



Mạng neuron và ứng dụng trong xử lý tín hiệu



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Bài 10:
Mạng neuron sâu
(Deep neural network)



Giới thiệu

ARTIFICIAL INTELLIGENCE

Any technique that enables computers to mimic human behavior



MACHINE LEARNING

Ability to learn without explicitly being programmed



DEEP LEARNING

Learn underlying features in data using neural networks

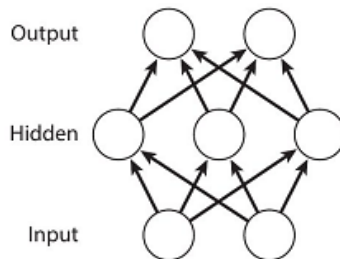
3 1 3 4 7 2
1 7 4 2 3 5

Source: Introduction to Deep Learning MIT 6.S191

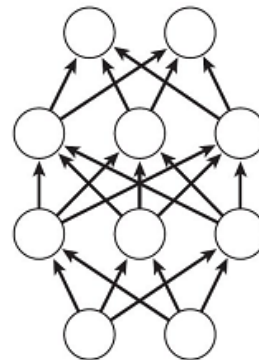
Deep and shallow network

Shallow vs. deep networks

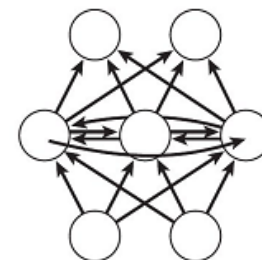
b Shallow feedforward
(1 hidden layer)



c Deep feedforward
(>1 hidden layer)



d Recurrent



- **Shallow:** one hidden layer
 - Features can be learned more-or-less independently
 - Arbitrary function approximator (with enough hidden units)
- **Deep:** two or more hidden layers
 - Upper hidden units **reuse** lower-level features to compute more complex, general functions
 - Learning is **slow**: Learning high-level features is not independent of learning low-level features
- **Recurrent:** form of deep network that reuses features over time

Why? – Achieved State of the Art in a Number of Different Areas

- **Language Modeling (2012, Mikolov et al)**
- **Image Recognition (Krizhevsky won 2012 ImageNet competition)**
- **Sentiment Classification (2011, Socher et al)**
- **Speech Recognition (2010, Dahl et al)**
- **MNIST hand-written digit recognition (Ciresan et al, 2010)**
- **Andrew Ng – Machine Learning Professor, Stanford:**
 - ◆ “I’ve worked all my life in Machine Learning, and I’ve never seen one algorithm knock over benchmarks like Deep Learning”

**Một số kiến trúc mạng neuron sâu (tích chập)
ứng dụng trong các bài toán phân tích nhận
dạng ảnh và video**

=> sẽ được trình bày vào tuần sau



Bài 11:
Mạng neuron tích chập
(Convolutional Neural
Network)



Giới thiệu chung

- Mạng neuron tích chập đang là một tiến hóa lớn, có tầm ảnh hưởng trong lĩnh vực về thị giác máy tính
- 2012 là năm đầu tiên Alex Krizhevsky đã ứng dụng mạng neuron tích chập và thắng trong cuộc thi của ImageNet, giảm lỗi nhận dạng từ 26% xuống còn 15%
- Từ đó trở đi, rất nhiều các viện nghiên cứu, doanh nghiệp đã sử dụng deep learning như các mô đun core của các hệ dịch vụ xung quanh



