

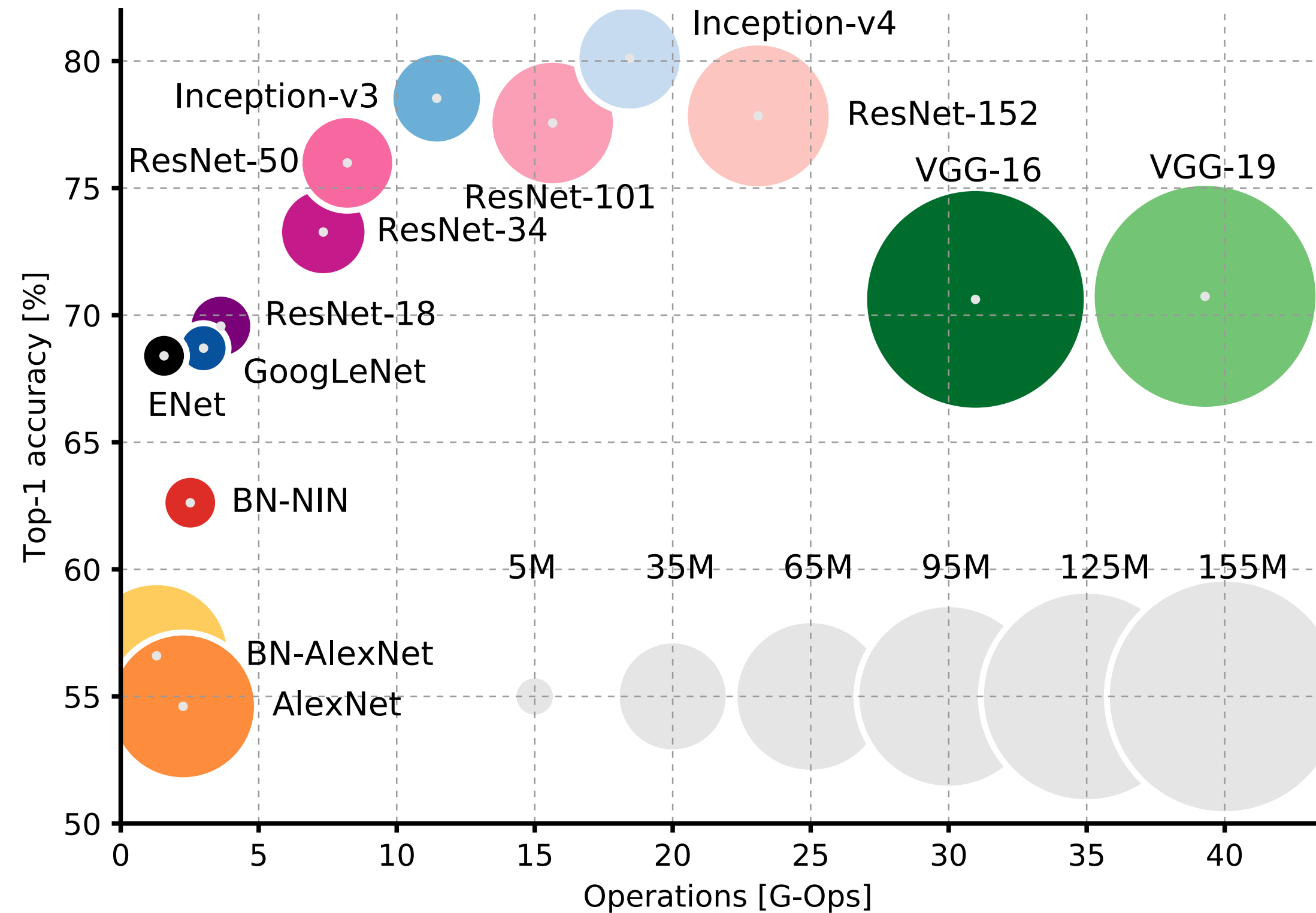
7.3

Convolutional Neural Networks Architectures

Part 3: A Whirlwind Tour Of Key Architecture Ideas

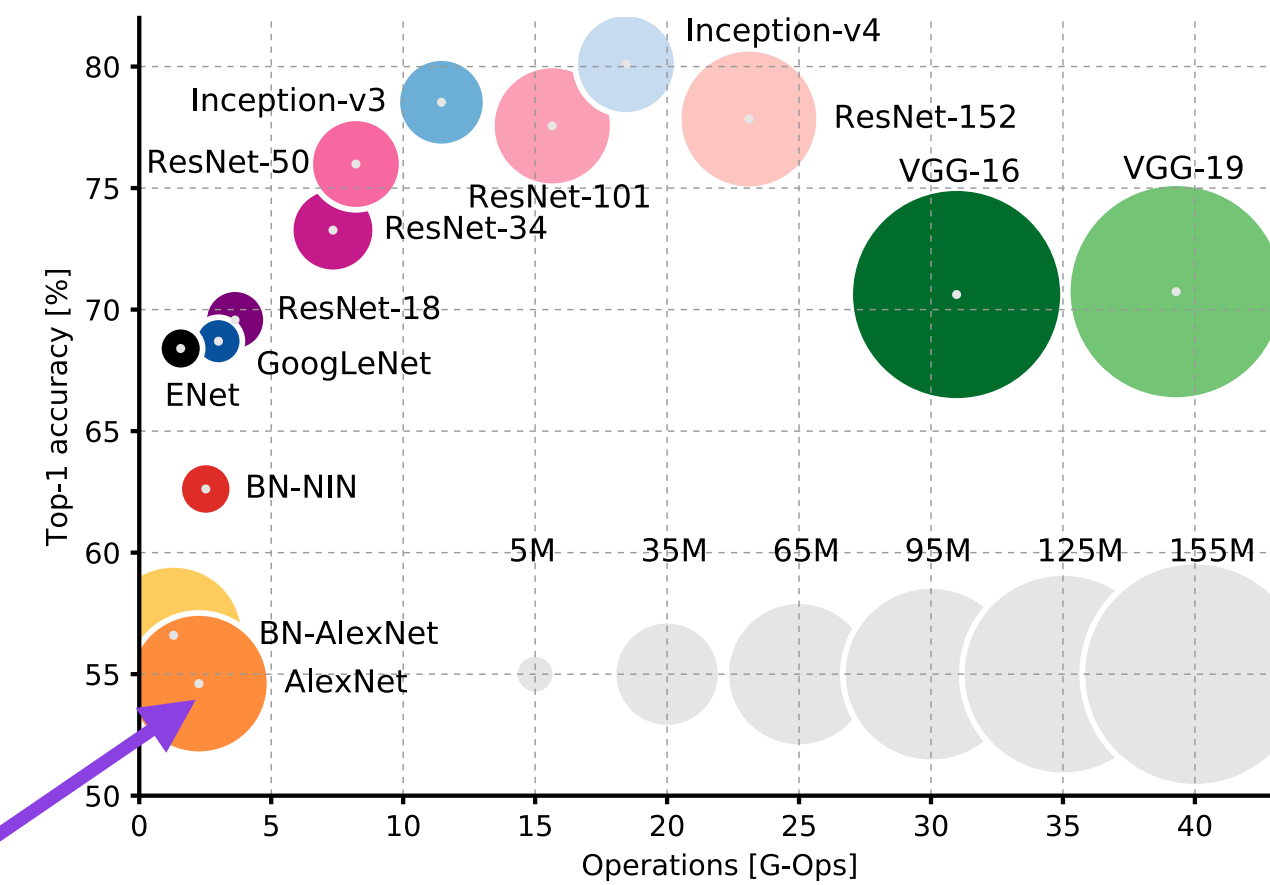
Sebastian Raschka and the Lightning AI Team

While this graphic is from 2016, many influential ideas or on this paper



Canziani, Paszke, Culurciello (2016). An analysis of deep neural network models for practical applications. <https://arxiv.org/abs/1605.07678>

