DIFFERENT ARCHITECTURE OF CNN

Discuss Shortly

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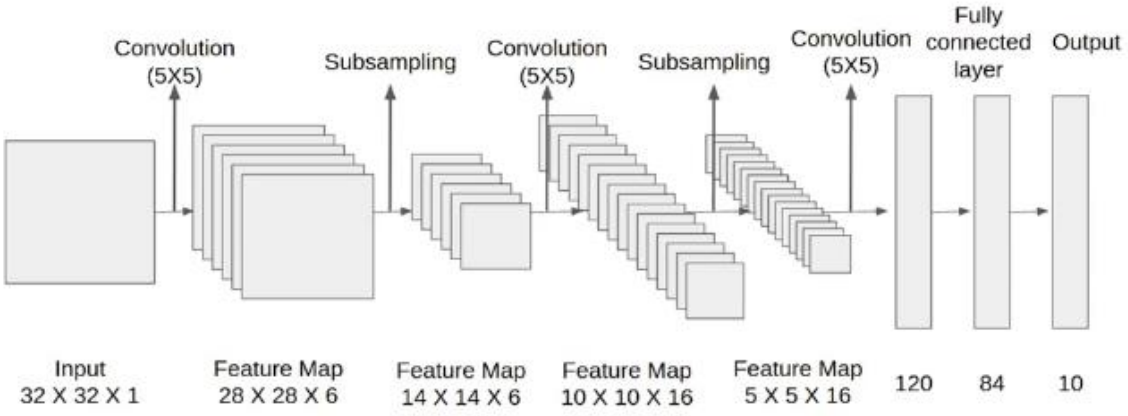
1. LeNet :

LeNet5 is a small network, it contains the basic modules of deep learning: convolutional layer, pooling layer, and full link layer. It is the basis of other deep learning models. Here we analyze LeNet5 in depth. At the same time, through example analysis, deepen the understanding of



Layer	# filters / neurons	Filter size	Stride	Size of feature map	Activation function
Input	-	-	-	32 X 32 X 1	
Conv 1	6	5 * 5	1	28 X 28 X 6	tanh
Avg. pooling 1		2 * 2	2	14 X 14 X 6	
Conv 2	16	5 * 5	1	10 X 10 X 16	tanh
Avg. pooling 2		2 * 2	2	5 X 5 X 16	
Conv 3	120	5 * 5	1	120	tanh
Fully Connected 1	-	-	-	84	tanh
Fully Connected 2	-	-	-	10	Softmax

the convolutional layer and pooling layer.

End Notes :

- 5 layers with learnable parameters
- The input to the model is a grayscale image
- It has 3 convolutions layers, two average pooling layers, and two fully connected layers with a softmax classifier
- The number of trainable parameters in 60000.

2. AlexNet :

AlexNet was designed by Hinton, winner of the 2012 ImageNet competition, and his student Alex Krizhevsky. It was also after that year that more and deeper neural networks were proposed, such as the excellent vgg, GoogleLeNet. Its official data model has an accuracy rate of 57.1% and top 1-5 reaches 80.2%. This is already quite outstanding for traditional machine learning classification algorithms.