facebook



Pinterest



amazon



Google



Problem space: Image classification



What We See

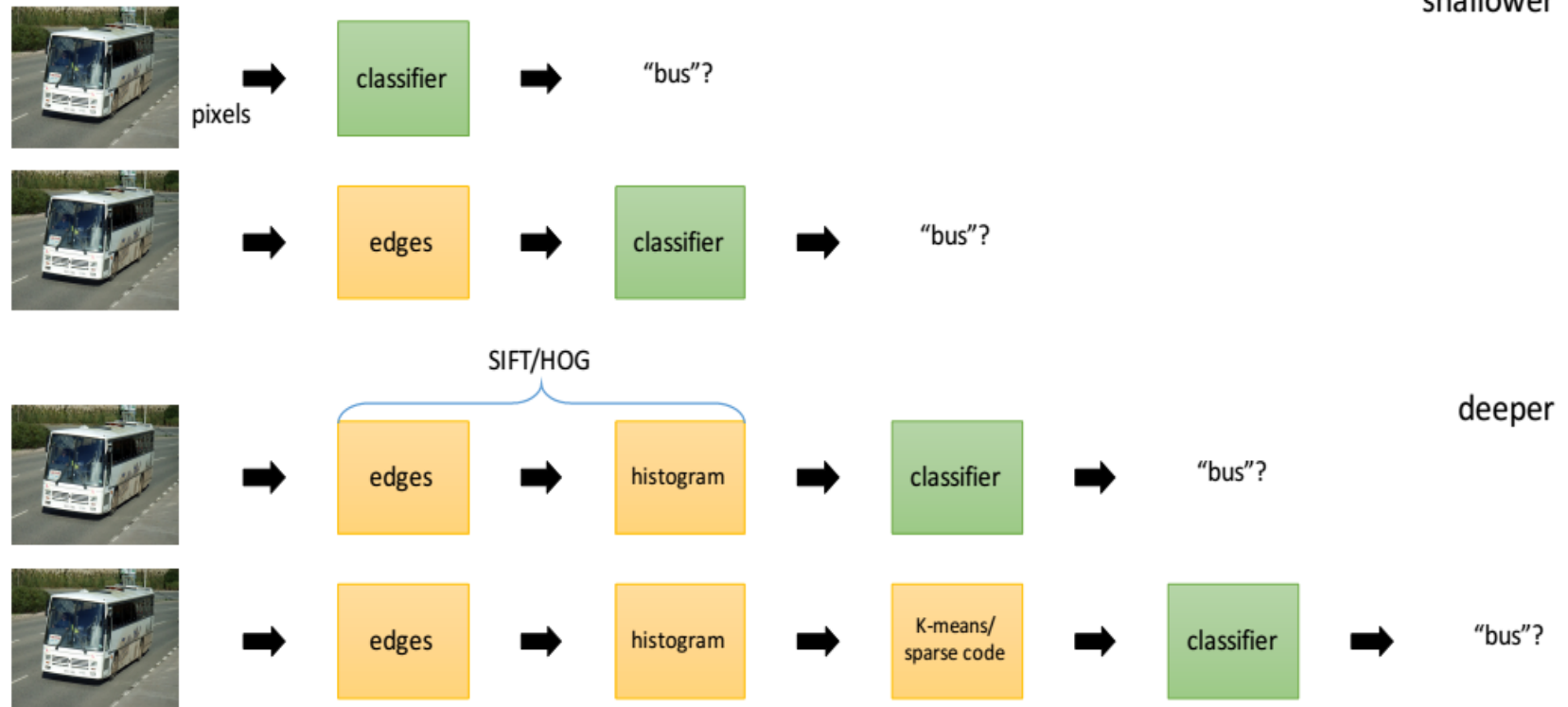
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49 49 99 40 17 81 18 57 60 87 17 40 98 43 69 48 04 56 62 00
81 49 31 73 55 79 14 29 93 71 40 67 53 88 30 03 49 13 36 65
52 70 95 23 04 60 11 42 69 24 68 56 01 32 56 71 37 02 36 91
22 31 16 71 51 67 63 89 41 92 36 54 22 40 40 28 66 33 13 80
24 47 32 60 99 03 45 02 44 75 33 53 78 36 84 20 35 17 12 50
32 98 81 28 64 23 67 10 26 38 40 67 59 54 70 66 18 38 64 70
67 26 20 68 02 62 12 20 95 63 94 39 63 08 40 91 66 49 94 21
