



Overview of Deep Learning

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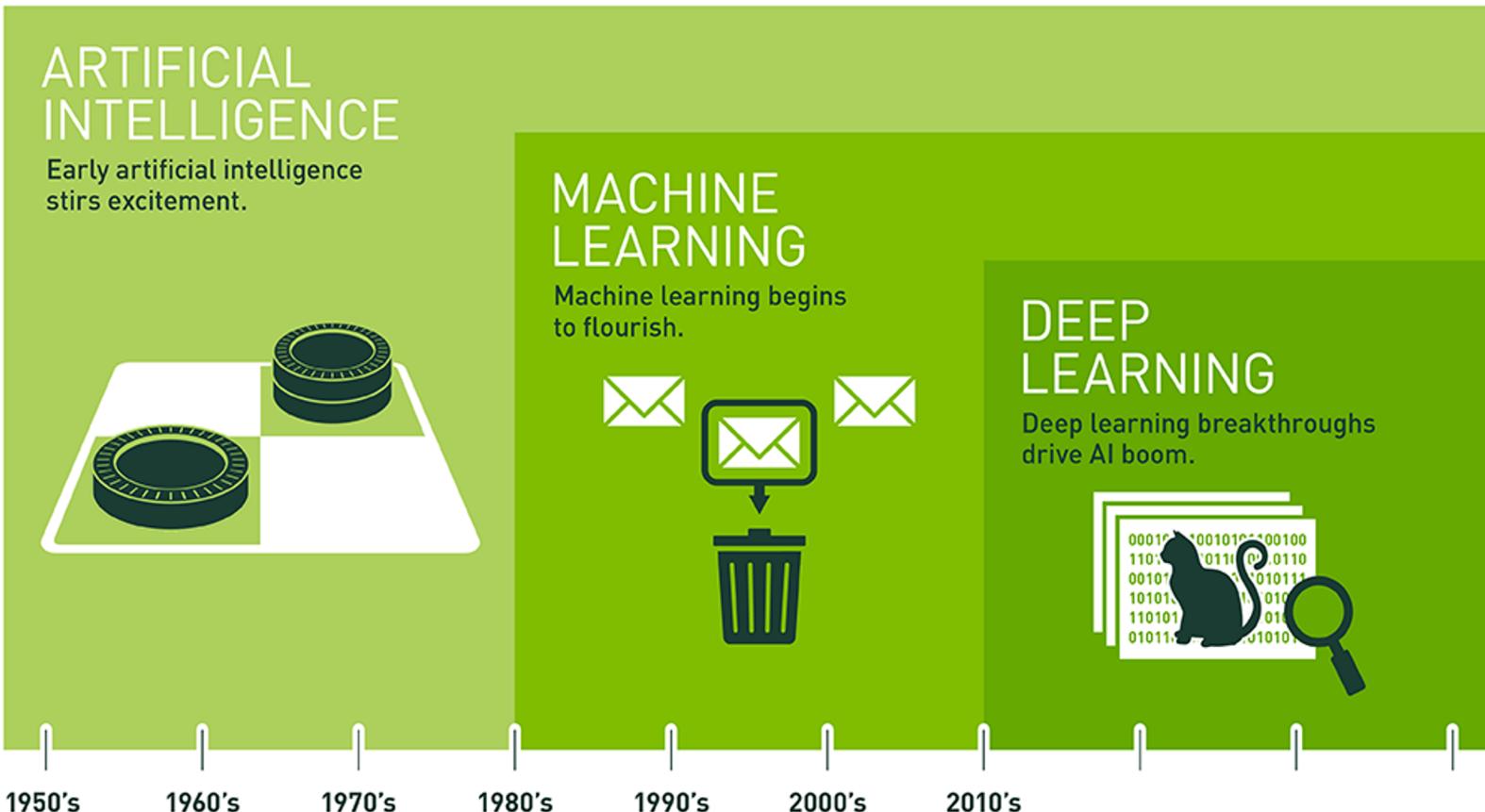
Artificial Intelligence (AI)

Machines exhibiting animal or human intelligence



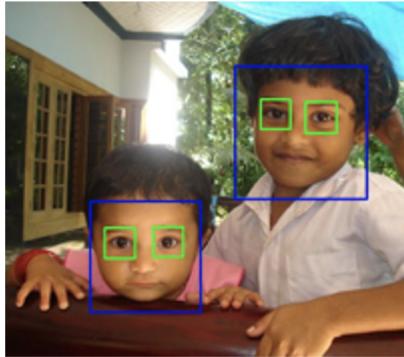
<https://www.quantamagazine.org/the-simple-algorithm-that-ants-use-to-build-bridges-20180226>