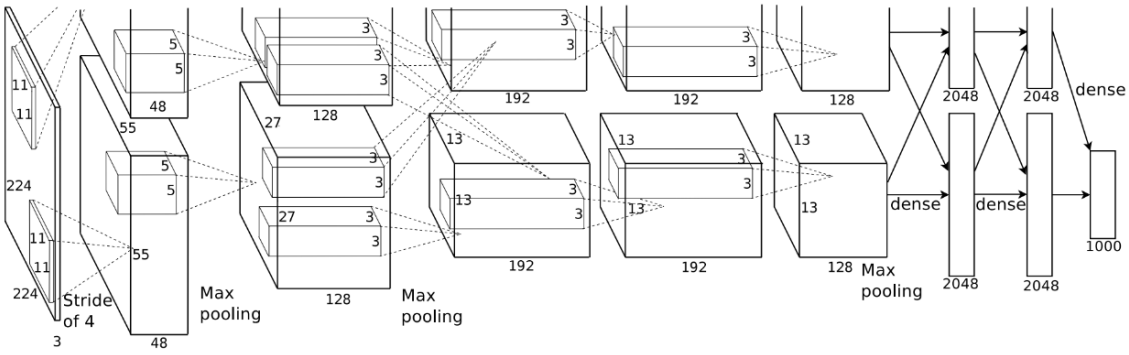
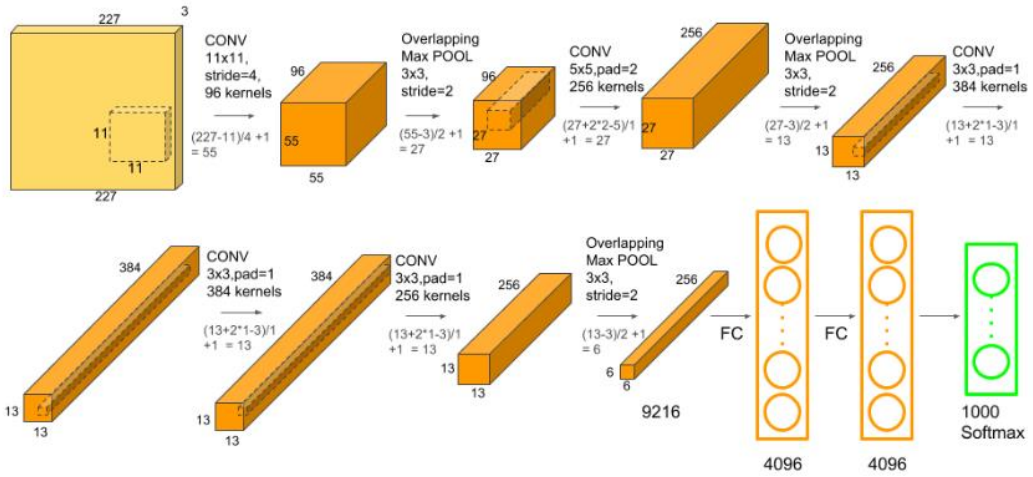


Figure 2: An illustration of the architecture of our CNN, explicitly showing the delineation of responsibilities between the two GPUs. One GPU runs the layer-parts at the top of the figure while the other runs the layer-parts at the bottom. The GPUs communicate only at certain layers. The network's input is 150,528-dimensional, and the number of neurons in the network's remaining layers is given by 253,440–186,624–64,896–64,896–43,264–4096–4096–1000.



	Activation shape	Activation size	# parameters
Input image	227 x 227 x 3	154587	0
Conv 1	55 x 55 x 96 (f=11 s = 4 p = 0)	290400	34944
Pool 1	27 x 27 x 96 (f=3 s = 2)	69984	0
Conv 2	27 x 27 x 256 (f=5 s = 1 p = 2)	186624	614,656
Pool 2	13 x 13 x 256 (f=3 s = 2)	43264	0
Conv 3	13 x 13 x 384 (f=3 s = 1 p = 1)	64896	885,120
Conv 4	13 x 13 x 384 (f=3 s = 1 p = 1)	64896	1,327,488
Conv 5	13 x 13 x 256 (f=3 s = 1 p = 1)	43264	884,992
Pool 5	6 x 6 x 256 (f=3 s = 2)	9216	0
FC 3	4096 x 1	4096	37,748,737
FC 4	4096 x 1	4096	16,777,217
Softmax	1000 x 1	1000	4096001