24 55 58 05 66 73 99 26 97 17 78 78 96 83 14 88 34 89 63 72
21 36 23 09 75 00 76 44 20 45 35 14 00 61 33 97 34 31 33 95
78 17 53 28 22 75 31 67 15 94 03 80 04 62 16 14 09 53 56 92
16 39 05 42 96 35 31 47 55 58 88 24 00 17 54 24 36 29 85 57
86 56 00 48 35 71 89 07 05 44 44 37 44 40 21 58 51 54 17 58
19 80 81 68 05 94 47 69 28 73 92 13 86 52 17 77 04 89 55 40
04 52 08 83 97 35 99 16 07 97 57 32 16 26 26 79 33 27 98 66
88 36 68 87 57 62 20 72 03 46 33 67 46 55 12 32 63 93 53 69
04 42 16 73 38 25 39 11 24 94 72 18 08 46 29 32 40 62 76 36
20 69 36 41 72 30 23 88 34 62 99 69 82 67 59 85 74 04 36 16
20 73 35 29 78 31 90 01 74 31 49 71 48 86 81 16 23 57 05 54
01 70 54 71 83 51 54 69 16 92 33 48 61 43 52 01 89 19 67 48
```

What Computers See

- **Input:** eg. 32x32x3 (RGB)
- **Output:** the probability of the image being a certain class.

From shallow to deep

Traditional recognition



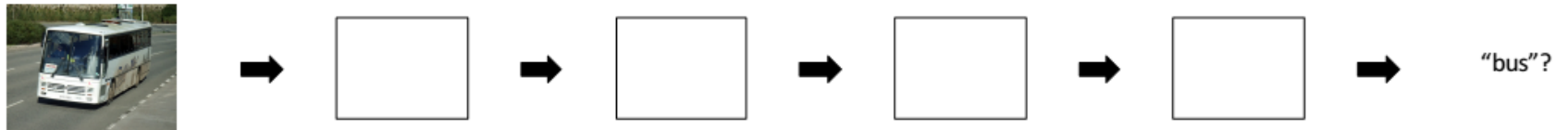
But what's next?

Deep learning

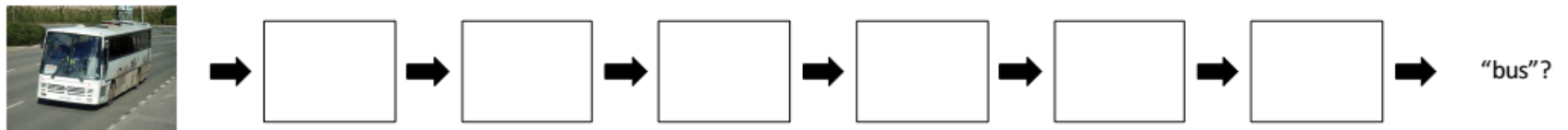
Specialized components, domain knowledge required



Generic components ("layers"), less domain knowledge

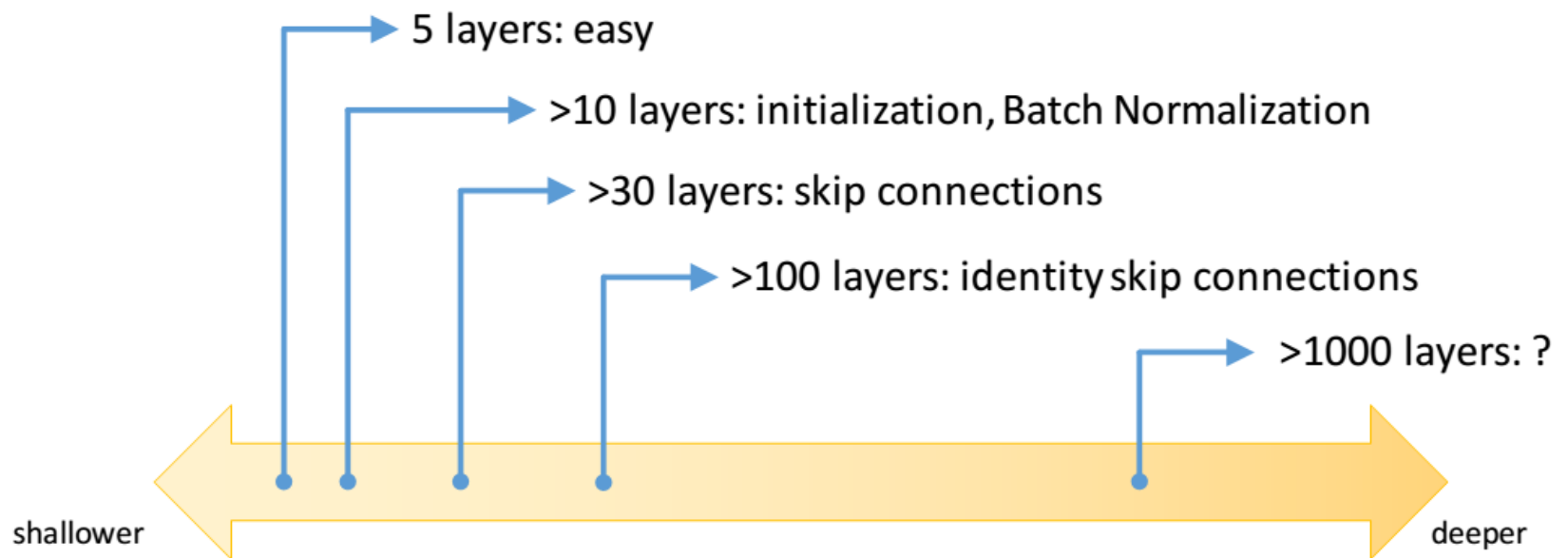


