模式识别课程

典型卷积神经网络

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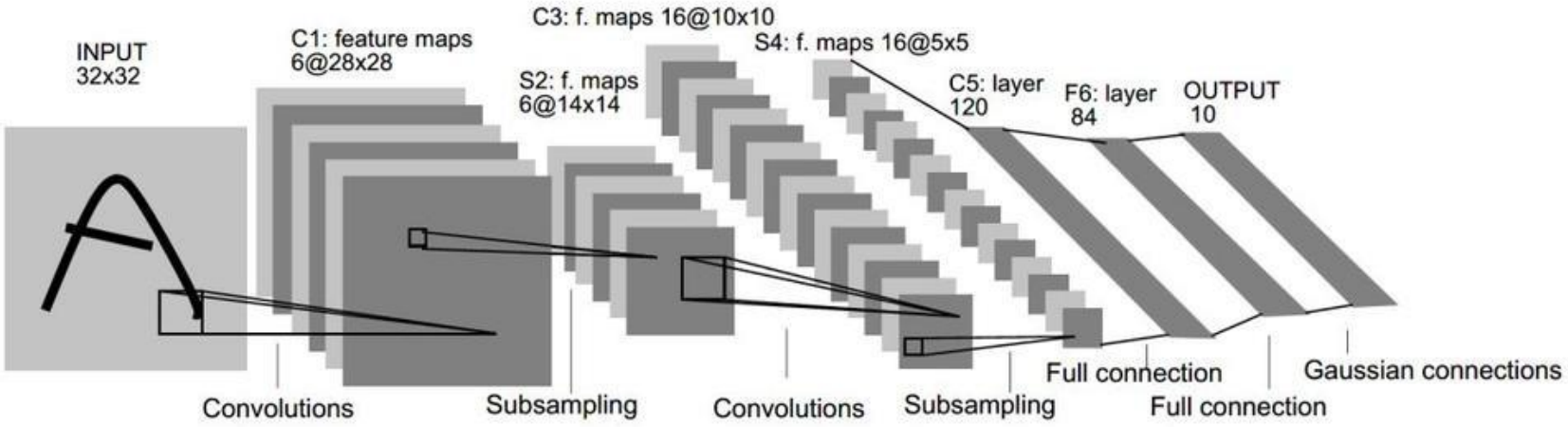
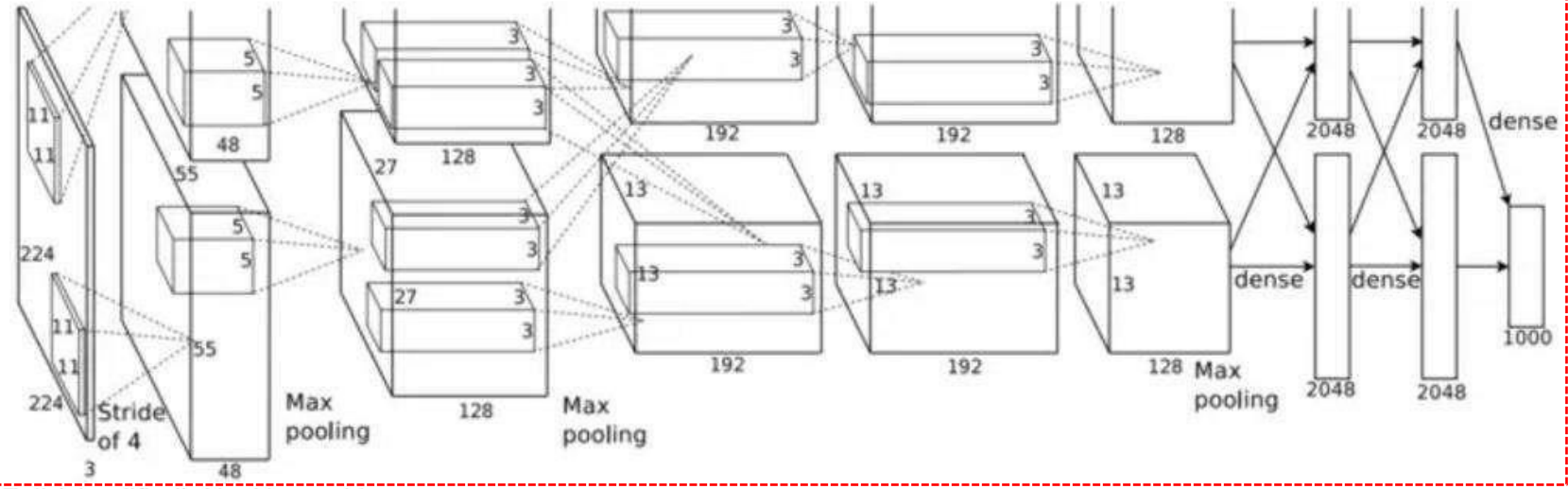
典型卷积神经网络 -LeNet-5



典型卷积神经网络 -AlexNet



Full (simplified) AlexNet architecture:
[227x227x3] INPUT
[55x55x96] CONV1: 96 11x11 filters at stride 4, pad 0
[27x27x96] MAX POOL1: 3x3 filters at stride 2
[27x27x96] NORM1: Normalization layer
[27x27x256] CONV2: 256 5x5 filters at stride 1, pad 2
[13x13x256] MAX POOL2: 3x3 filters at stride 2
[13x13x256] NORM2: Normalization layer
[13x13x384] CONV3: 384 3x3 filters at stride 1, pad 1
[13x13x384] CONV4: 384 3x3 filters at stride 1, pad 1
[13x13x256] CONV5: 256 3x3 filters at stride 1, pad 1
[6x6x256] MAX POOL3: 3x3 filters at stride 2
[4096] FC6: 4096 neurons
[4096] FC7: 4096 neurons
[1000] FC8: 1000 neurons (class scores)

