

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.

AlexNet Network - Structural Details												
Input	Output	Layer	Stride	Pad	Kernel size	in	out	# of Param				
227 227 3	55 55 96	conv1	4	0	11 11 3	96	96	34944				
55 55 96	27 27 96	maxpool1	2	0	3 3	96	96	0				
27 27 96	27 27 256	conv2	1	2	5 5	96	256	614656				
27 27 256	13 13 256	maxpool2	2	0	3 3	256	256	0				
13 13 256	13 13 384	conv3	1	1	3 3	256	384	885120				
13 13 384	13 13 384	conv4	1	1	3 3	384	384	1327488				
13 13 384	13 13 256	conv5	1	1	3 3	384	256	884992				
13 13 256	6 6 256	maxpool5	2	0	3 3	256	256	0				
									fc6	1	1	9216 4096 37752832
									fc7	1	1	4096 4096 16781312
									fc8	1	1	4096 1000 40970000
									Total			62,378,344

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.

VGG16 - Structural Details												
#	Input Image	output	Layer	Stride	Kernel	in	out	Param				
1	224 224 3	224 224 64	conv3-64	1	3 3 3	3	64	1792				
2	224 224 64	224 224 64	conv3-64	1	3 3 3	64	64	36928				
3	112 112 64	112 112 128	conv3-128	2	2 2 2	64	128	73856				
4	112 112 128	112 112 128	conv3-128	1	3 3 3	128	128	147584				
5	112 112 128	56 56 128	maxpool	2	2 2 2	128	128	65664				
6	56 56 128	56 56 256	conv3-256	1	3 3 3	128	256	295168				
7	56 56 256	56 56 256	conv3-256	1	3 3 3	256	256	590080				
8	56 56 256	28 28 256	maxpool	2	2 2 2	256	256	0				
9	28 28 256	28 28 512	conv3-512	1	3 3 3	256	512	1180160				
10	28 28 512	28 28 512	conv3-512	1	3 3 3	512	512	2359808				
11	14 14 512	14 14 512	conv3-512	1	3 3 3	512	512	2359808				
12	14 14 512	14 14 512	conv3-512	1	3 3 3	512	512	2359808				
13	14 14 512	14 14 512	conv3-512	1	3 3 3	512	512	2359808				
14	14 14 512	7 7 512	maxpool	2	2 2 2	512	512	0				
15	1 1 4096	1 1 4096	fc	1	1 1 4096	4096	102764544	16781312				
16	1 1 4096	1 1 1000	fc	1	1 1 4096	1000	40970000	40970000				
									Total			138,423,208

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.

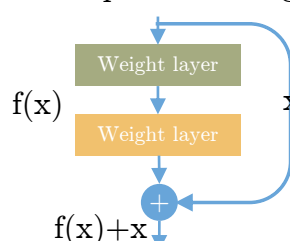


Figure 1 ResNet Block

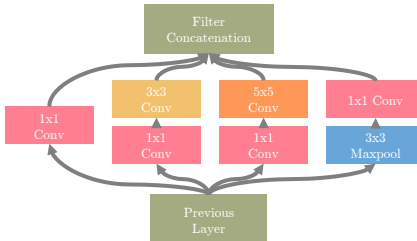


Figure 2 Inception Block

Inception – 2014

Why: Larger 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.