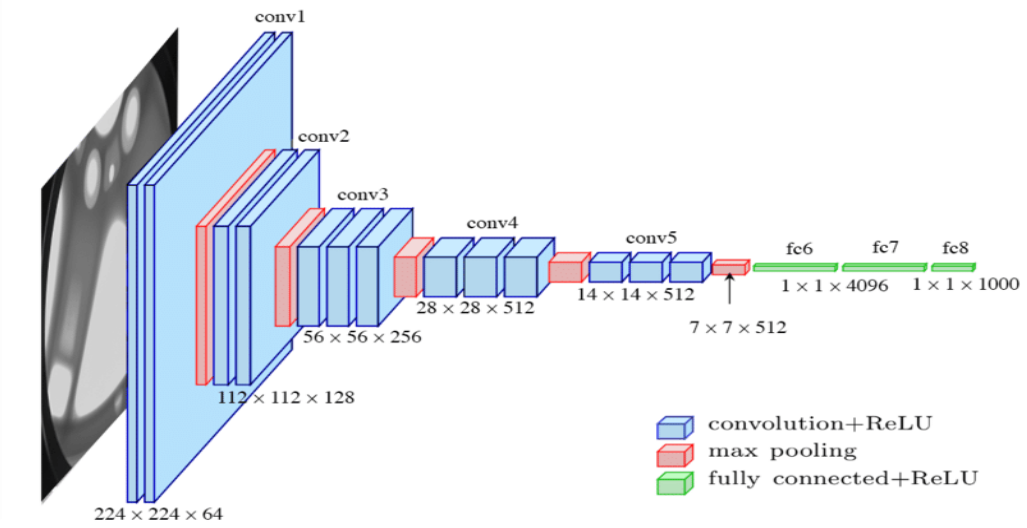
End Notes :

- It has 8 layers with learnable parameters.
- The input to the Model is RGB images.
- It has 5 convolution layers with a combination of max-pooling layers.
- Then it has 3 fully connected layers.
- The activation function used in all layers is Relu.
- It used two Dropout layers.
- The activation function used in the output layer is Softmax.
- The total number of parameters in this architecture is 62.3 million.

3. VGG :

The full name of VGG is the Visual Geometry Group, which belongs to the Department of Science and Engineering of Oxford University. It has released a series of convolutional network models beginning with VGG, which can be applied to face recognition and image classification, from VGG16 to VGG19. The original purpose of VGG's research on the depth of convolutional networks is to understand how the depth of convolutional networks affects the accuracy and accuracy of large-scale image classification and recognition. -Deep-16 CNN), in order to deepen the number of network layers and to avoid too many parameters, a small 3x3 convolution kernel is used in all layers.

The input of VGG is set to an RGB image of 224x244 size. The average RGB value is calculated for all images on the training set image, and then the image is input as an input to the VGG convolution network. A 3x3 or 1x1 filter is used, and the convolution step is fixed. . There are 3 VGG fully connected layers, which can vary from VGG11 to VGG19 according to the total number of convolutional layers + fully connected layers. The minimum VGG11 has 8 convolutional layers and 3 fully connected layers. The maximum VGG19 has 16 convolutional layers. +3 fully connected layers. In addition, the VGG network is not followed by a pooling layer behind each convolutional layer, or a total of 5 pooling layers distributed under different convolutional layers.



Layer		Feature Map	Size	Kernel Size	Stride	Activation
Input	Image	1	224 x 224 x 3	-	-	-
1	2 X Convolution	64	224 x 224 x 64	3x3	1	relu
	Max Pooling	64	112 x 112 x 64	3x3	2	relu
3	2 X Convolution	128	112 x 112 x 128	3x3	1	relu
	Max Pooling	128	56 x 56 x 128	3x3	2	relu
5	2 X Convolution	256	56 x 56 x 256	3x3	1	relu
	Max Pooling	256	28 x 28 x 256	3x3	2	relu
7	3 X Convolution	512	28 x 28 x 512	3x3	1	relu
	Max Pooling	512	14 x 14 x 512	3x3	2	relu
10	3 X Convolution	512	14 x 14 x 512	3x3	1	relu
	Max Pooling	512	7 x 7 x 512	3x3	2	relu
13	FC	-	25088	-	-	relu
14	FC	-	4096	-	-	relu
15	FC	-	4096	-	-	relu
Output	FC	-	1000	-	-	Softmax