- 使用ReLU作为非线性激活函数
- 数据增强
- 使用最大池化
- 使用LRN
- 使用dropout避免过拟合
- 使用GPU减少训练时间

典型卷积神经网络 -AlexNet

- LRN(Local Response Normalization)

$$b_{x,y}^{i} = a_{x,y}^{i} / \left(k + \alpha \sum_{j=\max(0,i-n/2)}^{\min(N-1,i+n/2)} (a_{x,y}^{j})^{2} \right)^{\beta}$$

后期争议

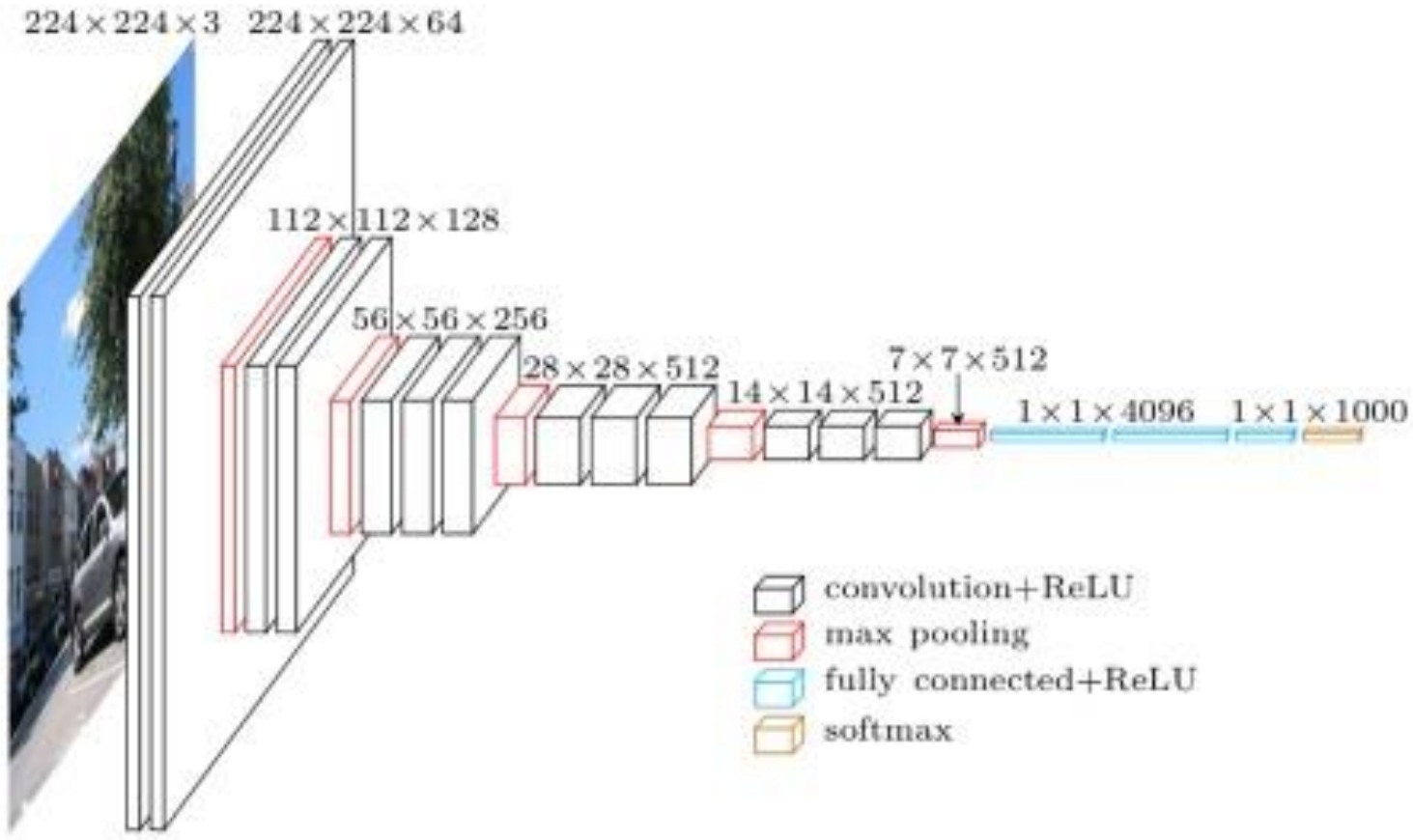
在2015年 Very Deep Convolutional Networks for Large-Scale Image Recognition. 提到LRN基本没什么用。

All hidden layers are equipped with the rectification (ReLU (Krizhevsky et al., 2012)) non-linearity. We note that none of our networks (except for one) contain Local Response Normalisation (LRN) normalisation (Krizhevsky et al., 2012): as will be shown in Sect. 4, such normalisation does not improve the performance on the ILSVRC dataset, but leads to increased memory consumption and computation time. Where applicable, the parameters for the LRN layer are those of (Krizhevsky et al., 2012).