AI, Machine Learning and Deep Learning



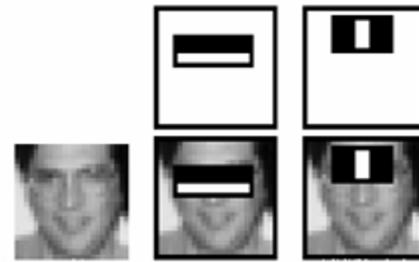
Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Artificial Intelligence, Machine Learning and Deep Learning on Face Detection



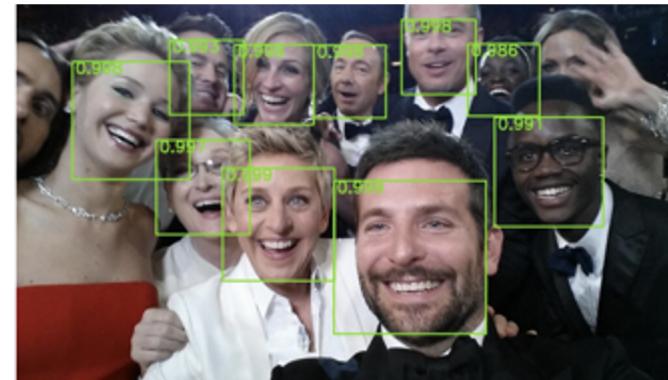
Rule-based (AI):
Detect facial
features based on
color/template
Apply if-else-if-else

[Viola & Jones 2001]



Machine Learning:
Use Haar Cascade
Classifier
**Hand-crafted feature
detection**

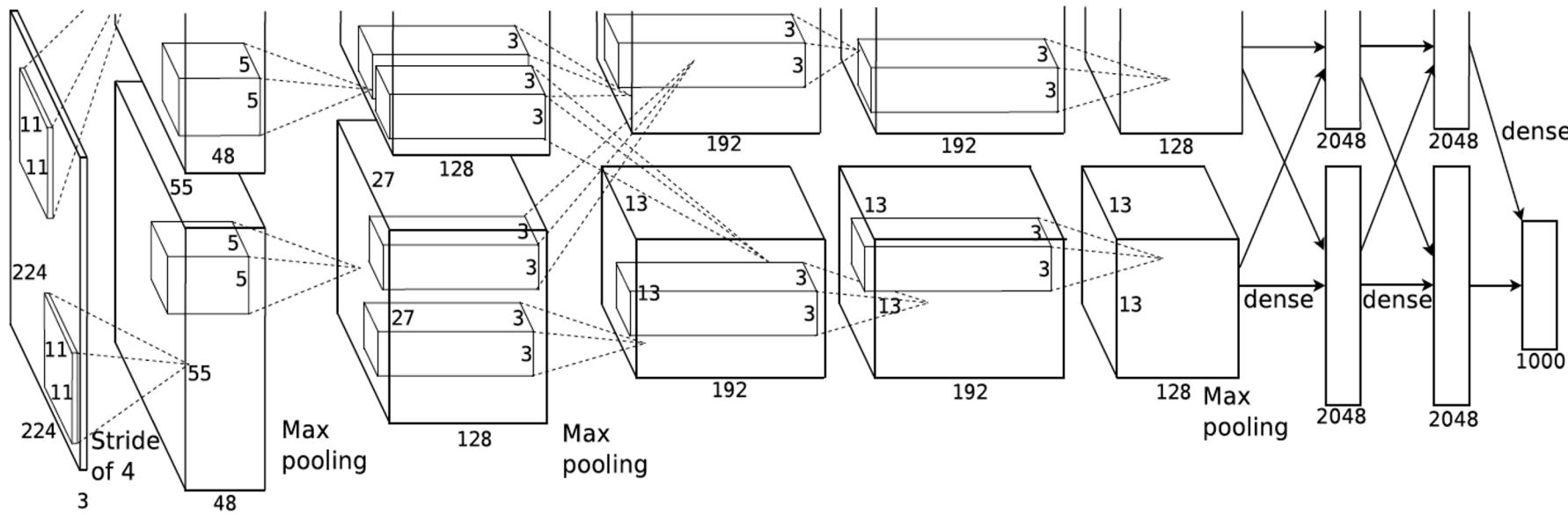
YOLO, SSD, RCNN [>2012]