Repeat elementary layers => Going deeper



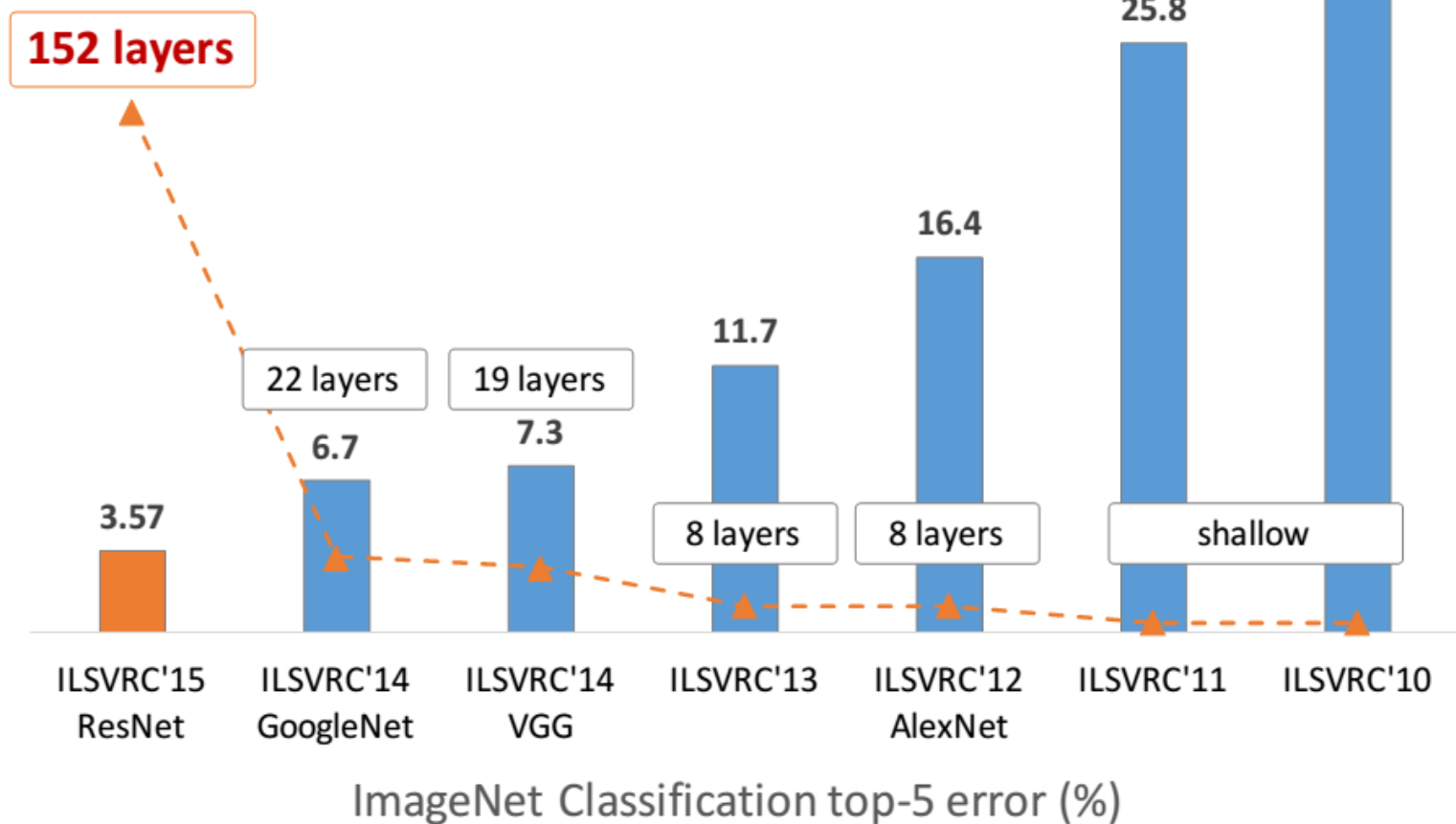
- End-to-end learning
- Richer solution space

Spectrum of depth



Một số mạng neuron sâu và kết quả

Revolution of Depth



Giới thiệu về mạng neuron tích chập

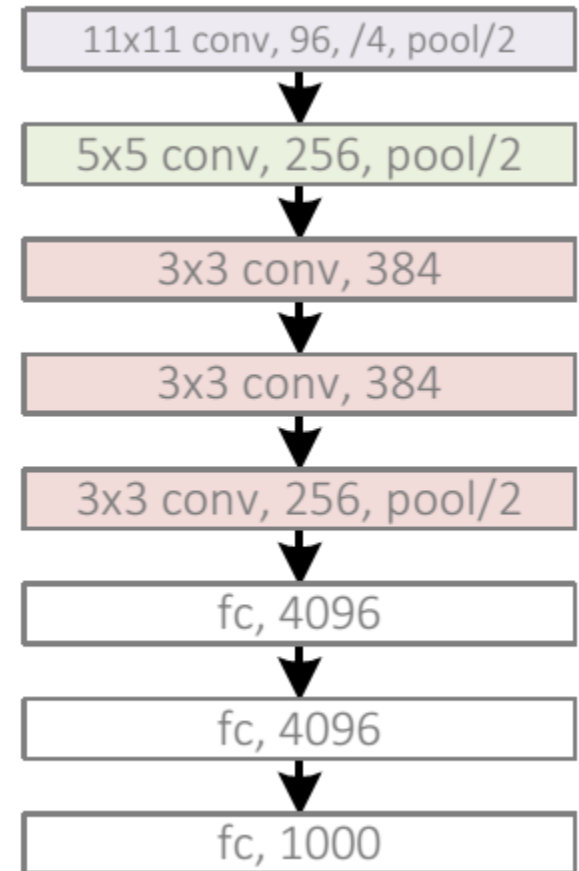
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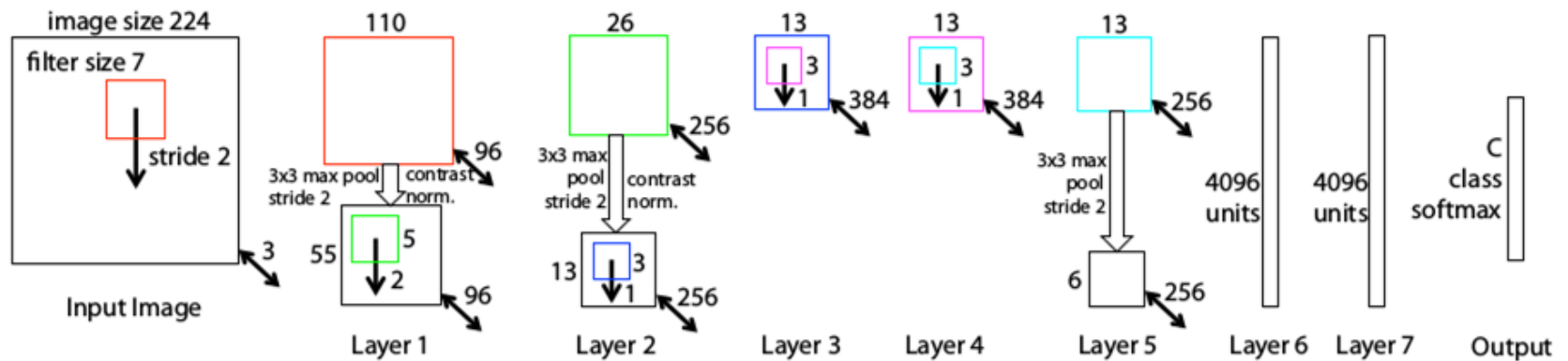
Revolution of depth

Slide trình
bày chi tiết:
"F:\Mang
Neuron -
2017\refs\Dee
pLearnig\Ale
xnet.pdf"

AlexNet, 8 layers
(ILSVRC 2012)



ZF Net (2013)



ZF Net Architecture

Xem trong trang: "F:\Mang Neuron -