典型卷积神经网络 -AlexNet

- 数据增强：旋转、剪切、镜像、缩放等

典型卷积神经网络 -VGG



典型卷积神经网络 -VGG

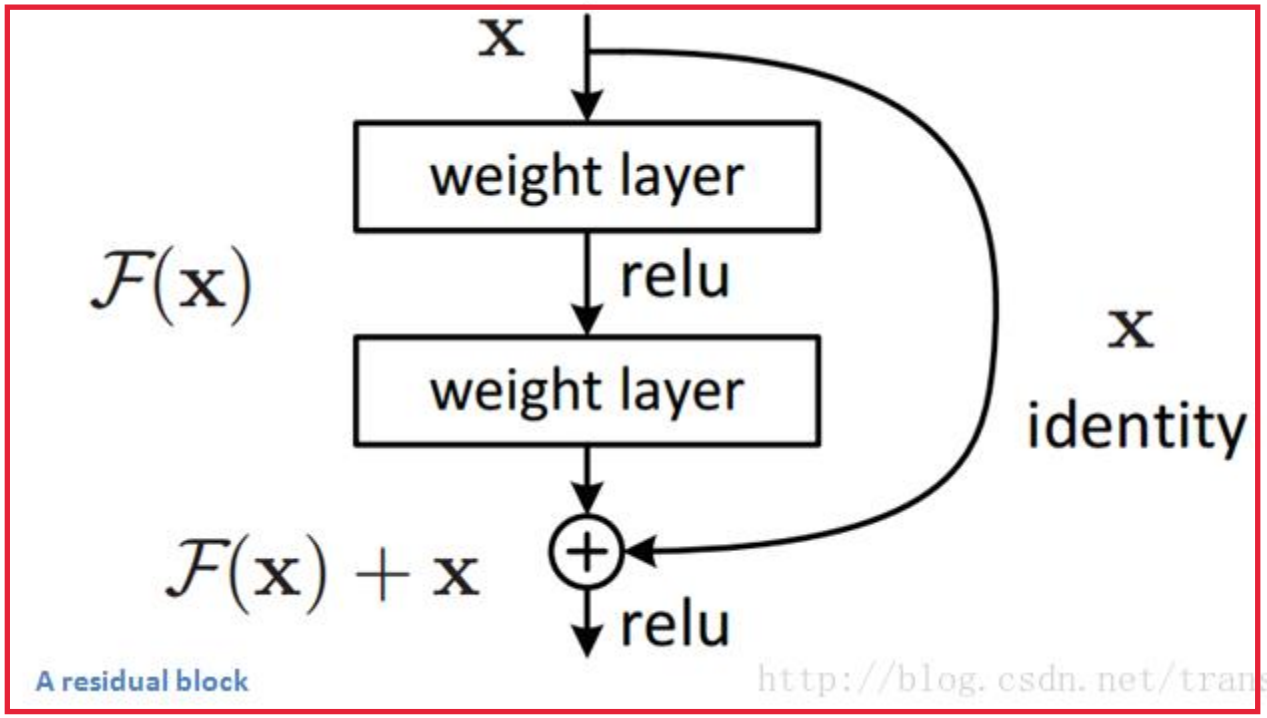
ConvNet Configuration					
A	A-LRN	B	C	D	E
11 weight layers	11 weight layers	13 weight layers	16 weight layers	16 weight layers	19 weight layers
input (224 × 224 RGB image)					
conv3-64	conv3-64 **LRN**	conv3-64 **conv3-64**	conv3-64 conv3-64	conv3-64 conv3-64	conv3-64 conv3-64
maxpool					
conv3-128	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					