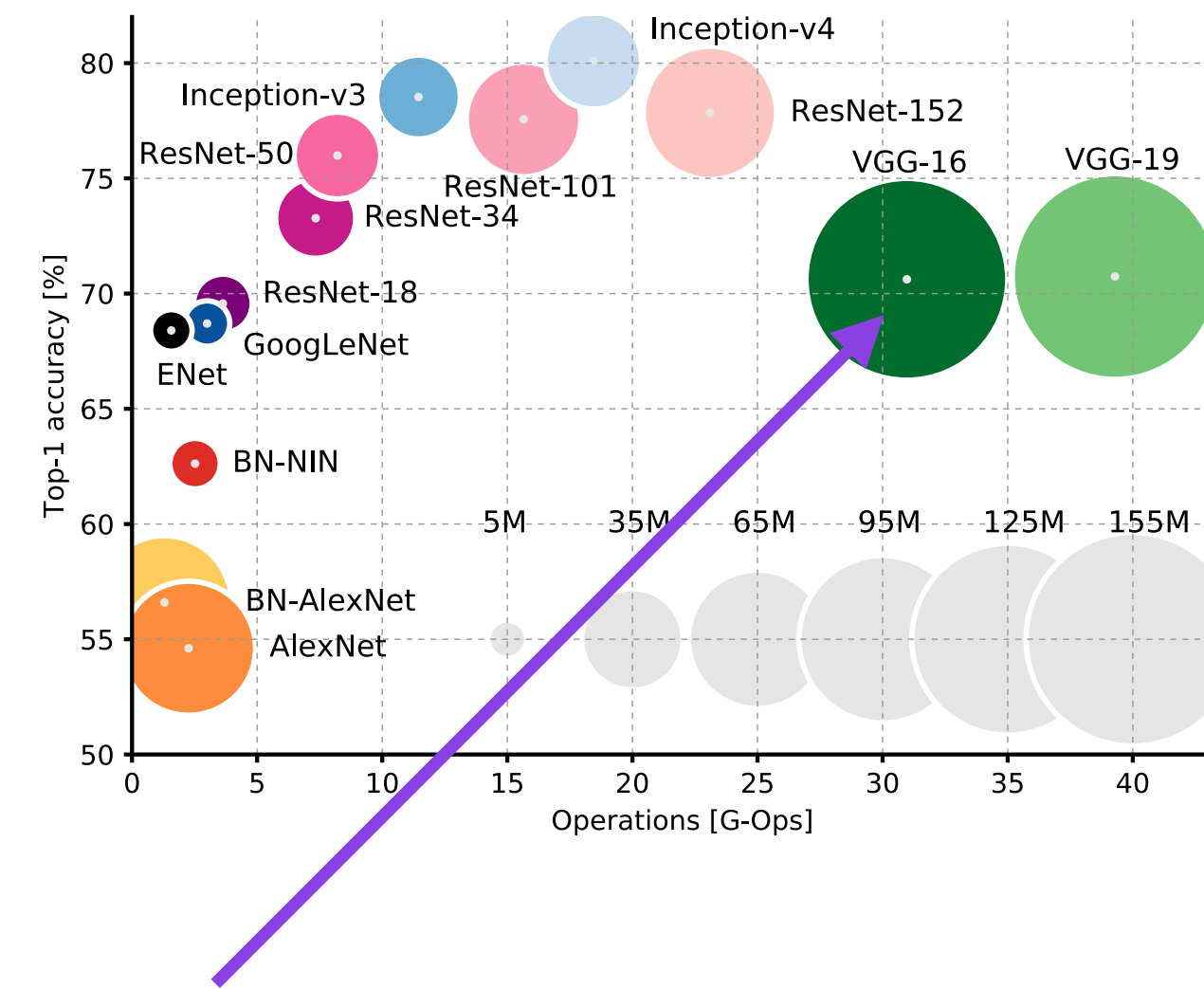
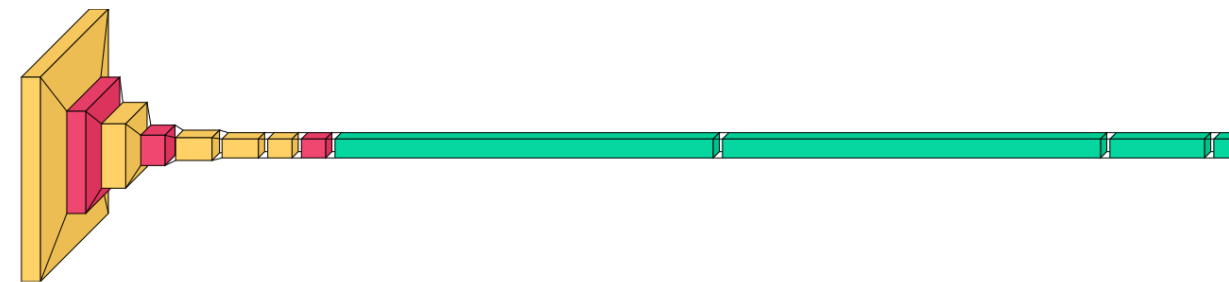
AlexNet



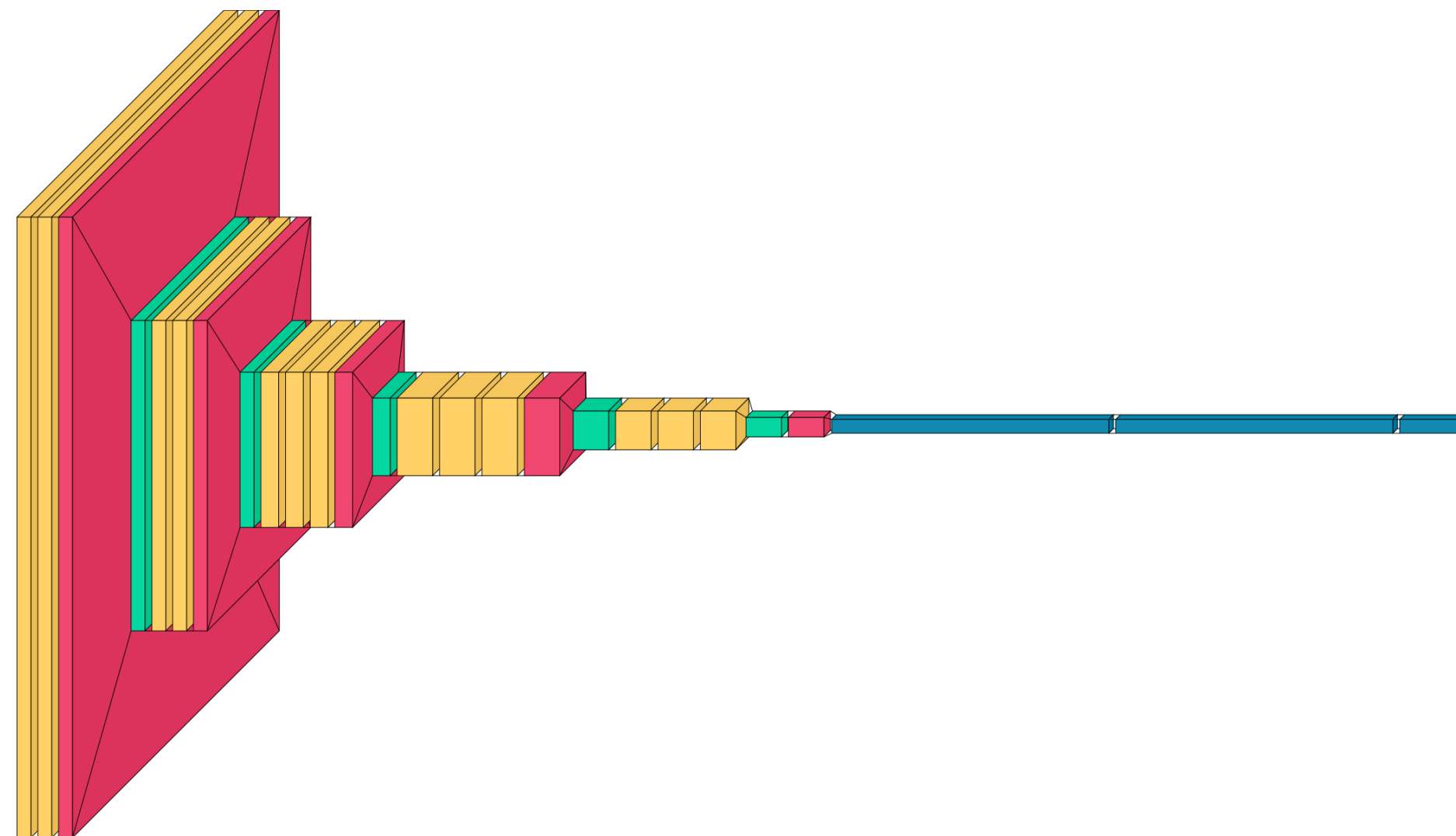
- "Birthday" of deep learning
- Won ImageNet 2012 competition
- One of the first CNNs utilizing GPUs for efficient training