GoogleNet - Structural Details												
	Input Image	output	Layer	Stride	Pad	Kernel	in	out	Param			
	224 224 3	112 112 64	conv1	2	0.5	3 3 64	64	64	0			
	112 112 64	56 56 64	conv2-1	1	1	3 3 64	64	64	36928			
	56 56 64	56 56 64	conv2-2	1	1	3 3 64	64	64	36928			
	56 56 64	56 56 64	conv2-3	1	1	3 3 64	64	64	36928			
	56 56 64	56 56 192	conv2-4	1	0.5	3 3 64	64	192	178560			
resnetp1 (3a)	28 28 192	28 28 128	conv3-1	2	0.5	3 3 128	128	128	147584			
	28 28 128	28 28 128	conv3-2	1	1	3 3 128	128	128	147584			
	28 28 128	28 28 128	conv3-3	1	1	3 3 128	128	128	147584			
	28 28 128	28 28 128	conv3-4	1	1	3 3 128	128	128	147584			
	28 28 128	28 28 256	conv3-5	conv3-5	conv3-5	conv3-5	conv3-5	conv3-5	conv3-5			
resnetp1 (3b)	28 28 256	28 28 256	conv3-6	conv3-6	conv3-6	conv3-6	conv3-6	conv3-6	conv3-6			
	28 28 256	28 28 256	conv3-7	conv3-7	conv3-7	conv3-7	conv3-7	conv3-7	conv3-7			
	28 28 256	28 28 256	conv3-8	conv3-8	conv3-8	conv3-8	conv3-8	conv3-8	conv3-8			
	28 28 256	28 28 256	conv3-9	conv3-9	conv3-9	conv3-9	conv3-9	conv3-9	conv3-9			
	28 28 256	28 28 256	conv3-10	conv3-10	conv3-10	conv3-10	conv3-10	conv3-10	conv3-10			
resnetp1 (3c)	28 28 256	28 28 256	conv3-11	conv3-11	conv3-11	conv3-11	conv3-11	conv3-11	conv3-11			
	28 28 256	28 28 256	conv3-12	conv3-12	conv3-12	conv3-12	conv3-12	conv3-12	conv3-12			
	28 28 256	28 28 256	conv3-13	conv3-13	conv3-13	conv3-13	conv3-13	conv3-13	conv3-13			
	28 28 256	28 28 256	conv3-14	conv3-14	conv3-14	conv3-14	conv3-14	conv3-14	conv3-14			
	28 28 256	28 28 256	conv3-15	conv3-15	conv3-15	conv3-15	conv3-15	conv3-15	conv3-15			
resnetp1 (3d)	28 28 256	28 28 256	conv3-16	conv3-16	conv3-16	conv3-16	conv3-16	conv3-16	conv3-16			
	28 28 256	28 28 256	conv3-17	conv3-17	conv3-17	conv3-17	conv3-17	conv3-17	conv3-17			
	28 28 256	28 28 256	conv3-18	conv3-18	conv3-18	conv3-18	conv3-18	conv3-18	conv3-18			
	28 28 256	28 28 256	conv3-19	conv3-19	conv3-19	conv3-19	conv3-19	conv3-19	conv3-19			
	28 28 256	28 28 256	conv3-20	conv3-20	conv3-20	conv3-20	conv3-20	conv3-20	conv3-20			
resnetp1 (3e)	28 28 256	28 28 256	conv3-21	conv3-21	conv3-21	conv3-21	conv3-21	conv3-21	conv3-21			
	28 28 256	28 28 256	conv3-22	conv3-22	conv3-22	conv3-22	conv3-22	conv3-22	conv3-22			
	28 28 256	28 28 256	conv3-23	conv3-23	conv3-23	conv3-23	conv3-23	conv3-23	conv3-23			
	28 28 256	28 28 256	conv3-24	conv3-24	conv3-24	conv3-24	conv3-24	conv3-24	conv3-24			
	28 28 256	28 28 256	conv3-25	conv3-25	conv3-25	conv3-25	conv3-25	conv3-25	conv3-25			
resnetp1 (3f)	28 28 256	28 28 256	conv3-26	conv3-26	conv3-26	conv3-26	conv3-26	conv3-26	conv3-26			
	28 28 256	28 28 256	conv3-27	conv3-27	conv3-27	conv3-27	conv3-27	conv3-27	conv3-27			
	28 28 256	28 28 256	conv3-28	conv3-28	conv3-28	conv3-28	conv3-28	conv3-28	conv3-28			
	28 28 256	28 28 256	conv3-29	conv3-29	conv3-29	conv3-29	conv3-29	conv3-29	conv3-29			
	28 28 256	28 28 256	conv3-30	conv3-30	conv3-30	conv3-30	conv3-30	conv3-30	conv3-30			
resnetp1 (3g)	28 28 256	28 28 256	conv3-31	conv3-31	conv3-31	conv3-31	conv3-31	conv3-31	conv3-31			
	28 28 256	28 28 256	conv3-32	conv3-32	conv3-32	conv3-32	conv3-32	conv3-32	conv3-32			
	28 28 256	28 28 256	conv3-33	conv3-33	conv3-33	conv3-33	conv3-33	conv3-33	conv3-33			
	28 28 256	28 28 256	conv3-34	conv3-34	conv3-34	conv3-34	conv3-34	conv3-34	conv3-34			