采用连续的几个3x3的卷积核代替AlexNet中的较大卷积核（11x11，7x7，5x5）

3*3的非线性大于5*5的

在VGG中，使用了3个3x3卷积核来代替7x7卷积核，使用了2个3x3卷积核来代替5*5卷积核，这样做的目的是什么？

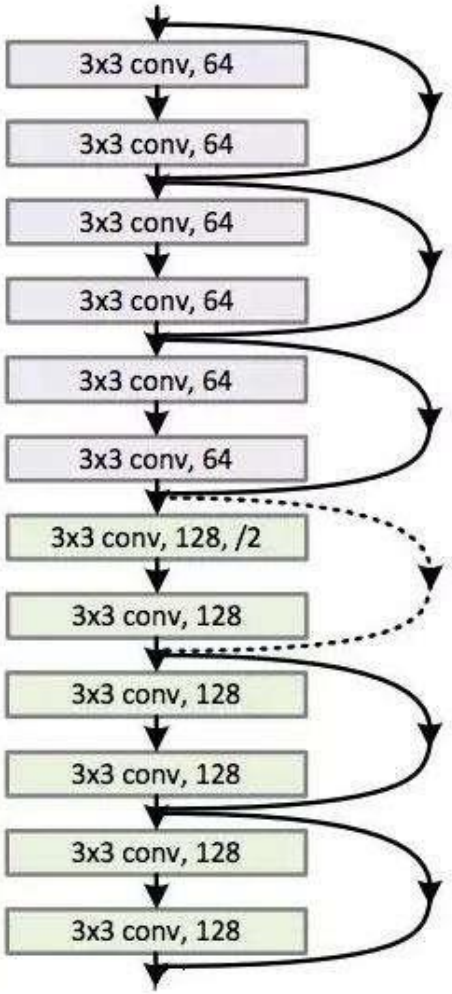
典型卷积神经网络 -ResNet



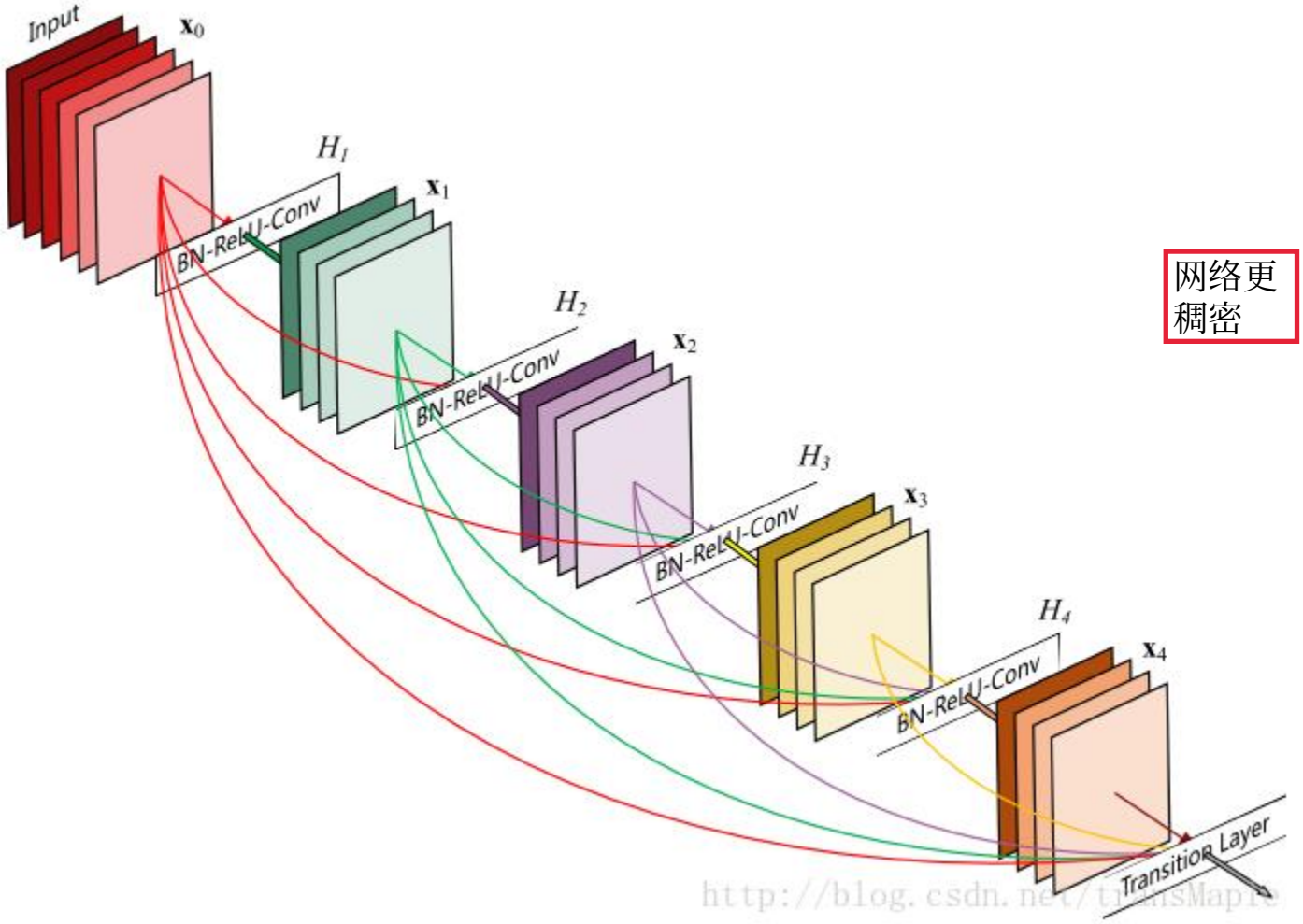
至少两层卷积结构

跳远连接：-可以解决梯度下降过程中的梯度消失问题

典型卷积神经网络 -ResNet



典型卷积神经网络 -DenseNet



网络更稠密

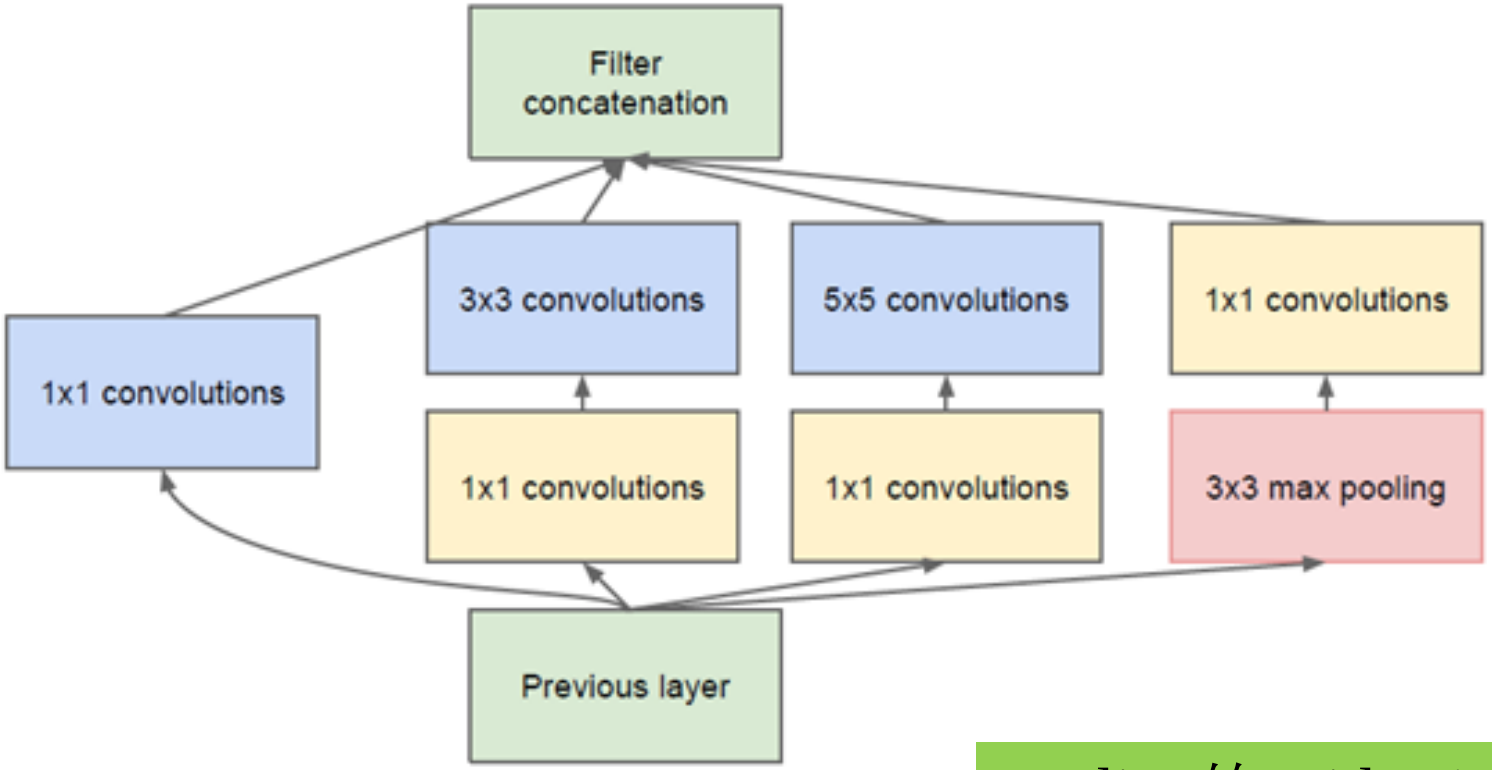
http://blog.csdn.net/t...

典型卷积神经网络 -GoogleNet

- [v1] Going Deeper with Convolutions, 6.67% test error, http://arxiv.org/abs/1409.4842
- [v2] Batch Normalization: Accelerating Deep Network Training by Reducing Internal Covariate Shift, 4.8% test error, http://arxiv.org/abs/1502.03167
- [v3] Rethinking the Inception Architecture for Computer Vision, 3.5% test error, http://arxiv.org/abs/1512.00567
- [v4] Inception-v4, Inception-ResNet and the Impact of Residual Connections on Learning, 3.08% test error, http://arxiv.org/abs/1602.07261

