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Deep Learning Applications for Computer Vision

Lecture 3: Neural Networks and Their
Impact in Computer Vision



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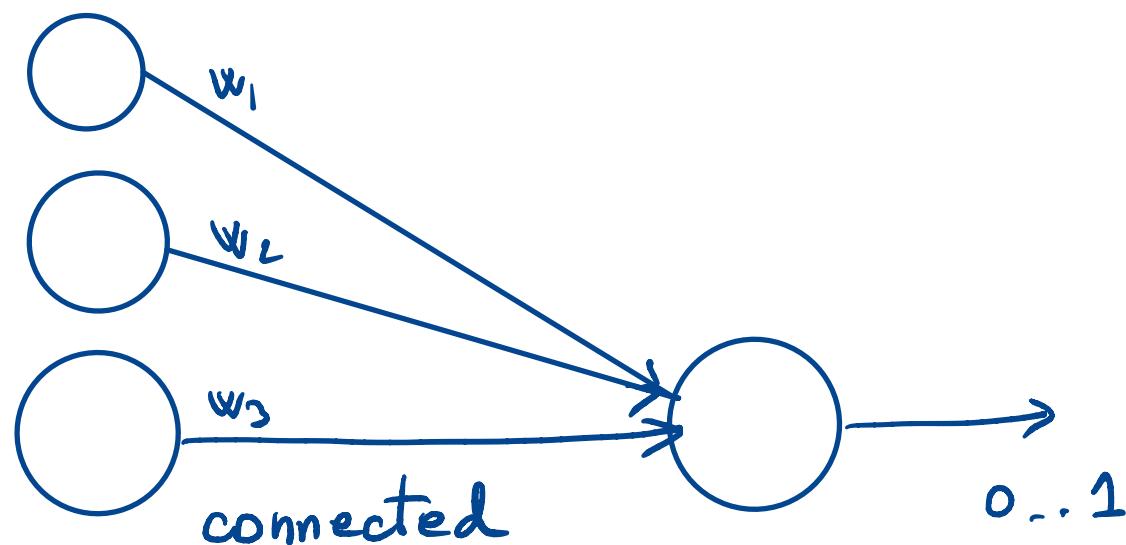
Neural Networks – biological vs artificial