Krizhevsky, Sutskever, and Hinton (2012). ImageNet classification with deep convolutional neural networks. <https://dl.acm.org/doi/abs/10.1145/3065386>

AlexNet

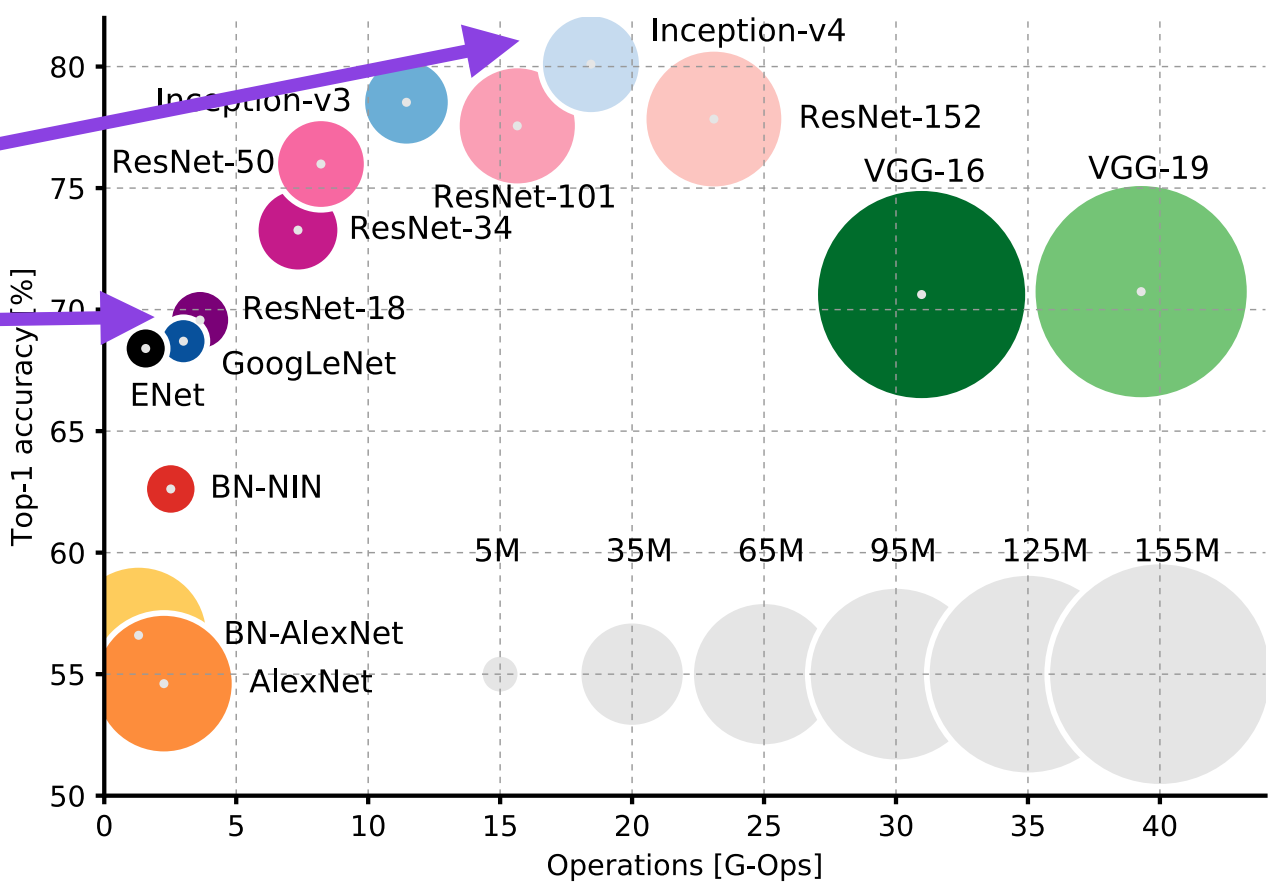


VGG16

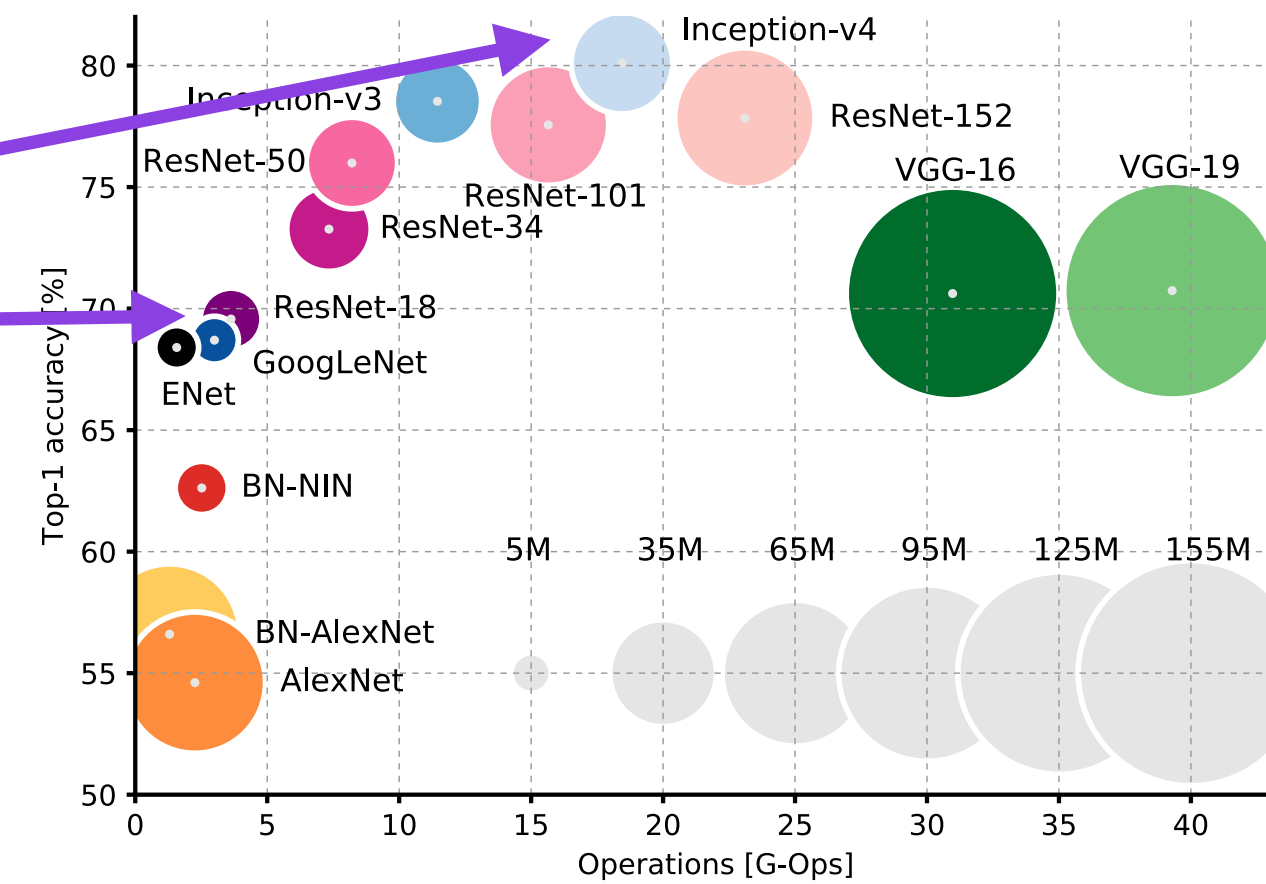


