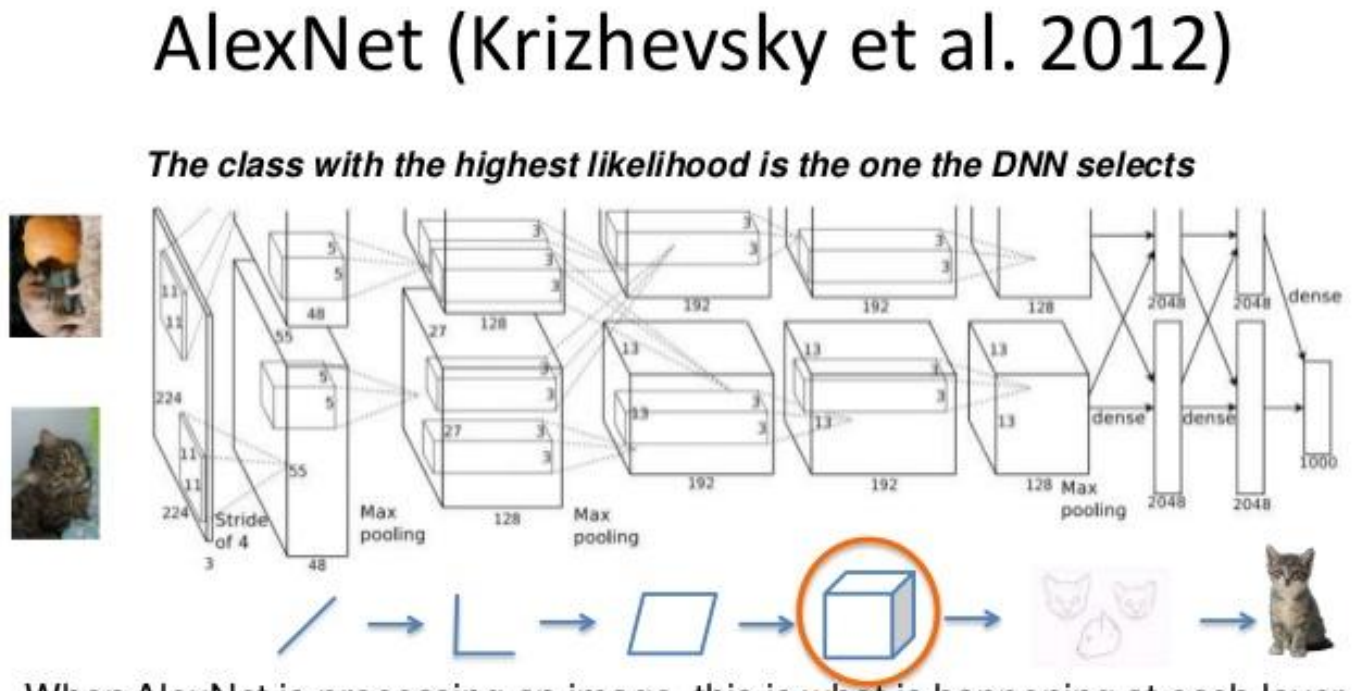
Applications

LeNet - Identify Numbers (MNIST Dataset!)