ConvNet Configuration					
A	A-LRN	B	C	D	E
11 weight layers	11 weight layers	13 weight layers	16 weight layers	16 weight layers	19 weight layers
input (224 × 224 RGB image)					
conv3-64	conv3-64 **LRN**	conv3-64 **conv3-64**	conv3-64 conv3-64	conv3-64 conv3-64	conv3-64 conv3-64
maxpool					
conv3-128	conv3-128	conv3-128 **conv3-128**	conv3-128 conv3-128	conv3-128 conv3-128	conv3-128 conv3-128
maxpool					
conv3-256 conv3-256	conv3-256 conv3-256	conv3-256 conv3-256	conv3-256 conv3-256 **conv1-256**	conv3-256 conv3-256 **conv3-256**	conv3-256 conv3-256 conv3-256 **conv3-256**
maxpool					
conv3-512 conv3-512	conv3-512 conv3-512	conv3-512 conv3-512	conv3-512 conv3-512 **conv1-512**	conv3-512 conv3-512 **conv3-512**	conv3-512 conv3-512 conv3-512 **conv3-512**
maxpool					
conv3-512 conv3-512	conv3-512 conv3-512	conv3-512 conv3-512	conv3-512 conv3-512 **conv1-512**	conv3-512 conv3-512 **conv3-512**	conv3-512 conv3-512 conv3-512 **conv3-512**
maxpool					
FC-4096					
FC-4096					
FC-1000					
soft-max					

End Notes :

- VGG16 has a total of 16 layers that has some weights.
- Only Convolution and pooling layers are used.
- Always uses a 3 x 3 Kernel for convolution. 20
- 2×2 size of the max pool.
- 138 million parameters.
- Trained on ImageNet data.
- It has an accuracy of 92.7%.
- Another version that is VGG 19, has a total of 19 layers with weights.
- It is a very good Deep learning architecture for benchmarking on any particular task.
- The pre-trained networks for VGG is made open-source, so it can be commonly used out of the box for various types of applications.

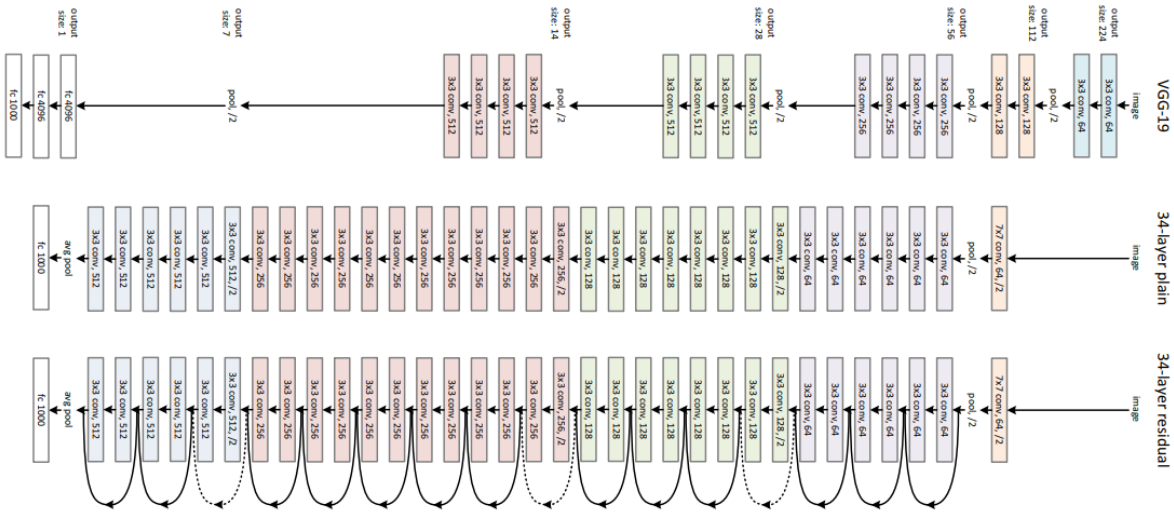
4. ResNet：

ResNet is a network structure proposed by the He Kaiming, Sun Jian and others of Microsoft Research Asia in 2015, and won the first place in the ILSVRC-2015 classification task. At the same time, it won the first place in ImageNet detection, ImageNet localization, COCO detection, and COCO segmentation tasks. It was a sensation at the time.

ResNet, also known as residual neural network, refers to the idea of adding residual learning to the traditional convolutional neural network, which solves the problem of gradient dispersion and accuracy degradation (training set) in deep networks, so that the network can get more and more the deeper, both the accuracy and the speed are controlled.