Same basic architecture,
but more layers, bigger size

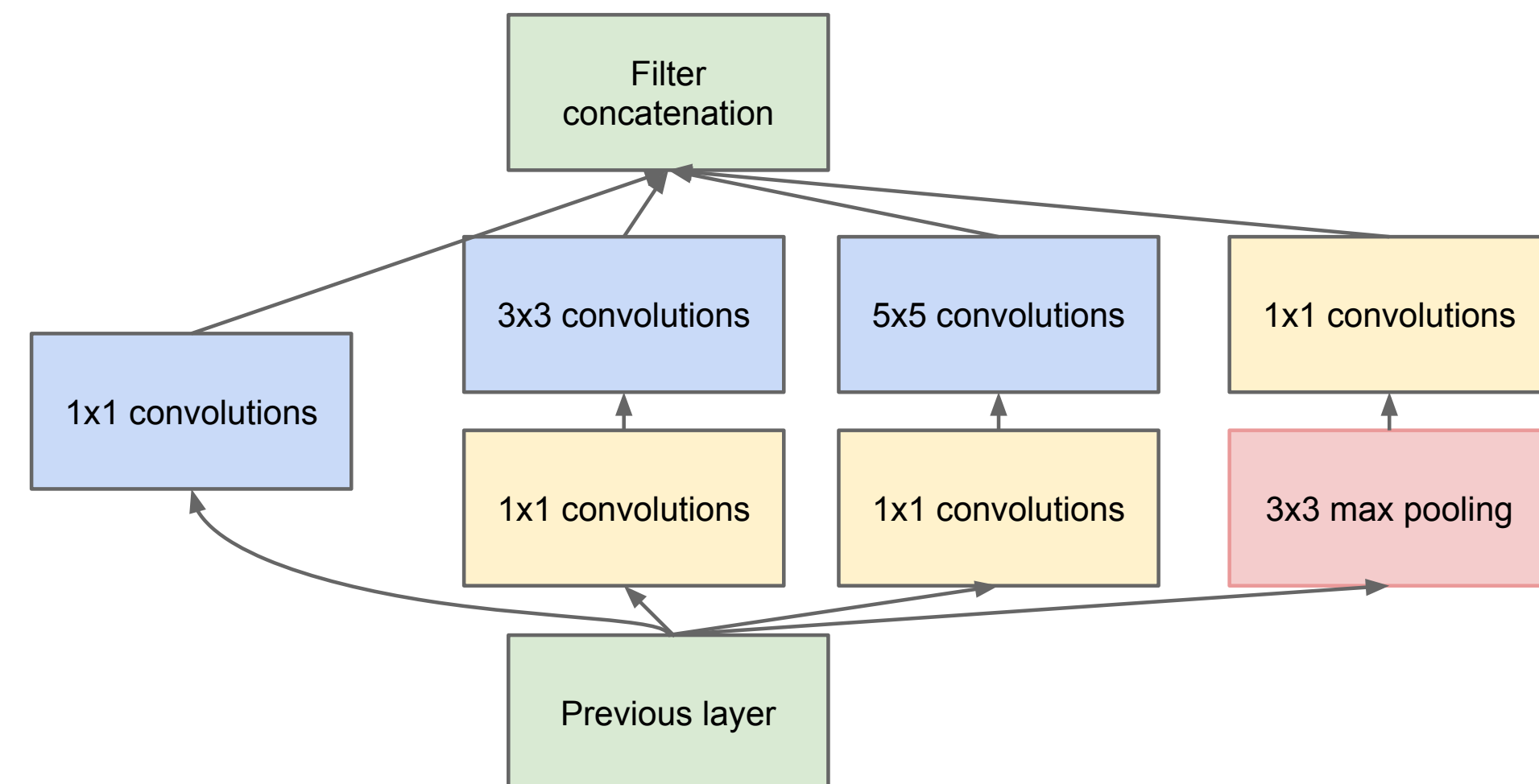
GoogLeNet/ Inception



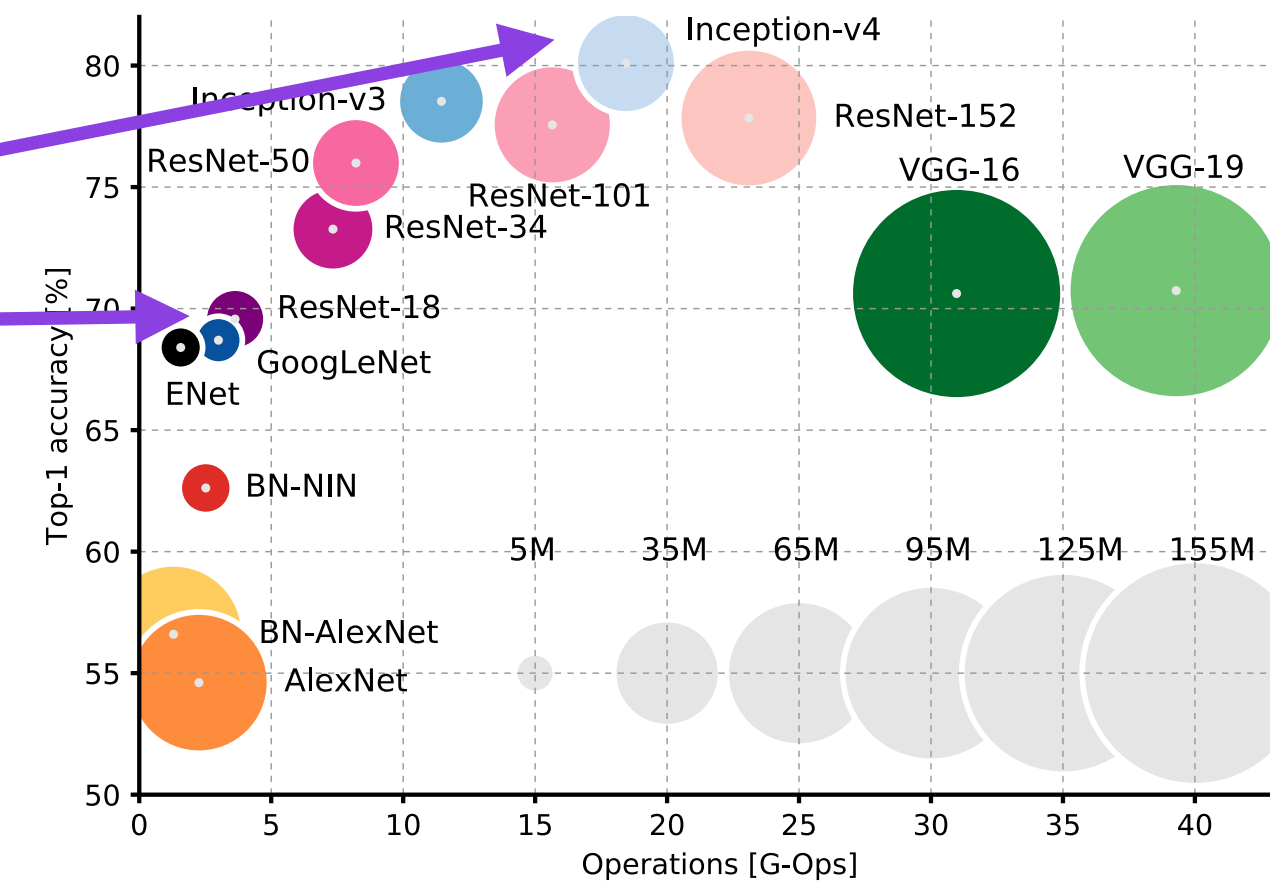
GoogLeNet/ Inception



Inception modules: use multiple convolutional layers with smaller kernels in parallel