	28 28 256	28 28 256	conv3-35	conv3-35	conv3-35	conv3-35	conv3-35	conv3-35	conv3-35			
resnetp1 (3h)	28 28 256	28 28 256	conv3-36	conv3-36	conv3-36	conv3-36	conv3-36	conv3-36	conv3-36			
	28 28 256	28 28 256	conv3-37	conv3-37	conv3-37	conv3-37	conv3-37	conv3-37	conv3-37			
	28 28 256	28 28 256	conv3-38	conv3-38	conv3-38	conv3-38	conv3-38	conv3-38	conv3-38			
	28 28 256	28 28 256	conv3-39	conv3-39	conv3-39	conv3-39	conv3-39	conv3-39	conv3-39			
	28 28 256	28 28 256	conv3-40	conv3-40	conv3-40	conv3-40	conv3-40	conv3-40	conv3-40			
resnetp1 (3i)	28 28 256	28 28 256	conv3-41	conv3-41	conv3-41	conv3-41	conv3-41	conv3-41	conv3-41			
	28 28 256	28 28 256	conv3-42	conv3-42	conv3-42	conv3-42	conv3-42	conv3-42	conv3-42			
	28 28 256	28 28 256	conv3-43	conv3-43	conv3-43	conv3-43	conv3-43	conv3-43	conv3-43			
	28 28 256	28 28 256	conv3-44	conv3-44	conv3-44	conv3-44	conv3-44	conv3-44	conv3-44			
	28 28 256	28 28 256	conv3-45	conv3-45	conv3-45	conv3-45	conv3-45	conv3-45	conv3-45			
resnetp1 (3j)	28 28 256	28 28 256	conv3-46	conv3-46	conv3-46	conv3-46	conv3-46	conv3-46	conv3-46			
	28 28 256	28 28 256	conv3-47	conv3-47	conv3-47	conv3-47	conv3-47	conv3-47	conv3-47			
	28 28 256	28 28 256	conv3-48	conv3-48	conv3-48	conv3-48	conv3-48	conv3-48	conv3-48			
	28 28 256	28 28 256	conv3-49	conv3-49	conv3-49	conv3-49	conv3-49	conv3-49	conv3-49			
	28 28 256	28 28 256	conv3-50	conv3-50	conv3-50	conv3-50	conv3-50	conv3-50	conv3-50			
resnetp1 (3k)	28 28 256	28 28 256	conv3-51	conv3-51	conv3-51	conv3-51	conv3-51	conv3-51	conv3-51			
	28 28 256	28 28 256	conv3-52	conv3-52	conv3-52	conv3-52	conv3-52	conv3-52	conv3-52			
	28 28 256	28 28 256	conv3-53	conv3-53	conv3-53	conv3-53	conv3-53	conv3-53	conv3-53			
	28 28 256	28 28 256	conv3-54	conv3-54	conv3-54	conv3-54	conv3-54	conv3-54	conv3-54			
	28 28 256	28 28 256	conv3-55	conv3-55	conv3-55	conv3-55	conv3-55	conv3-55	conv3-55			
resnetp1 (3l)	28 28 256	28 28 256	conv3-56	conv3-56	conv3-56	conv3-56	conv3-56	conv3-56	conv3-56			
	28 28 256	28 28 256	conv3-57	conv3-57	conv3-57	conv3-57	conv3-57	conv3-57	conv3-57			
	28 28 256	28 28 256	conv3-58	conv3-58	conv3-58	conv3-58	conv3-58	conv3-58	conv3-58			
	28 28 256	28 28 256	conv3-59	conv3-59	conv3-59	conv3-59	conv3-59	conv3-59	conv3-59			
	28 28 256	28 28 256	conv3-60	conv3-60	conv3-60	conv3-60	conv3-60	conv3-60	conv3-60			
resnetp1 (3m)	28 28 256	28 28 256	conv3-61	conv3-61	conv3-61	conv3-61	conv3-61	conv3-61	conv3-61			
	28 28 256	28 28 256	conv3-62	conv3-62	conv3-62	conv3-62	conv3-62	conv3-62	conv3-62			
	28 28 256	28 28 256	conv3-63	conv3-63	conv3-63	conv3-63	conv3-63	conv3-63	conv3-63			
	28 28 256	28 28 256	conv3-64	conv3-64	conv3-64	conv3-64	conv3-64	conv3-64	conv3-64			
	28 28 256	28 28 256	conv3-65	conv3-65	conv3-65	conv3-65	conv3-65	conv3-65	conv3-65			
resnetp1 (3n)	28 28 256	28 28 256	conv3-66	conv3-66	conv3-66	conv3-66	conv3-66	conv3-66	conv3-66			
	28 28 256	28 28 256	conv3-67	conv3-67	conv3-67	conv3-67	conv3-67	conv3-67	conv3-67			
	28 28 256	28 28 256	conv3-68	conv3-68	conv3-68	conv3-68	conv3-68	conv3-68	conv3-68			
	28 28 256	28 28 256	conv3-69	conv3-69	conv3-69	conv3-69	conv3-69	conv3-69	conv3-69			
	28 28 256	28 28 256	conv3-70	conv3-70	conv3-70	conv3-70	conv3-70	conv3-70	conv3-70			