1. ResNet50
2. ResNet50V2
3. ResNet101
4. ResNet101V2
5. ResNet152
6. ResNet152V2

ResNet is Best Model used by researcher. Giving good accuracy by skipping the layers.



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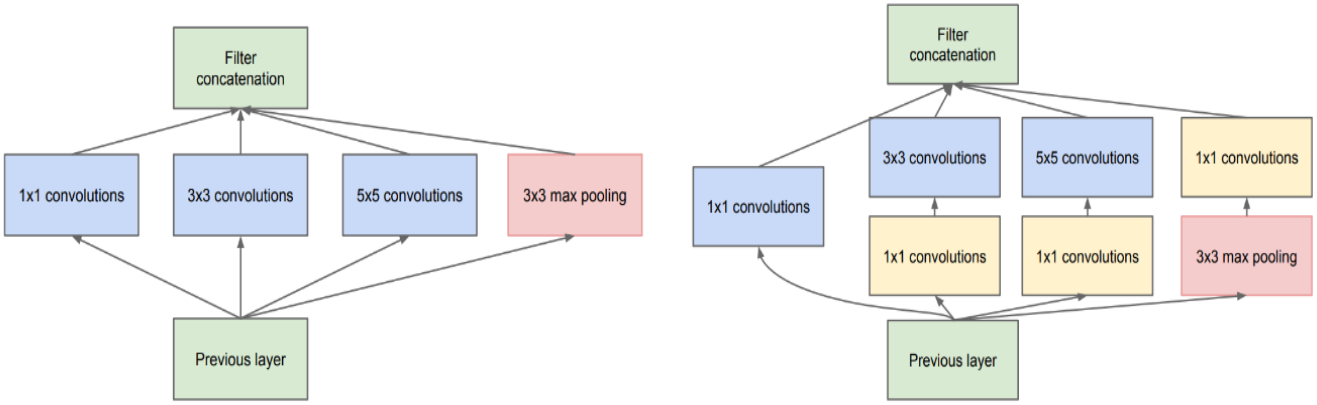
Inception-Net:

Toward Data Science An Inception Module is an image model block that aims to approximate an optimal local sparse structure in a CNN. Put simply, it allows for us to use multiple types of filter size, instead of being restricted to a single filter size, in a single image block, which we then concatenate and pass onto the