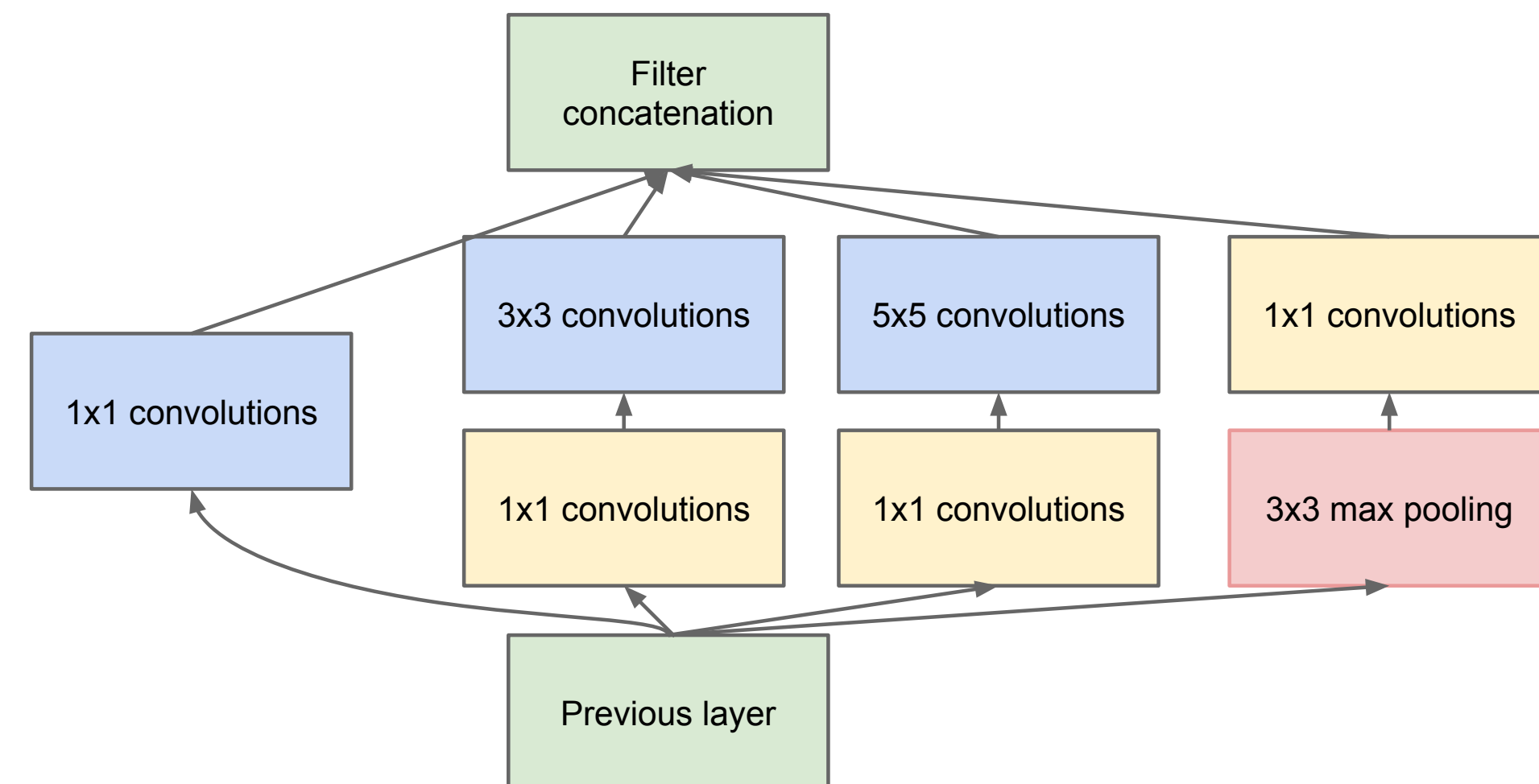


GoogLeNet/ Inception

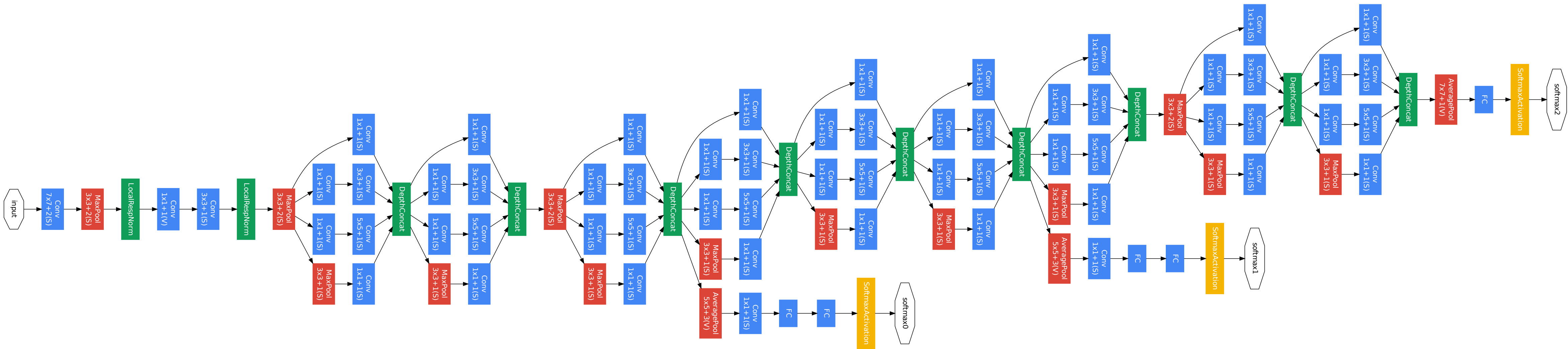
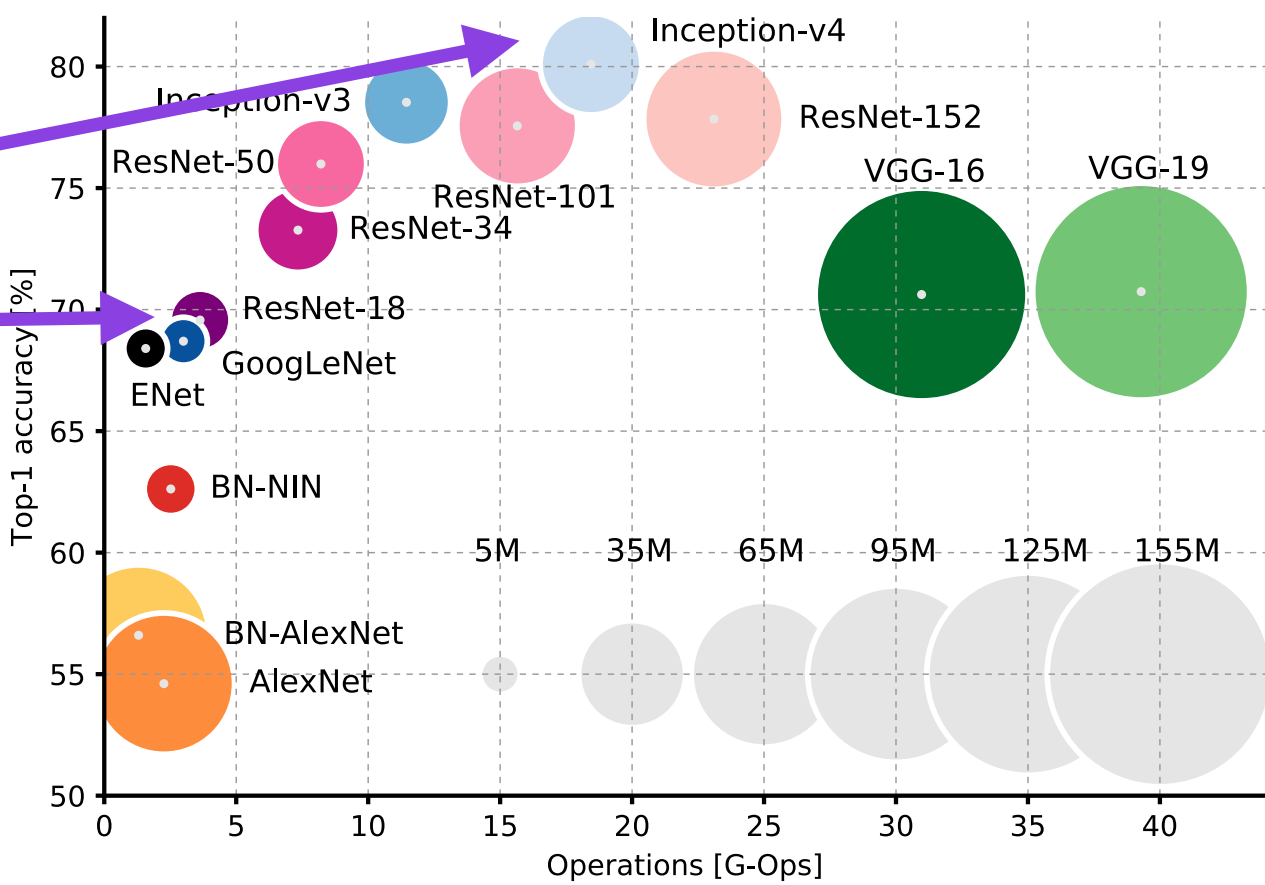