2017\refs\DeepLearnig\The 9 Deep Learning Papers
You Need To Know About (Understanding CNNs
Part 3) – Adit Deshpande – CS Undergrad at UCLA
(10).html"

VGG Net (2014)

- Xem trong: "F:\Mang Neuron - 2017\refs\DeepLearnig\ILSVRC_2014.pdf"



Google lenet

- Xem trong : "F:\Mang Neuron - 2017\refs\DeepLearnig\The 9 Deep Learning Papers You Need To Know About (Understanding CNNs Part 3) – Adit Deshpande – CS Undergrad at UCLA ('19).html"



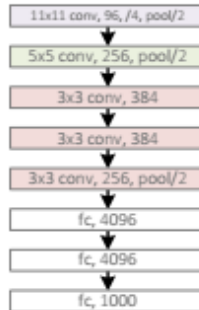
Microsoft ResNet (2015)



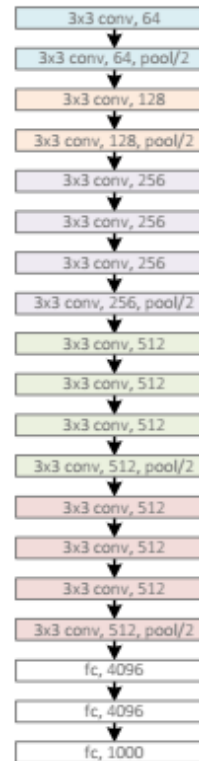
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2017\refs\DeepLearnig\icml2016_tutorial_deep_residual_netw
