Cheat Sheet – Famous CNNs

AlexNet - 2012

Why: AlexNet was born out of the need to improve the results of the ImageNet challenge.

What: The network consists of 5 Convolutional (CONV) layers and 3 Fully Connected (FC) layers. The activation used is the Rectified Linear Unit (ReLU).

How: Data augmentation is carried out to reduce over-fitting, Uses Local response localization.

VGGNet - 2014

Why: VGGNet was born out of the need to reduce the # of parameters in the CONV layers and improve on training time

What: There are multiple variants of VGGNet (VGG16, VGG19, etc.) **How:** The important point to note here is that all the conv kernels are of size 3x3 and maxpool kernels are of size 2x2 with a stride of two.

ResNet - 2015

Why: Neural Networks are notorious for not being able to find a simpler mapping when it exists. ResNet solves that.

What: There are multiple versions of ResNetXX architectures where 'XX' denotes the number of layers. The most used ones are ResNet50 and ResNet101. Since the vanishing gradient problem was taken care of (more about it in the How part), CNN started to get deeper and deeper How: ResNet architecture makes use of shortcut connections do solve the vanishing gradient problem. The basic building block of ResNet is a Residual block that is repeated throughout the network.

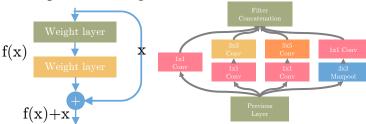


Figure 1 ResNet Block

Figure 2 Inception Block

Inception -2014

Why: Lager kernels are preferred for more global features, on the other hand, smaller kernels provide good results in detecting area-specific features. For effective recognition of such a variable-sized feature, we need kernels of different sizes. That is what Inception does.

What: The Inception network architecture consists of several inception modules of the following structure. Each inception module consists of four operations in parallel, 1x1 conv layer, 3x3 conv layer, 5x5 conv layer, max pooling

How: Inception increases the network space from which the best network is to be chosen via training. Each inception module can capture salient features at different levels.

| | Comparison | | | | | | | | | | | |
|------------|------------|--------------------------|---------------|------------|-------|--|--|--|--|--|--|--|
| Network | Year | Salient Feature | top5 accuracy | Parameters | FLOP | | | | | | | |
| AlexNet | 2012 | Deeper | 84.70% | 62M | 1.5B | | | | | | | |
| VGGNet | 2014 | Fixed-size kernels | 92.30% | 138M | 19.6B | | | | | | | |
| Inception | 2014 | Wider - Parallel kernels | 93.30% | 6.4M | 2B | | | | | | | |
| ResNet-152 | 2015 | Shortcut connections | 95.51% | 60.3M | 11B | | | | | | | |

| 1 | | 224 | 3 | 224 | 224 | 64 | conv3-64 | 1 | 3 | 3 | 3 | 64 | 1792 |
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| 2 | 224 | 224 | 64 | 224 | 224 | 64 | conv3064 | 1 | 3 | 3 | 64 | 64 | 36928 |
| | 224 | 224 | 64 | 112 | 112 | 64 | maxpool | 2 | 2 | 2 | 64 | 64 | 0 |
| 3 | 112 | 112 | 64 | 112 | 112 | 128 | conv3-128 | 1 | 3 | 3 | 64 | 128 | 73856 |
| 4 | 112 | 112 | 128 | 112 | 112 | 128 | conv3-128 | 1 | 3 | 3 | 128 | 128 | 147584 |
| | 112 | 112 | 128 | 56 | 56 | 128 | maxpool | 2 | 2 | 2 | 128 | 128 | 65664 |
| 5 | 56 | 56 | 128 | 56 | 56 | 256 | conv3-256 | 1 | 3 | 3 | 128 | 256 | 295168 |
| 6 | 56 | 56 | 256 | 56 | 56 | 256 | conv3-256 | 1 | 3 | 3 | 256 | 256 | 590080 |
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| 8 | 28 | 28 | 256 | 28 | 28 | 512 | conv3-512 | 1 | 3 | 3 | 256 | 512 | 1180160 |
| 9 | 28 | 28 | 512 | 28 | 28 | 512 | conv3-512 | 1 | 3 | 3 | 512 | 512 | 2359808 |
| 10 | 28 | 28 | 512 | 28 | 28 | 512 | conv3-512 | 1 | 3 | 3 | 512 | 512 | 2359808 |
| | 28 | 28 | 512 | 14 | 14 | 512 | maxpool | 2 | 2 | 2 | 512 | 512 | 0 |
| 11 | 14 | 14 | 512 | 14 | 14 | 512 | conv3-512 | 1 | 3 | 3 | 512 | 512 | 2359808 |
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| 13 | 14 | 14 | 512 | 14 | 14 | 512 | conv3-512 | 1 | 3 | 3 | 512 | 512 | 2359808 |
| | 14 | 14 | 512 | 7 | 7 | 512 | maxpool | 2 | 2 | 2 | 512 | 512 | 0 |
| 14 | 1 | 1 | 25088 | 1 | 1 | 4096 | | | 1 | 1 | 25088 | 4096 | 102764544 |
| 15 | 1 | 1 | 4096 | 1 | 1 | 4096 | fc | | 1 | 1 | 4096 | 4096 | 16781312 |
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| | | | | | | | Total | | | | | | 138,423,208 |
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| | 112 | 112 | 64 | 56 | 56 | 64 | maxpool | 2 | 0.5 | 3 | 3 | 64 | 64 | 0 |
| 2 | 56 | 56 | 64 | 56 | 56 | 64 | conv2-1 | 1 | 1 | 3 | 3 | 64 | 64 | 36928 |
| 3 | 56 | 56 | 64 | 56 | 56 | 64 | conv2-2 | 1 | 1 | 3 | 3 | 64 | 64 | 36928 |
| 4 | 4 56 56 64 56 56 64 conv2-3 1 1 3 3 64 64 | | | | | | | | | | | | | 36928 |
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| 6 | 56 | 56 | 64 | 28 | 28 | 128 | conv3-1 | 2 | 0.5 | 3 | 3 | 64 | 128 | 73856 |
| 7 | 28 | 28 | 128 | 28 | 28 | 128 | conv3-2 | 1 | 1 | 3 | 3 | 128 | 128 | 147584 |
| 8 | 28 | 28 | 128 | 28 | 28 | 128 | conv3-3 | 1 | 1 | 3 | 3 | 128 | 128 | 147584 |
| 9 | 28 | 28 | 128 | 28 | 28 | 128 | conv3-4 | 1 | 1 | 3 | 3 | 128 | 128 | 147584 |
| 10 | 28 | 28 | 128 | 14 | 14 | 256 | conv4-1 | 2 | 0.5 | 3 | 3 | 128 | 256 | 295168 |
| 11 | 14 | 14 | 256 | 14 | 14 | 256 | conv4-2 | 1 | 1 | 3 | 3 | 256 | 256 | 590080 |
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