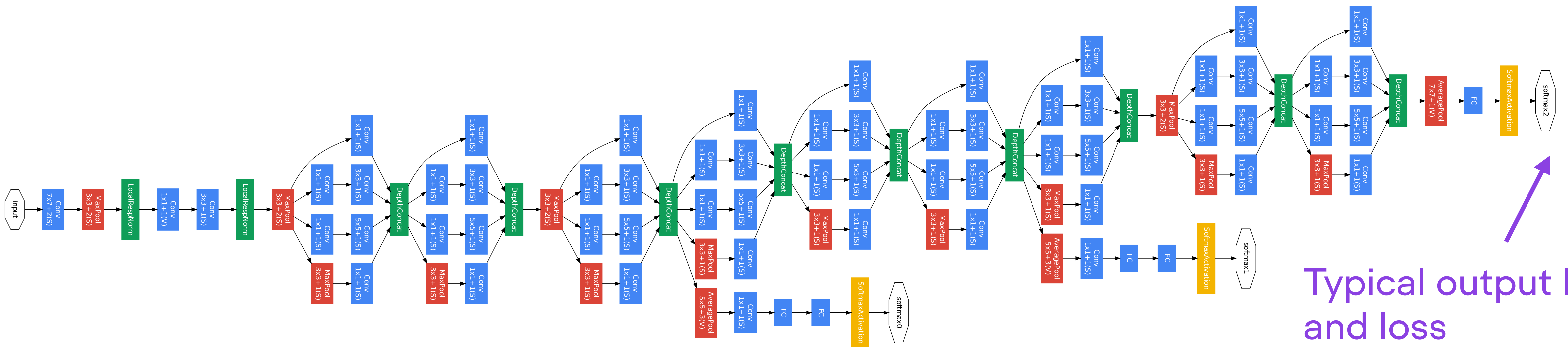
Inception modules: use multiple convolutional layers with smaller kernels **in parallel**