resnetp1 (3o)	28 28 256	28 28 256	conv3-71	conv3-71	conv3-71	conv3-71	conv3-71	conv3-71	conv3-71			
	28 28 256	28 28 256	conv3-72	conv3-72	conv3-72	conv3-72	conv3-72	conv3-72	conv3-72			
	28 28 256	28 28 256	conv3-73	conv3-73	conv3-73	conv3-73	conv3-73	conv3-73	conv3-73			
	28 28 256	28 28 256	conv3-74	conv3-74	conv3-74	conv3-74	conv3-74	conv3-74	conv3-74			
	28 28 256	28 28 256	conv3-75	conv3-75	conv3-75	conv3-75	conv3-75	conv3-75	conv3-75			
resnetp1 (3p)	28 28 256	28 28 256	conv3-76	conv3-76	conv3-76	conv3-76	conv3-76	conv3-76	conv3-76			
	28 28 256	28 28 256	conv3-77	conv3-77	conv3-77	conv3-77	conv3-77	conv3-77	conv3-77			
	28 28 256	28 28 256	conv3-78	conv3-78	conv3-78	conv3-78	conv3-78	conv3-78	conv3-78			
	28 28 256	28 28 256	conv3-79	conv3-79	conv3-79	conv3-79	conv3-79	conv3-79	conv3-79			
	28 28 256	28 28 256	conv3-80	conv3-80	conv3-80	conv3-80	conv3-80	conv3-80	conv3-80			
resnetp1 (3q)	28 28 256	28 28 256	conv3-81	conv3-81	conv3-81	conv3-81	conv3-81	conv3-81	conv3-81			
	28 28 256	28 28 256	conv3-82	conv3-82	conv3-82	conv3-82	conv3-82	conv3-82	conv3-82			
	28 28 256	28 28 256	conv3-83	conv3-83	conv3-83	conv3-83	conv3-83	conv3-83	conv3-83			
	28 28 256	28 28 256	conv3-84	conv3-84	conv3-84	conv3-84	conv3-84	conv3-84	conv3-84			
	28 28 256	28 28 256	conv3-85	conv3-85	conv3-85	conv3-85	conv3-85	conv3-85	conv3-85			
resnetp1 (3r)	28 28 256	28 28 256	conv3-86	conv3-86	conv3-86	conv3-86	conv3-86	conv3-86	conv3-86			
	28 28 256	28 28 256	conv3-87	conv3-87	conv3-87	conv3-87	conv3-87	conv3-87	conv3-87			
	28 28 256	28 28 256	conv3-88	conv3-88	conv3-88	conv3-88	conv3-88	conv3-88	conv3-88			
	28 28 256	28 28 256	conv3-89	conv3-89	conv3-89	conv3-89	conv3-89	conv3-89	conv3-89			
	28 28 256	28 28 256	conv3-90	conv3-90	conv3-90	conv3-90	conv3-90	conv3-90	conv3-90			
resnetp1 (3s)	28 28 256	28 28 256	conv3-91	conv3-91	conv3-91	conv3-91	conv3-91	conv3-91	conv3-91			
	28 28 256	28 28 256	conv3-92	conv3-92	conv3-92	conv3-92	conv3-92	conv3-92	conv3-92			
	28 28 256	28 28 256	conv3-93	conv3-93	conv3-93	conv3-93	conv3-93	conv3-93	conv3-93			
	28 28 256	28 28 256	conv3-94	conv3-94	conv3-94	conv3-94	conv3-94	conv3-94	conv3-94			
	28 28 256	28 28 256	conv3-95	conv3-95	conv3-95	conv3-95	conv3-95	conv3-95	conv3-95			
resnetp1 (3t)	28 28 256	28 28 256	conv3-96	conv3-96	conv3-96	conv3-96	conv3-96	conv3-96	conv3-96			
	28 28 256	28 28 256	conv3-97	conv3-97	conv3-97	conv3-97	conv3-97	conv3-97	conv3-97			
	28 28 256	28 28 256	conv3-98	conv3-98	conv3-98	conv3-98	conv3-98	conv3-98	conv3-98			
	28 28 256	28 28 256	conv3-99	conv3-99	conv3-99	conv3-99	conv3-99	conv3-99	conv3-99			
	28 28 256	28 28 256	conv3-100	conv3-100	conv3-100	conv3-100	conv3-100	conv3-100	conv3-100			
resnetp1 (3u)	28 28 256	28 28 256	conv3-101	conv3-101	conv3-101	conv3-101	conv3-101	conv3-101	conv3-101			
	28 28 256	28 28 256	conv3-102	conv3-102	conv3-102	conv3-102	conv3-102	conv3-102	conv3-102			
	28 28 256	28 28 256	conv3-103	conv3-103	conv3-103	conv3-103	conv3-103	conv3-103	conv3-103			
	28 28 256	28 28 256	conv3-104	conv3-104	conv3-104	conv3-104	conv3-104	conv3-104	conv3-104			
	28 28 256	28 28 256	conv3-105	conv3-105	conv3-105	conv3-105	conv3-105	conv3-105	conv3-105			
resnetp1 (3v)	28 28 256	28 28 256	conv3-106	conv3-106	conv3-106	conv3-106</						