典型卷积神经网络 -GoogleNet

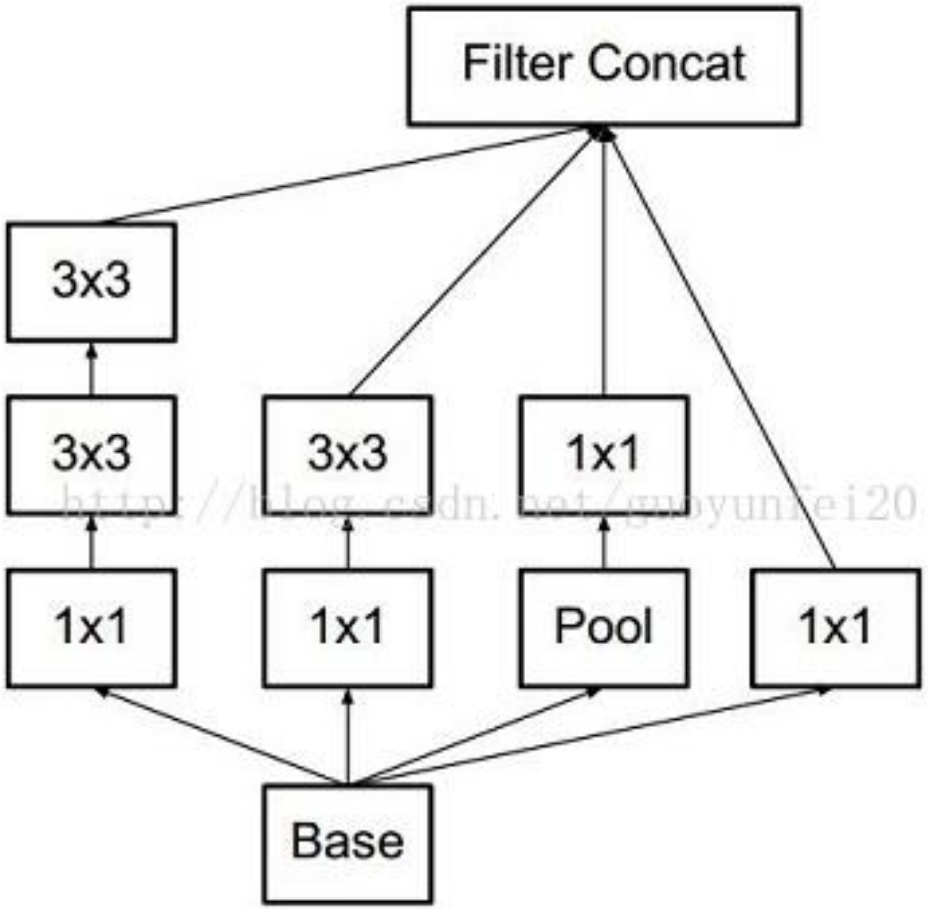
- Inception V1



Pooling的stride=1

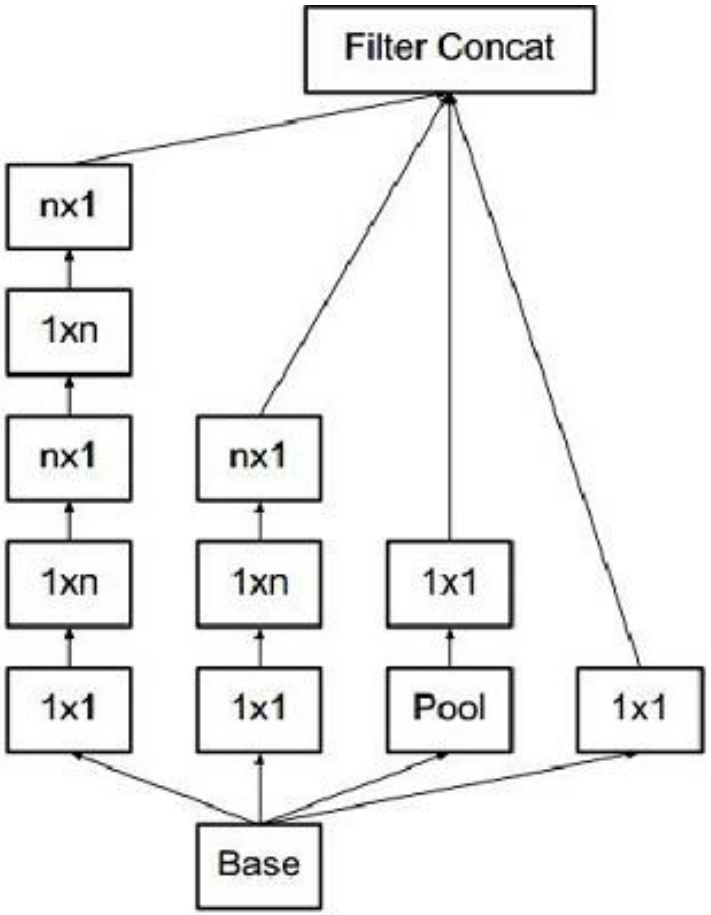
典型卷积神经网络 -GoogleNet

- Inception V2



典型卷积神经网络 -GoogleNet

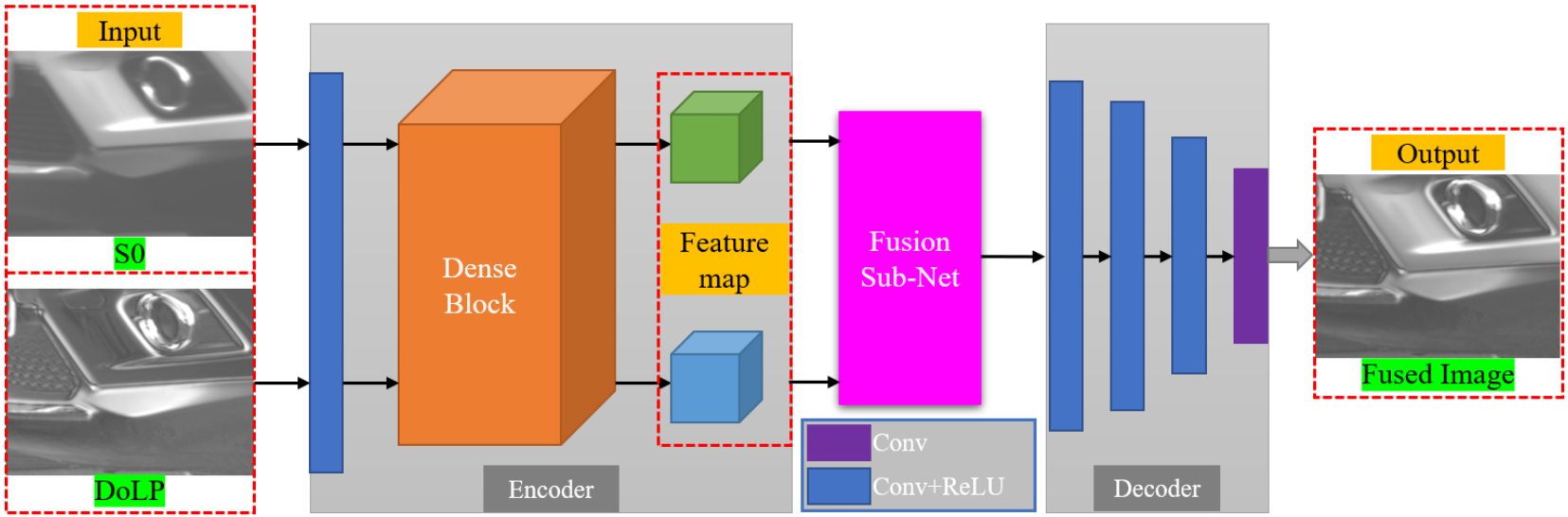