- keeps model smaller
- extracts features at various scales

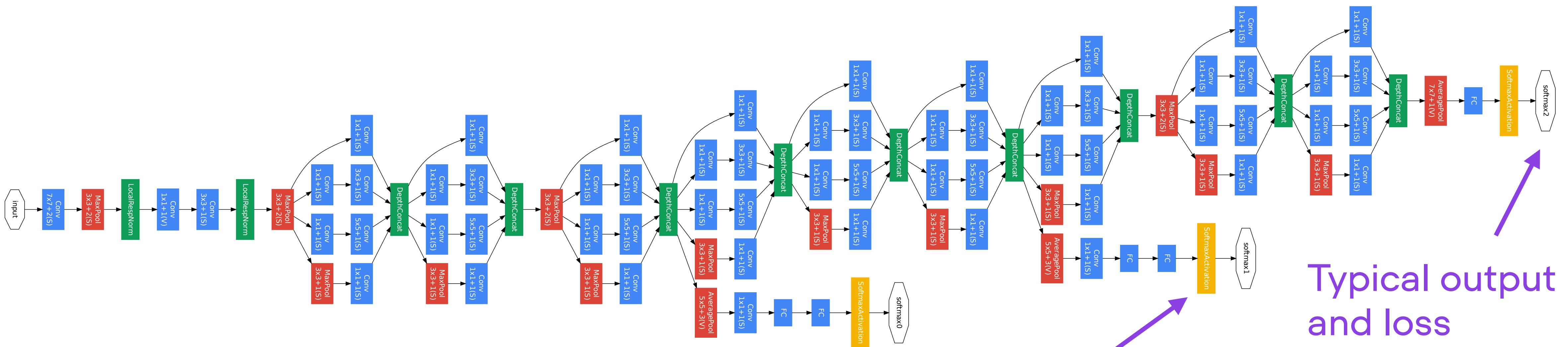


GoogLeNet/ Inception





Typical output layer and loss



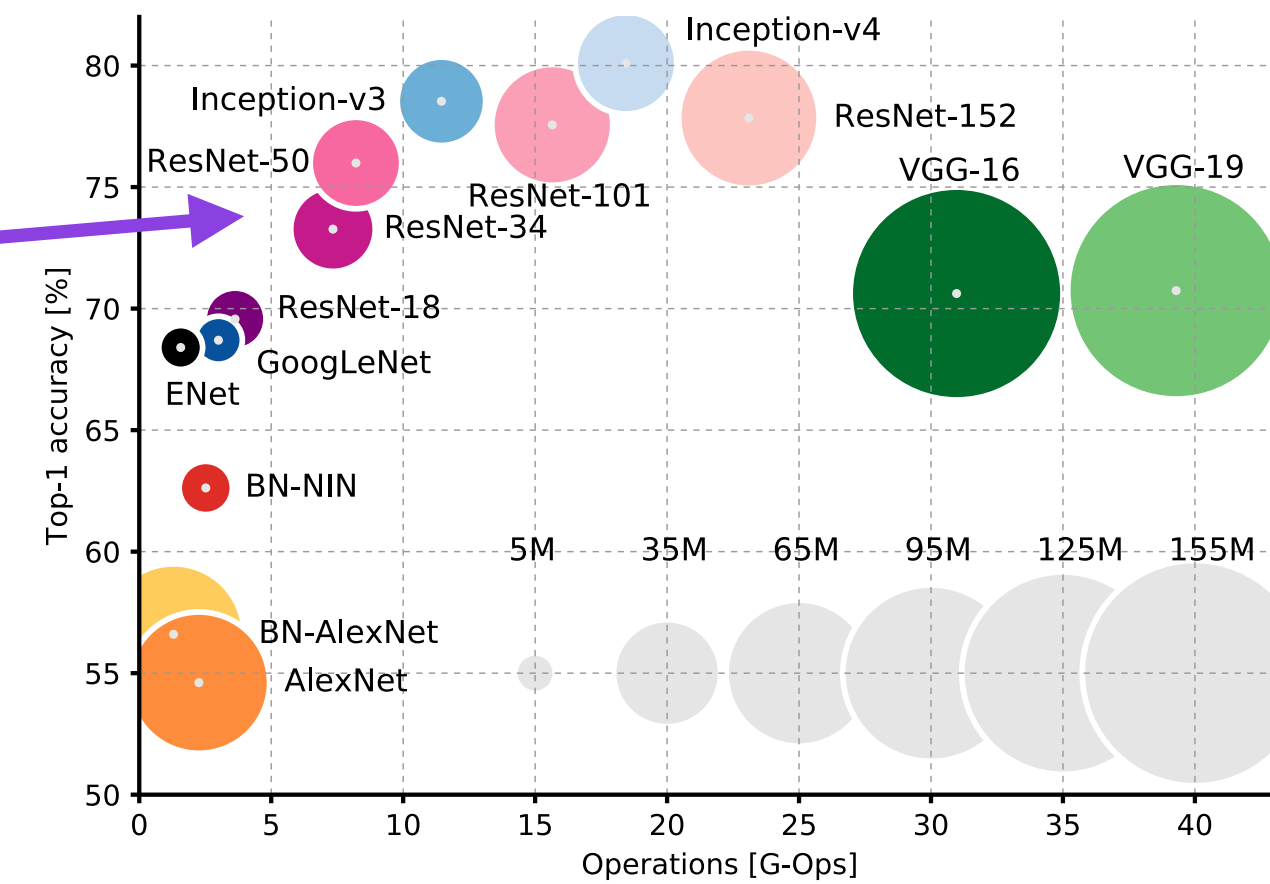
Typical output layer and loss

Auxiliary output layers and losses

ResNet-34, 50, 101

Even more layers (but smaller)

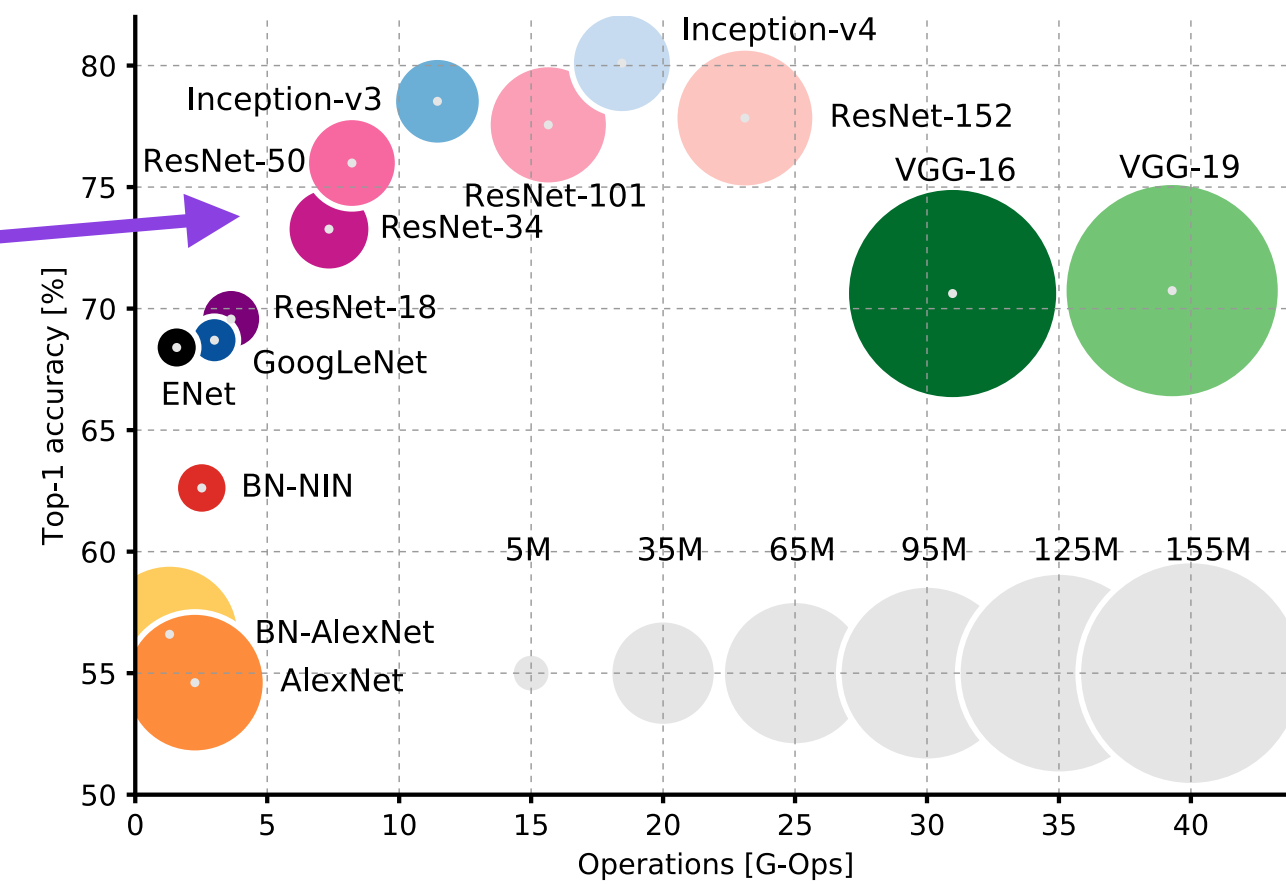
Key idea: skip connections!