Deep Learning:
Train a network by
showing thousands of
labelled region of faces
**Automatic feature
detection**

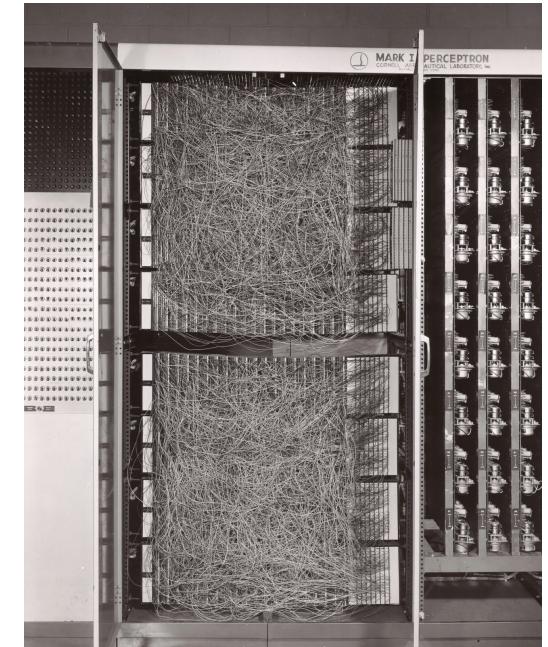
Deep Learning Moment - 2012

- AlexNet – 650,000-neuron deep neural network won 2012 ImageNet1k competition with 15% Top-5 error rate compared to 2nd place with 26%. Its top 1 accuracy is 63.3%.



Deep Learning - what made it work?

- Concepts of artificial neural network (ANN) and convolutional neural network (CNN) are old
 - Neurons in perceptron (1-layer NN) – 1958
 - Neocognitron (1980) and CNN (1989)
 - Backpropagation (1986)
- What's new?
 - Computing power – Massive number of GPU CUDA cores
 - Data – from the Internet

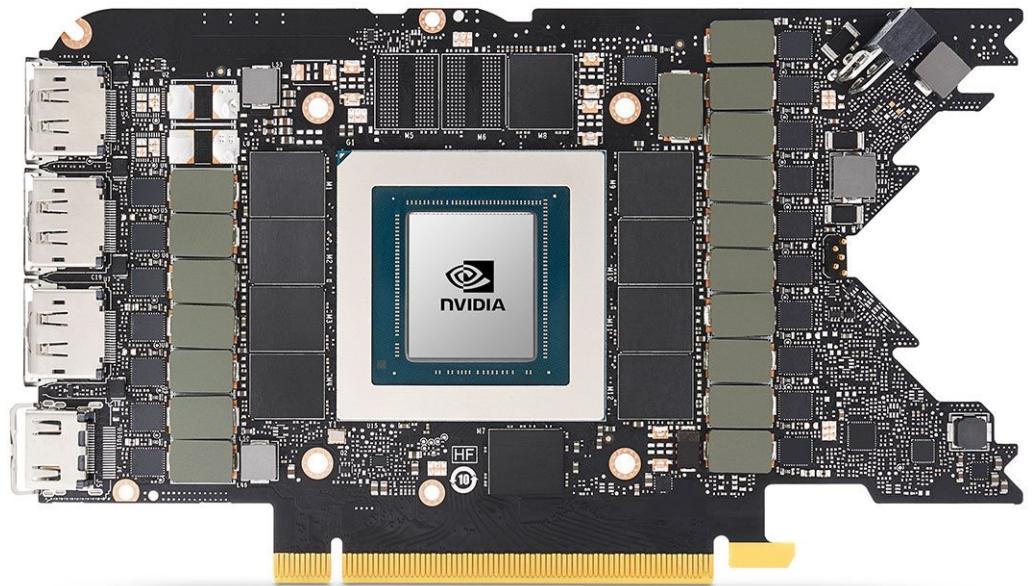
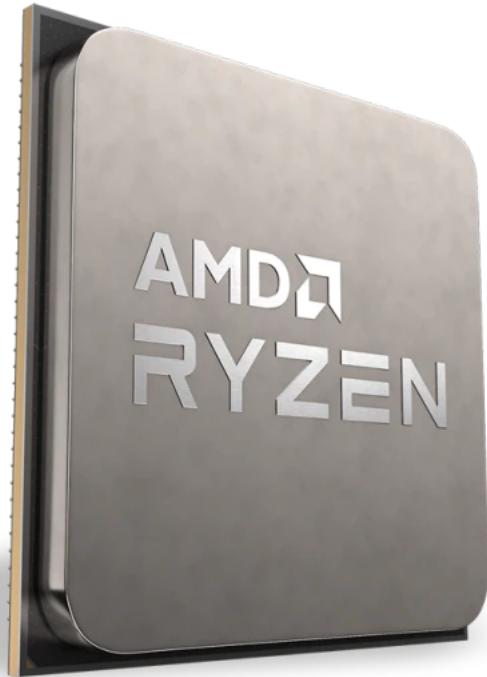