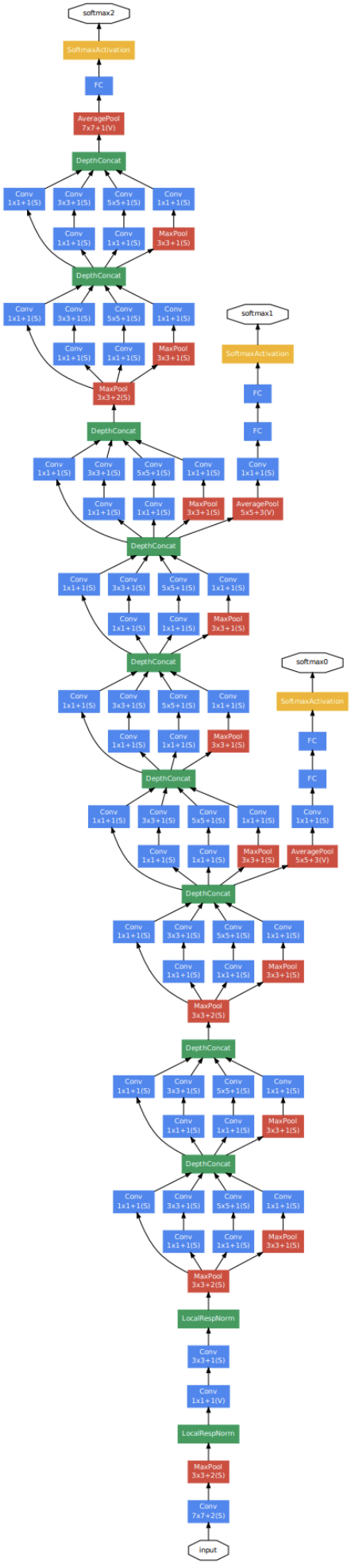


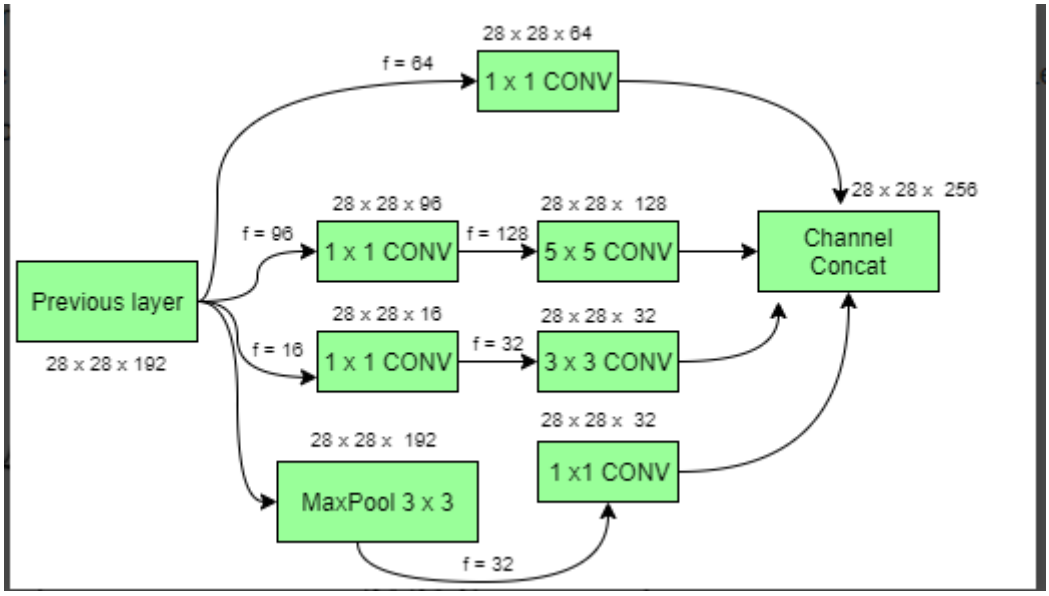
(a) Inception module, naïve version (b) Inception module with dimension reductions

next layer.

Research Paper :

Going Deeper to Neural Network


softmax2
SoftmaxActivation
FC
AveragePool 7x7+1(V)
DepthConcat
Conv 1x1+1(S)
Conv 3x3+1(S)
Conv 5x5+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
MaxPool 3x3+1(S)
DepthConcat
Conv 1x1+1(S)
Conv 3x3+1(S)
Conv 5x5+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
MaxPool 3x3+1(S)
MaxPool 3x3+2(S)
softmax1
SoftmaxActivation
FC
FC
DepthConcat
Conv 1x1+1(S)
Conv 3x3+1(S)
Conv 5x5+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
MaxPool 3x3+1(S)
AveragePool 5x5+3(V)
DepthConcat
Conv 1x1+1(S)
Conv 3x3+1(S)
Conv 5x5+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
MaxPool 3x3+1(S)
DepthConcat
softmax0
SoftmaxActivation
FC
FC
Conv 1x1+1(S)
Conv 3x3+1(S)
Conv 5x5+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
MaxPool 3x3+1(S)
AveragePool 5x5+3(V)
DepthConcat
Conv 1x1+1(S)
Conv 3x3+1(S)
Conv 5x5+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
MaxPool 3x3+1(S)
MaxPool 3x3+2(S)
DepthConcat
Conv 1x1+1(S)
Conv 3x3+1(S)
Conv 5x5+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
MaxPool 3x3+1(S)
DepthConcat
Conv 1x1+1(S)
Conv 3x3+1(S)
Conv 5x5+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
Conv 1x1+1(S)
MaxPool 3x3+1(S)
MaxPool 3x3+2(S)
LocalRespNorm
Conv 3x3+1(S)
Conv 1x1+1(V)
LocalRespNorm
MaxPool 3x3+2(S)
Conv 7x7+2(S)
input



Inception V1

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