orks_kaiminghe.pdf"

So sánh các kiến trúc

AlexNet, 8 layers
(ILSVRC 2012)



VGG, 19 layers
(ILSVRC 2014)



GoogleNet, 22 layers
(ILSVRC 2014)



So sánh các kiến trúc

Revolution of Depth

AlexNet, 8 layers
(ILSVRC 2012)



VGG, 19 layers
(ILSVRC 2014)

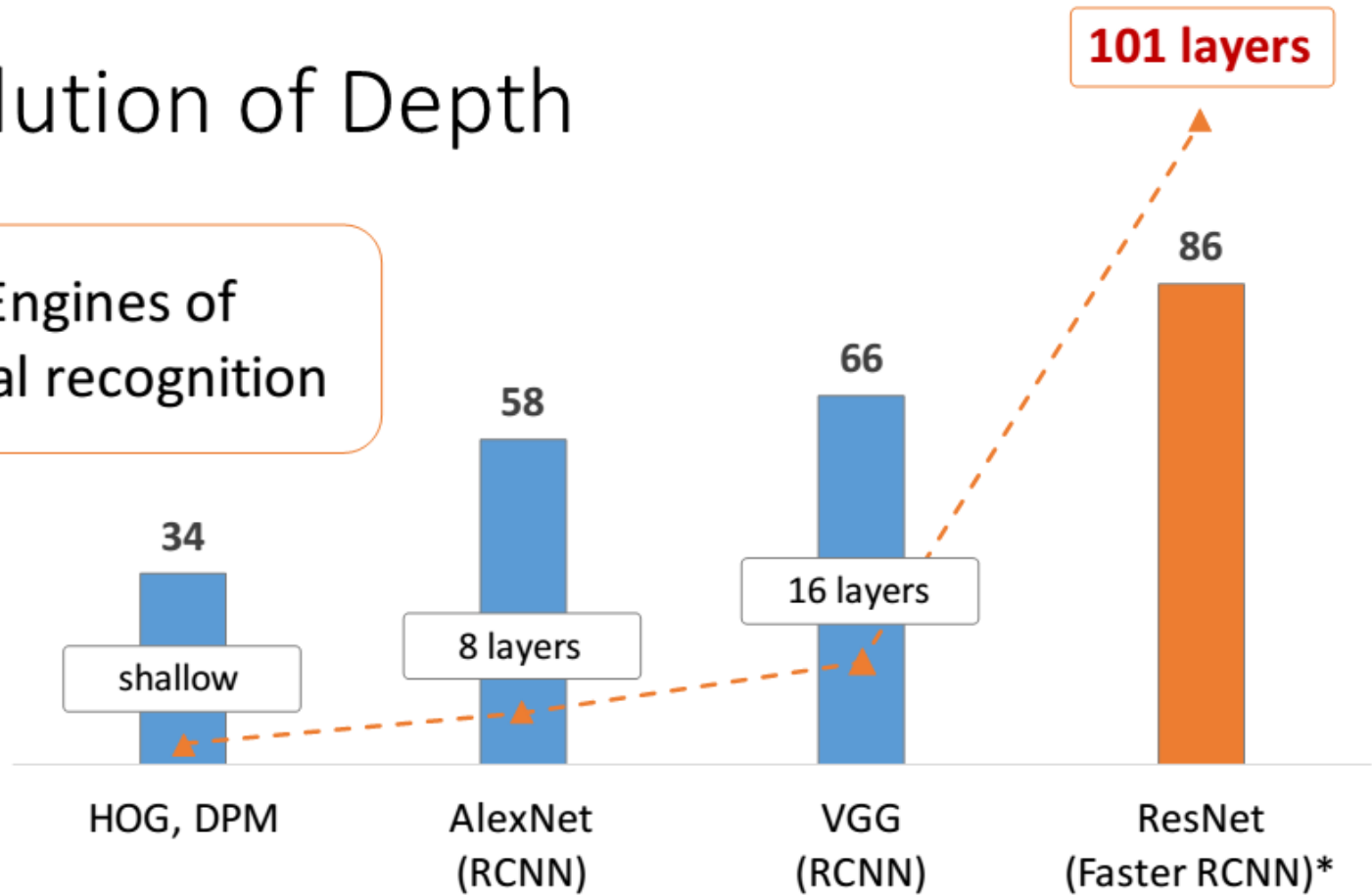


ResNet, **152 layers**
(ILSVRC 2015)

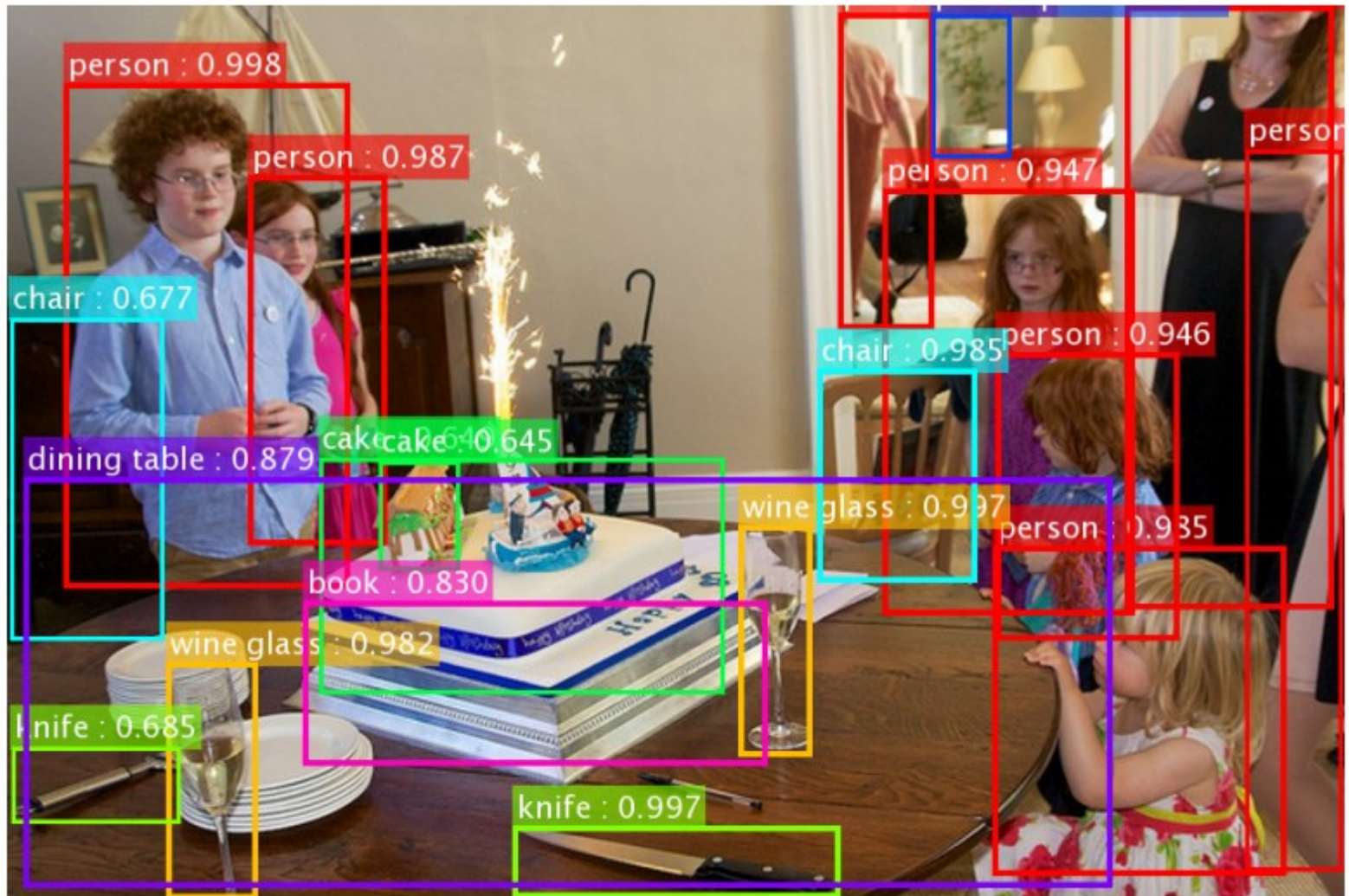


Revolution of Depth

Engines of
visual recognition



PASCAL VOC 2007 **Object Detection** mAP (%)



ResNet's object detection result on COCO

Yolo

- <https://pjreddie.com/darknet/yolo/>
- "F:\Mang Neuron - 2017\refs\DeepLearnig\YOLO CVPR 2016.pptx"
- "F:\Mang Neuron - 2017\refs\DeepLearnig\YOLO_ Real-Time Object Detection.html"



Demo

- **Yolo**
- **Mask-RCNN**
- **Style Transfer**



Tài liệu tham khảo

- https://medium.com/@siddharthdas_32104/cnns-architectures-lenet-alexnet-vgg-googlenet-resnet-and-more-666091488df5
- <http://yann.lecun.com/exdb/lenet/>
- <http://cs231n.github.io/convolutional-networks/>
- <http://ufldl.stanford.edu/tutorial/supervised/ConvolutionalNeuralNetwork/>
- http://web.stanford.edu/class/cs231a/lectures/intro_cnn.pdf