BNN

- network / circuit
- neurons / nodes
- excited
- $>$ threshold

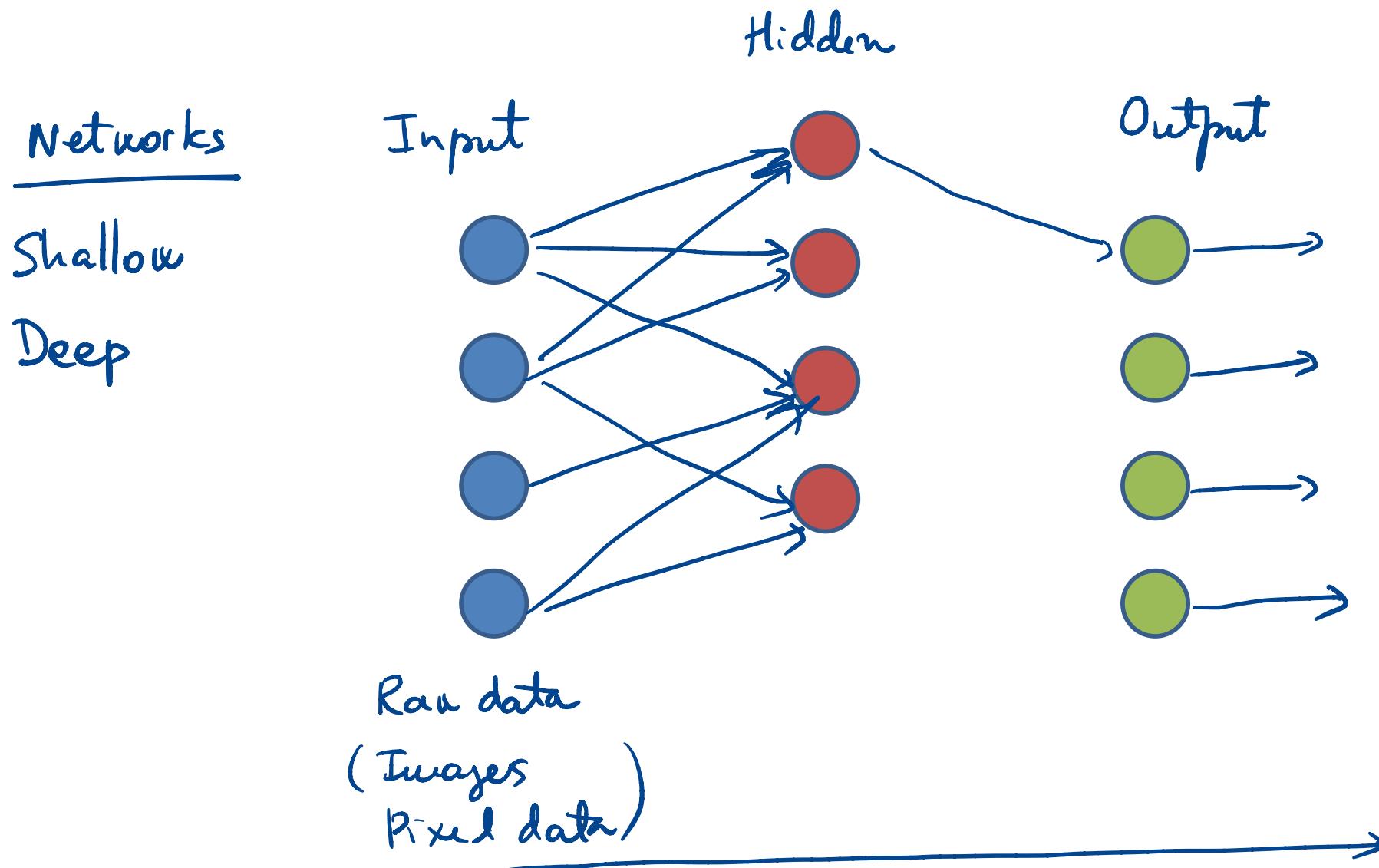
ANN

- weights
- activation function



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Neural Networks – biological vs artificial



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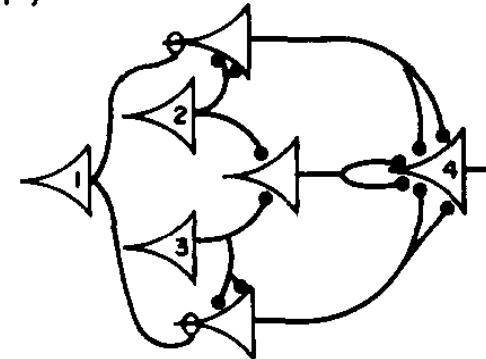
Neural Networks—a history lesson

1943

McCulloch, Pitts
→ thresholds
→ dynamics



(f)



40's, 50's Computational Models

"Calculators"

Unsupervised Learning

1958

Rosenblatt - 2-layer network

Perceptron

No: loss function, gradient descent, back propagation



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Neural Networks—a history lesson

Drawbacks

- long training times
- large amounts of training data

CV

- large datasets of images



Traditional pipeline for image classification



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Neural Networks—a history lesson

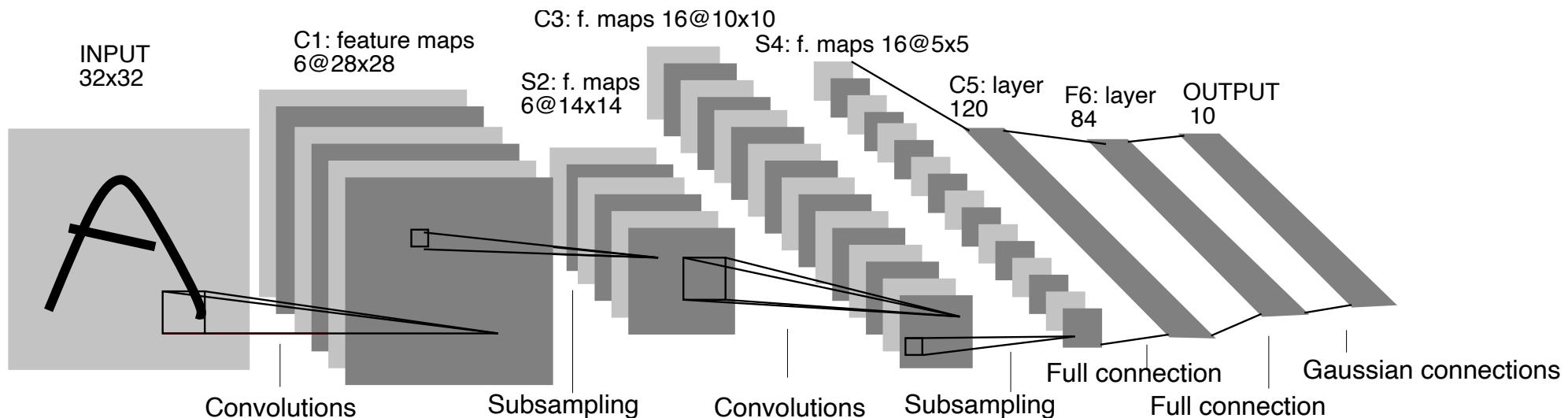


Fig. 2. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

1st CNN → OCR : Optical Character Recognition

Yann Le Cun (1989, 1998)