- Inception V3



典型卷积神经网络-应用

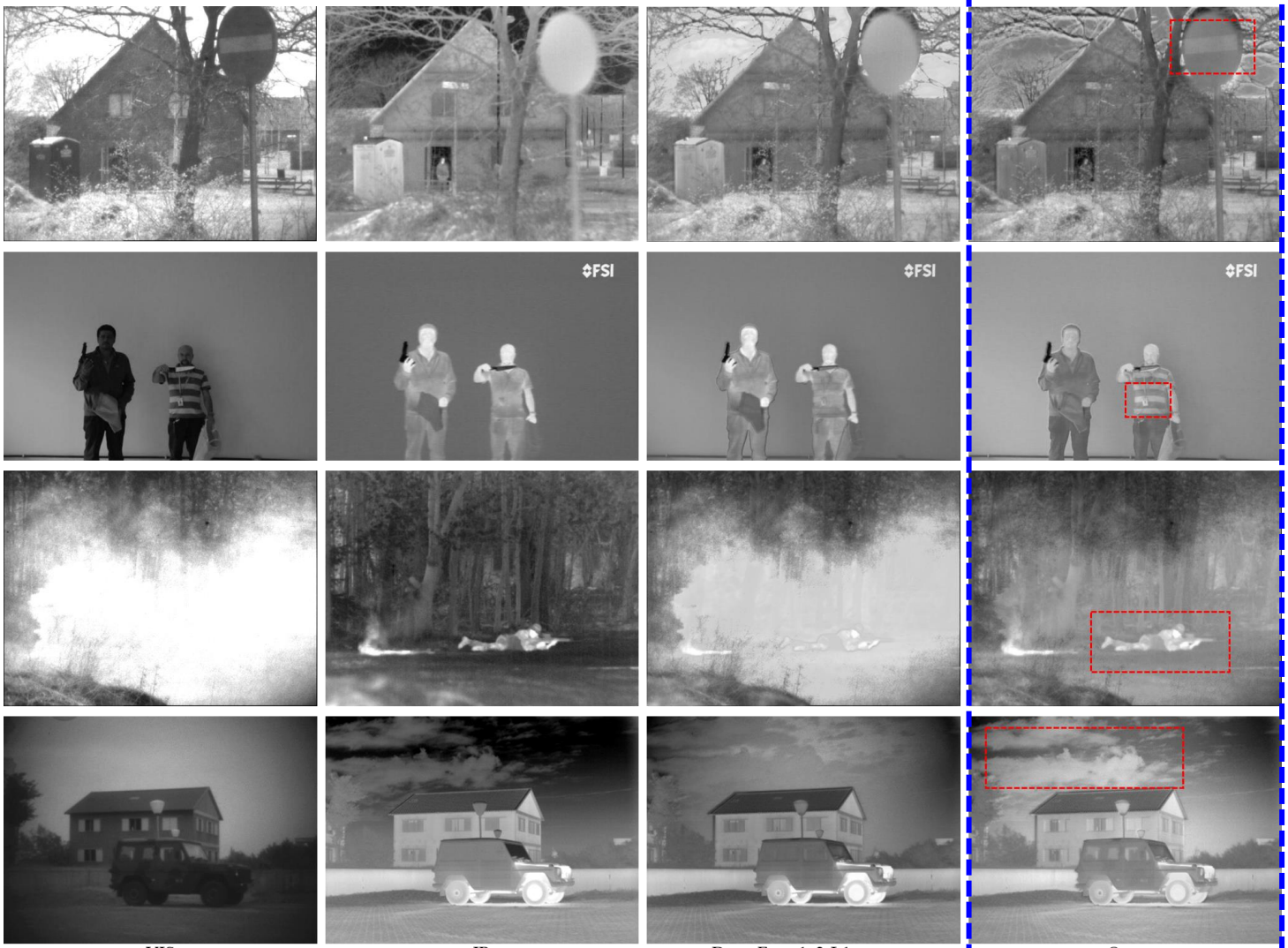
- 图像融合

偏振图像融合、红外与可见光图像融合



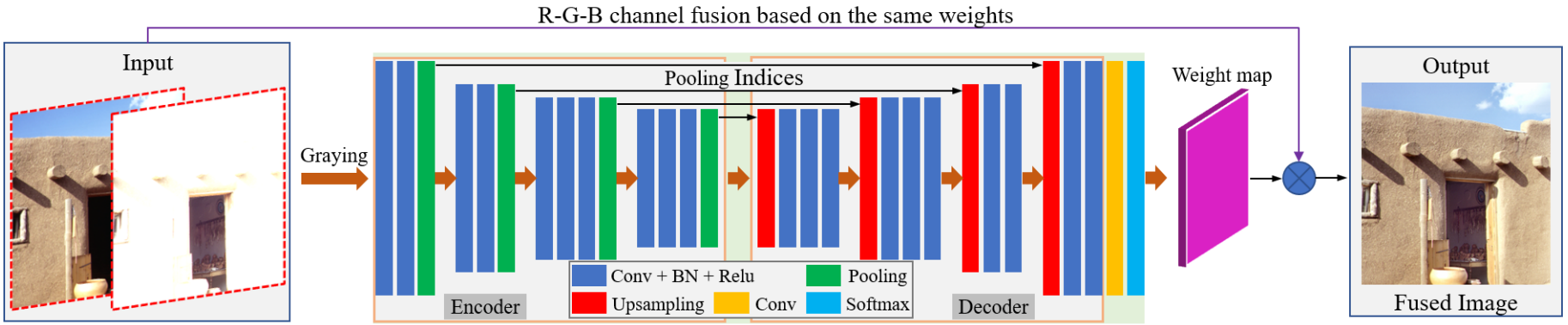
典型卷积神经网络-应用

红外与可见光图像融合结果



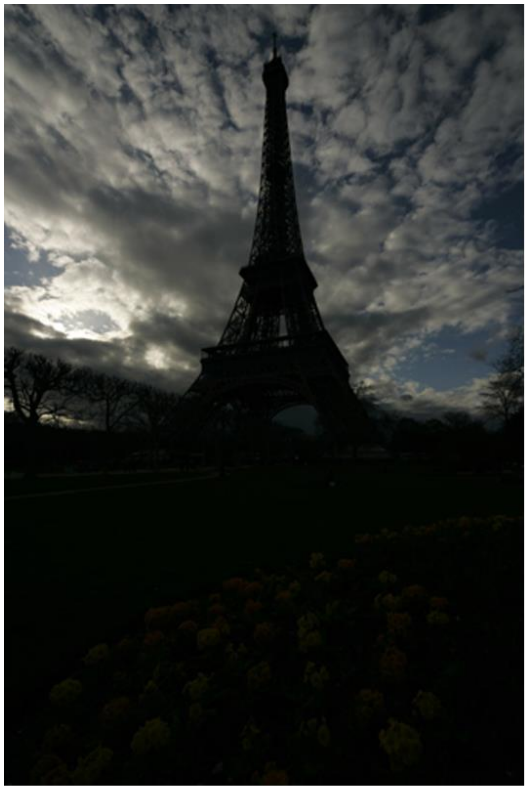