Perceptron is a binary classifier

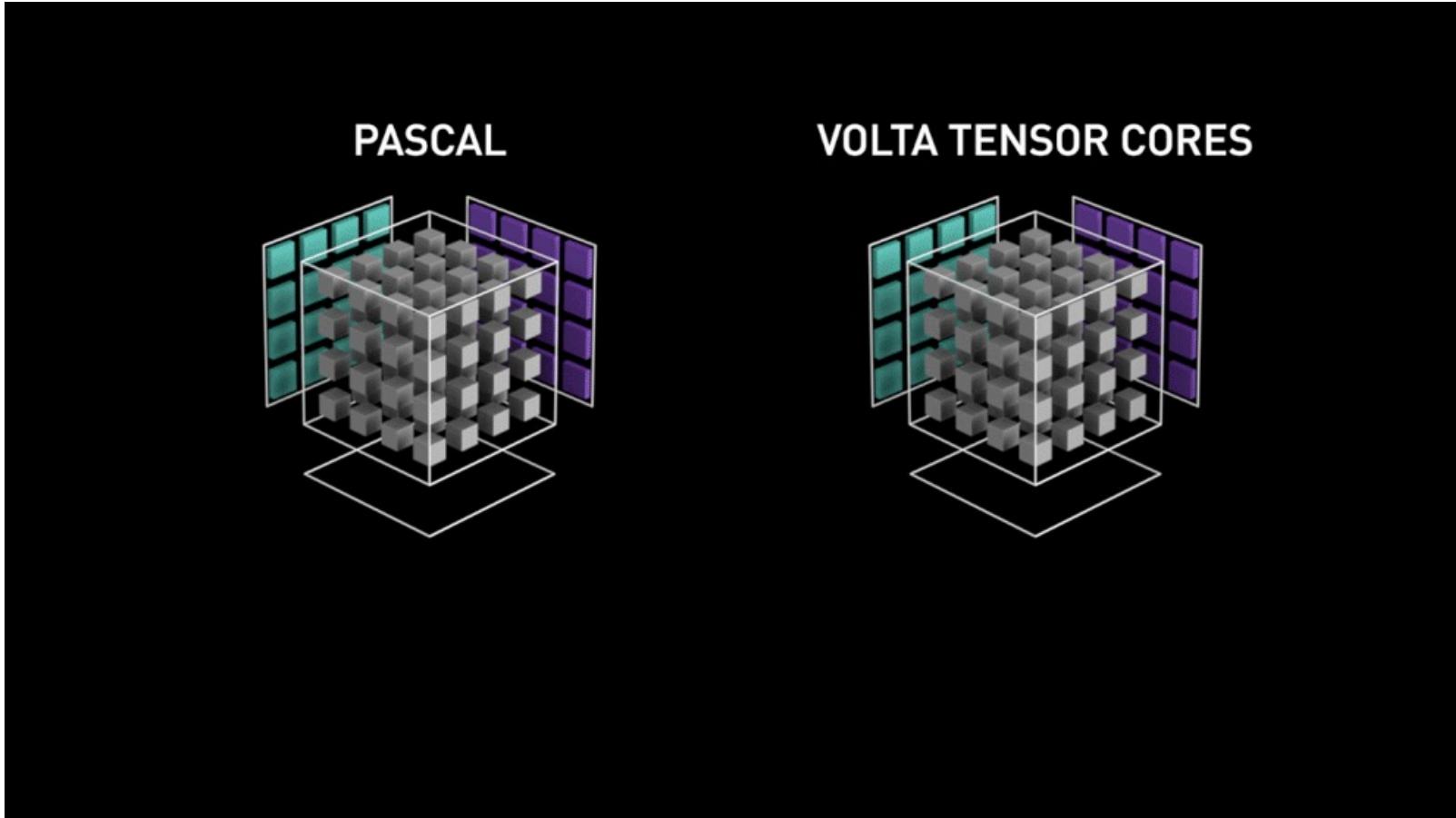
CPU

VS

GPU

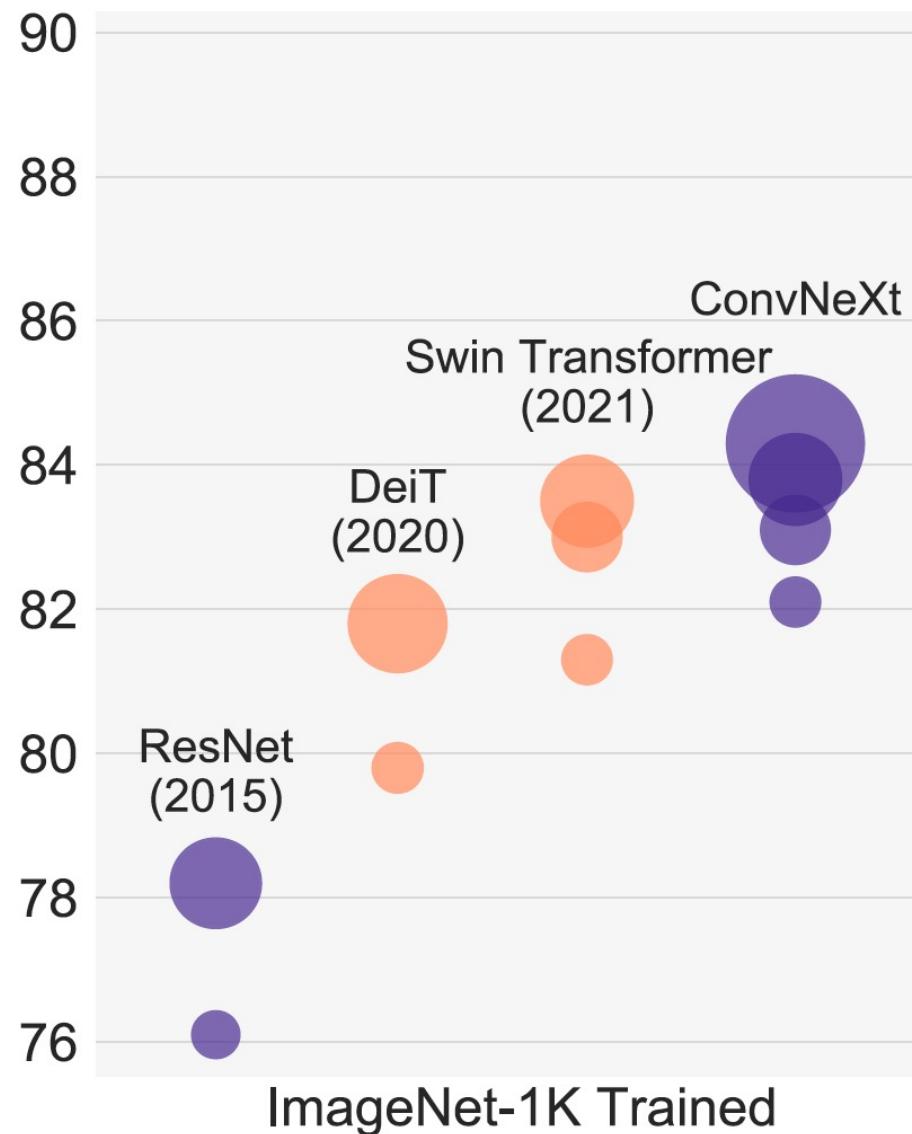


Scalar vs Tensor Operation



The Rest is History

ImageNet-1K Acc.



References

- Strickland, E. The Turbulent Past and Uncertain Future of Artificial Intelligencels there a way out of AI's boom-and-bust cycle?
<https://spectrum.ieee-org.cdn.ampproject.org/c/s/spectrum.ieee.org/amp/history-of-ai-2655064200>
- Liu, Zhuang, et al. "A ConvNet for the 2020s." arXiv preprint arXiv:2201.03545 (2022).
- NVIDIA.com
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