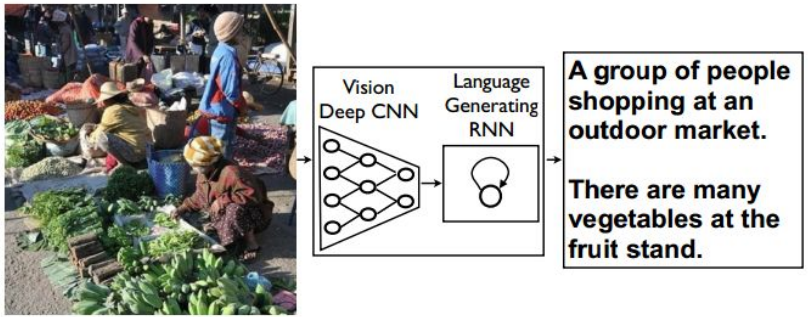


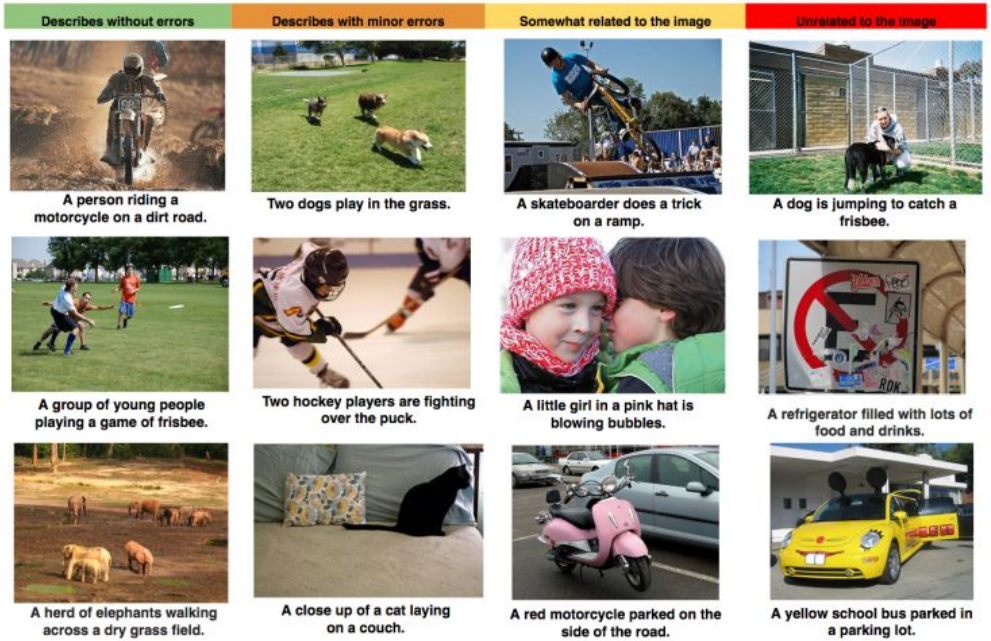
CNN called LeNet by Yann LeCun (1998)