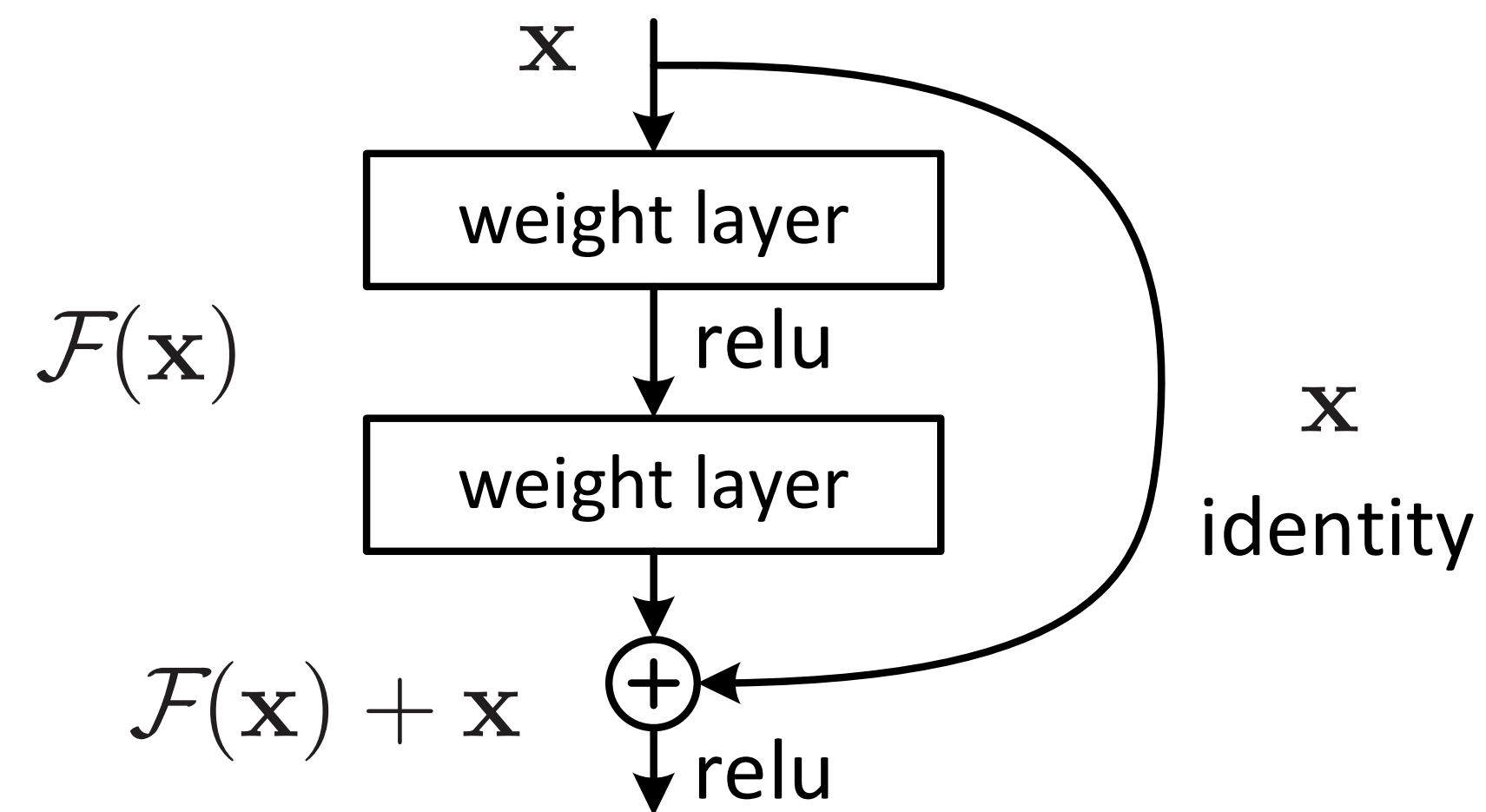
ResNet-34, 50, 101

Even more layers (but smaller)

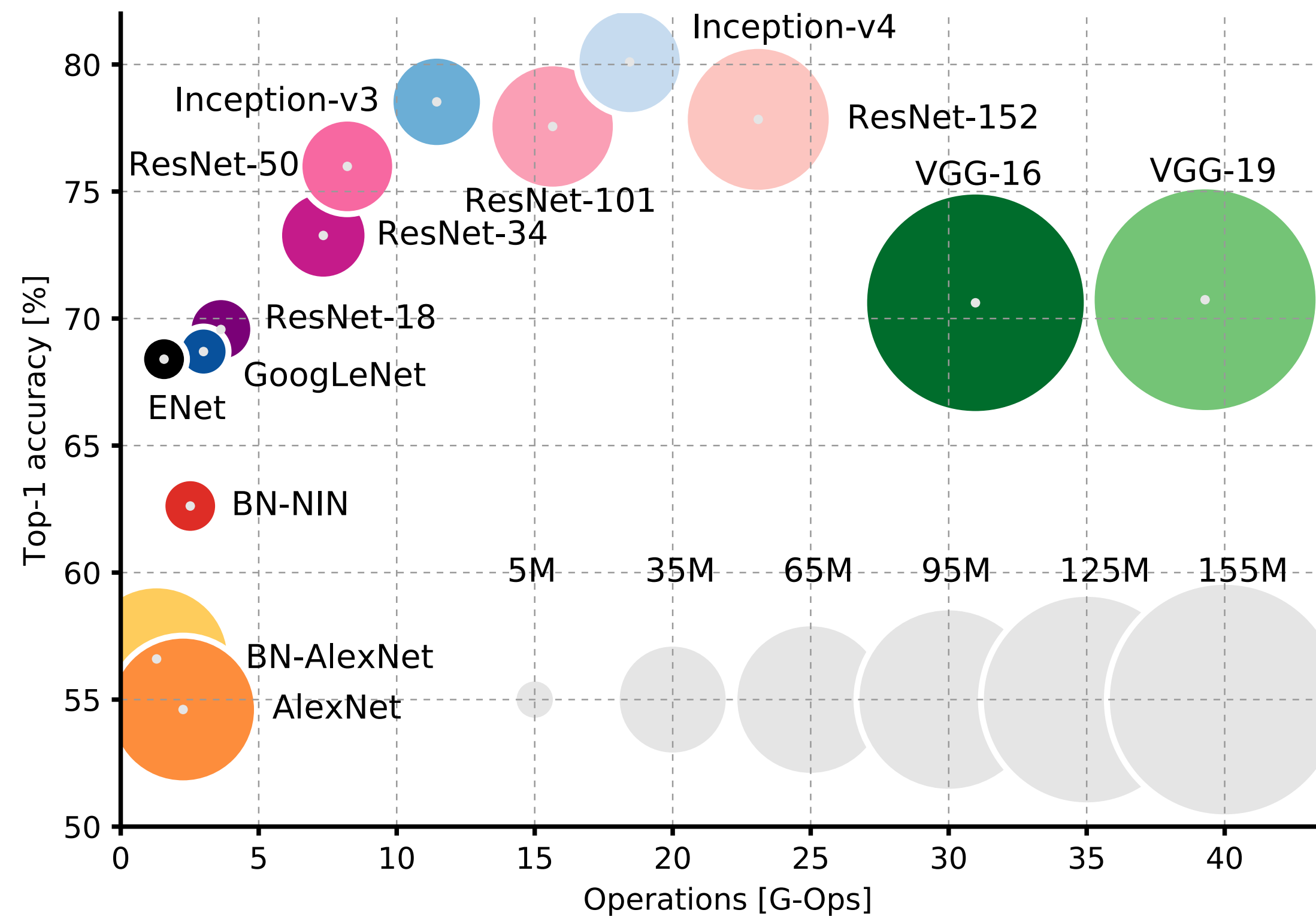
Key idea: skip connections!



Can ignore "bad" layers if layers
Stronger signal during backprop

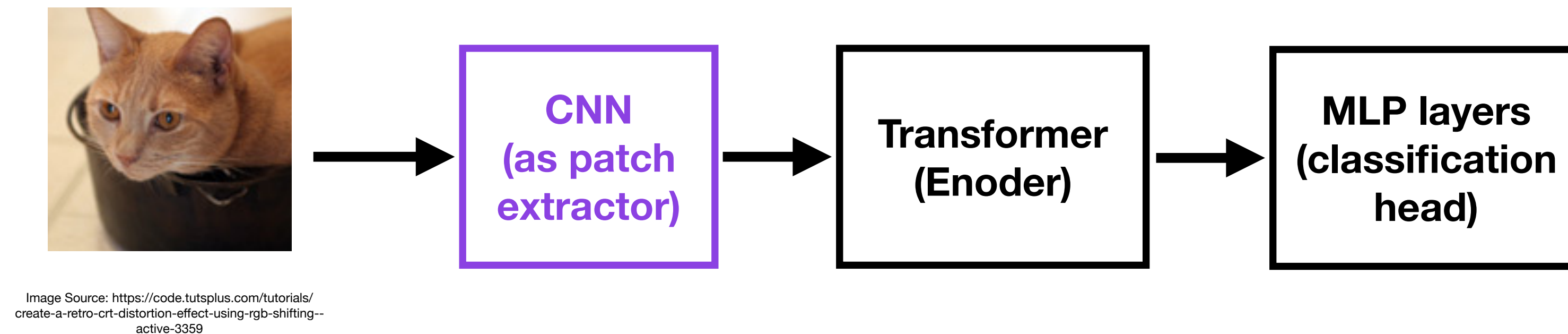


Many additional architectures were created in recent years



Convolutional Vision Transformer Hybrids

Combining convolutional networks and transformers based on self-attention (next unit)



Next: Let's finally train CNNs ourselves!