- zip codes
- bank checks

Training - 3 days

95% accuracy



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ImageNet, the ILSVRC Challenge

Prof. Fei Fei Li (Stanford)

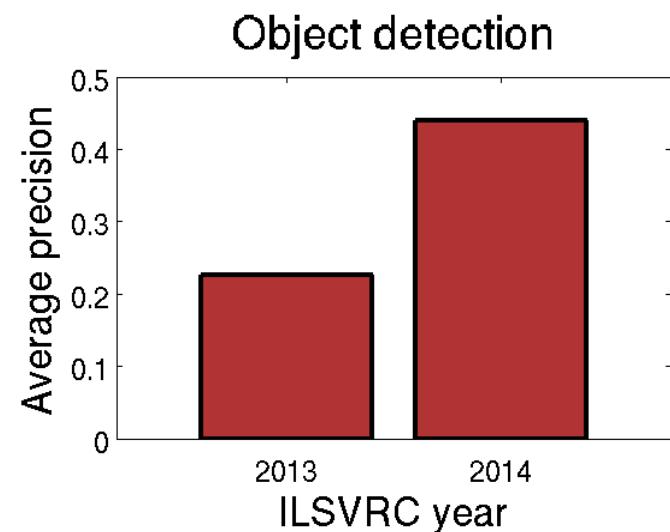
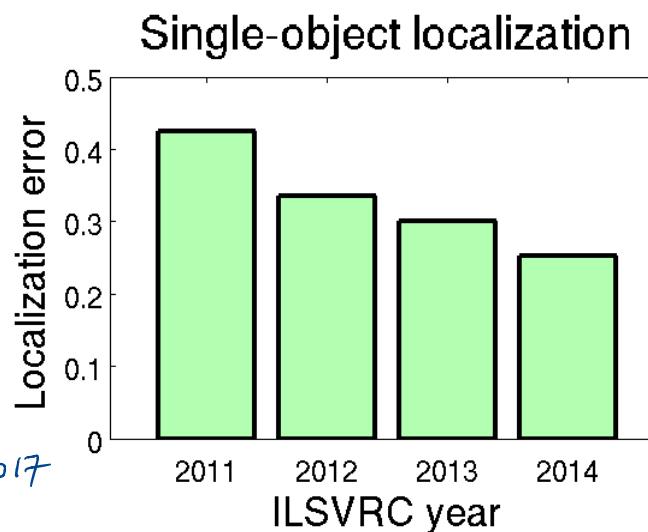
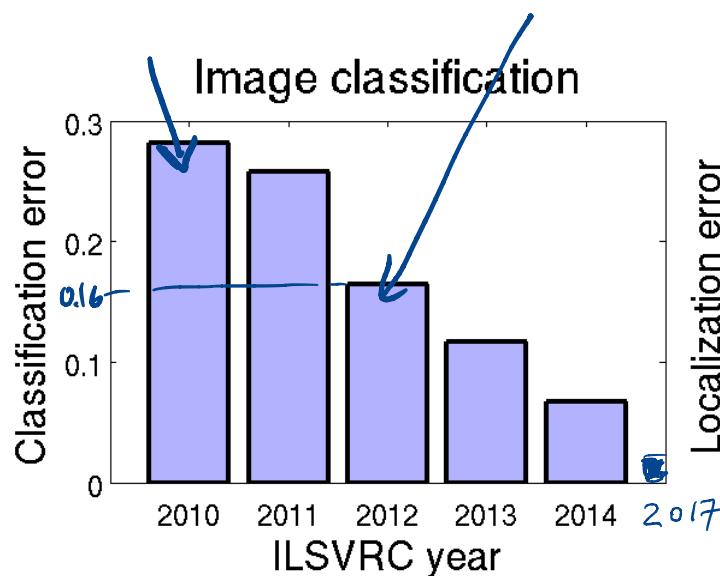
ImageNet, Crowdsourcing

↳ ILSVRC - 2010 : 150 k images, 1000 objects

2009 - 3.2 M images, 5000 categories

AlexNet, CNN, 8 layers

- 2017
- 152 layers
- 2.3% error



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Deep Learning – other CV tasks

- Image classification - generating captions
- Object Detection and Localization - ICPRI, MICCAI
cancer detection
- Face Detection
- Person Detection, Pose estimation
- Object Segmentation
- Video Classification



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