AlexNet - ImageNet Classification

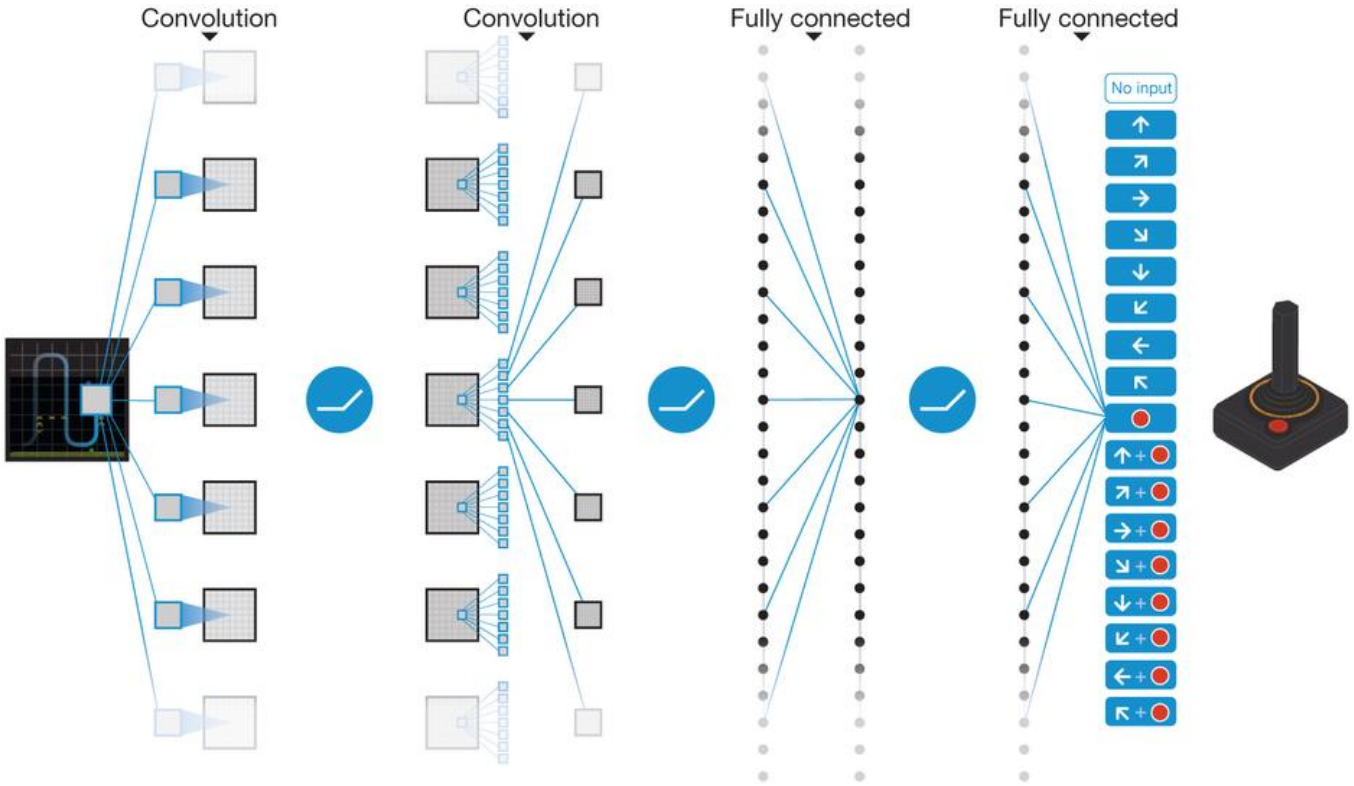


Automatic Figure Captioning

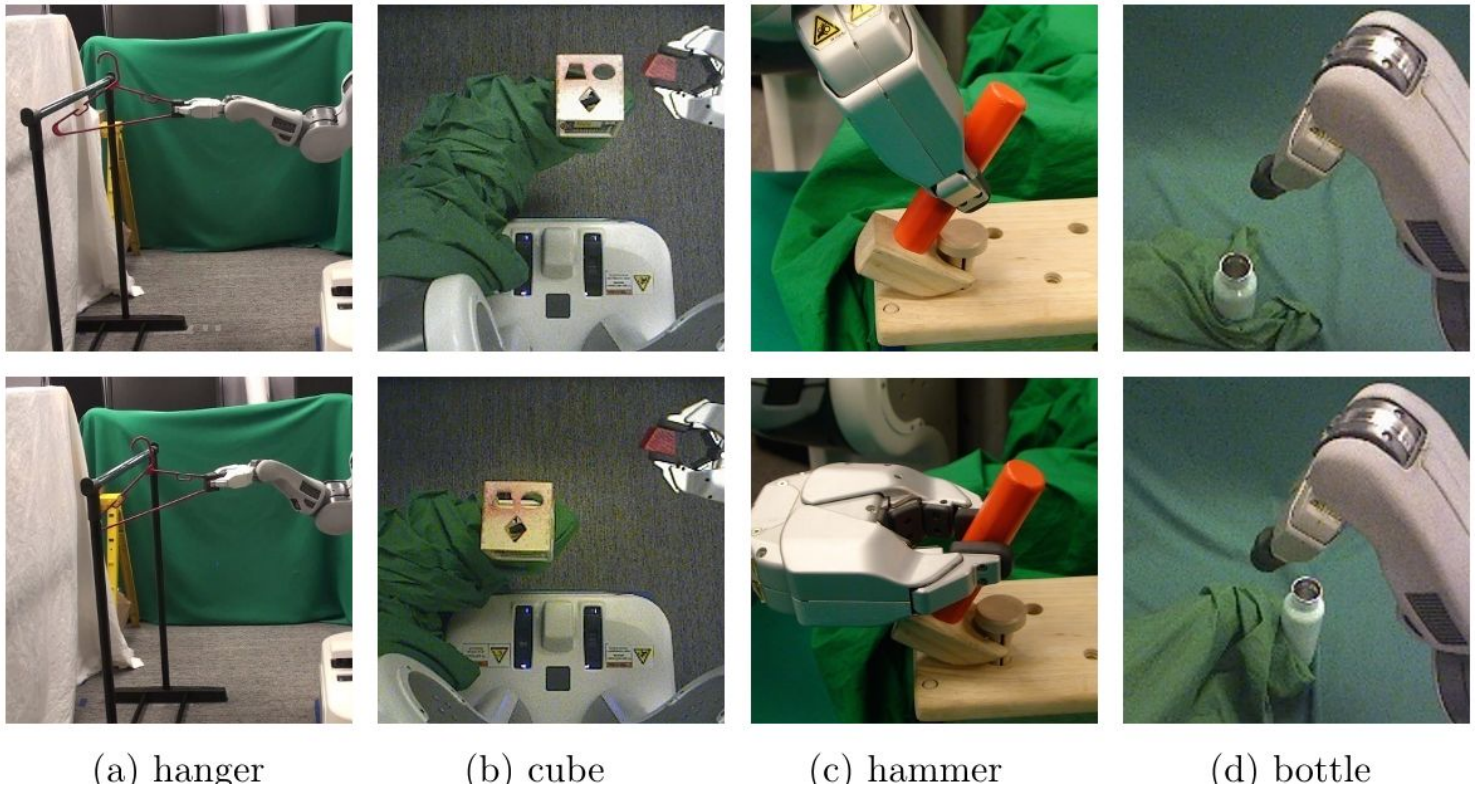




Playing Atari

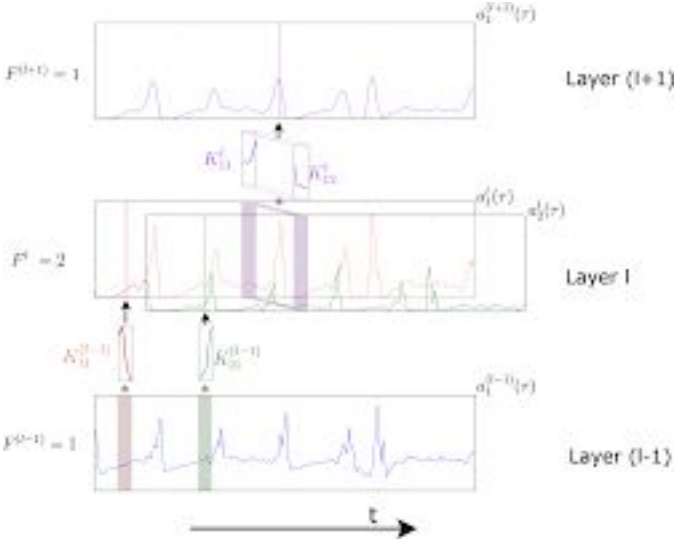


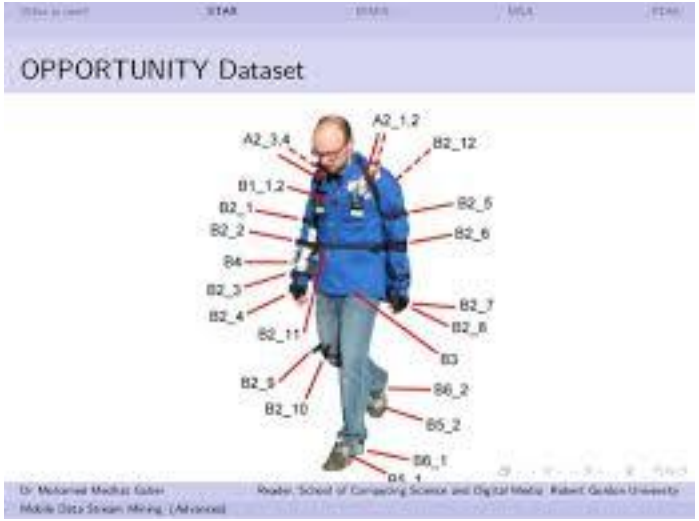
Control Robots



(a) hanger (b) cube (c) hammer (d) bottle

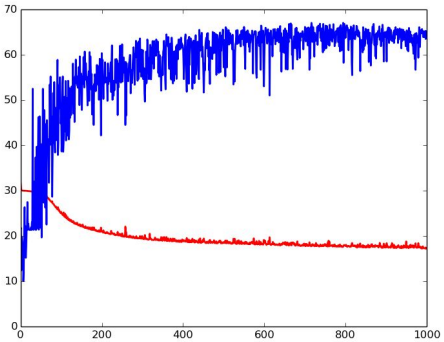
Human Activity Recognition



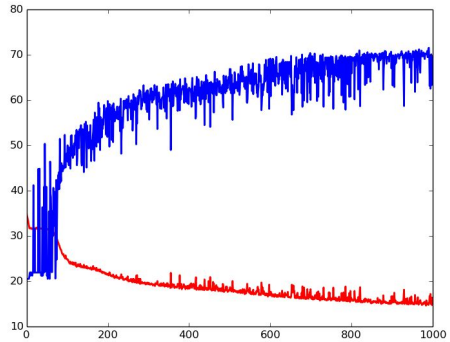


Caffe and TensorFlow

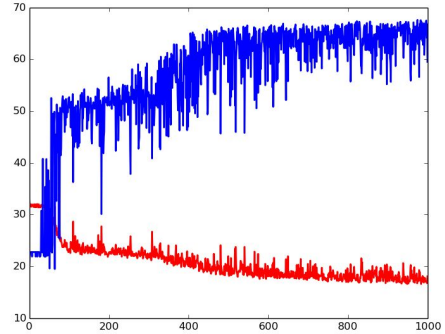
HAR Demo



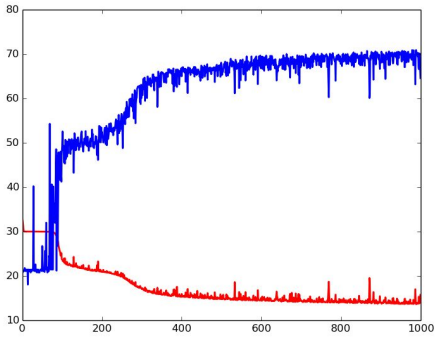
FFNN
1 layer
6,807 params



CNN
1 layer
4,387 params



FFNN
2 layer
15,907 params



CNN
2 layer
2,547 params