典型卷积神经网络-应用

- 图像融合 (HDR)

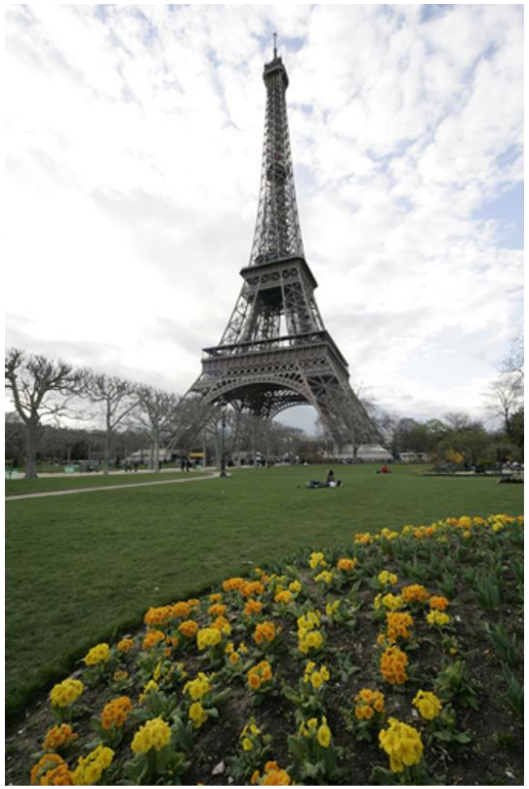


典型卷积神经网络-应用

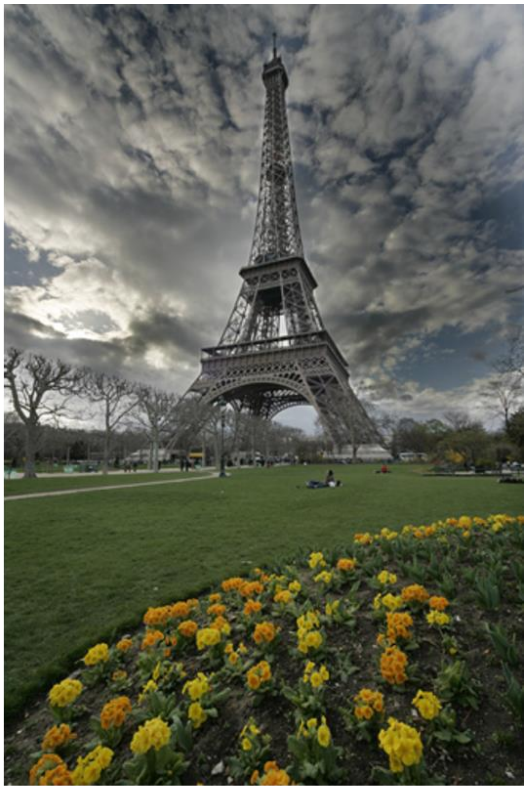
HDR结果



Under-Exposure



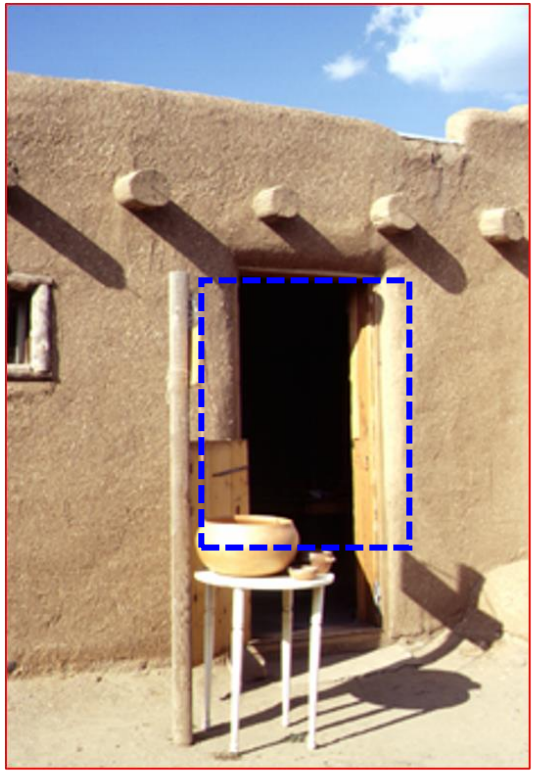
Over-Exposure



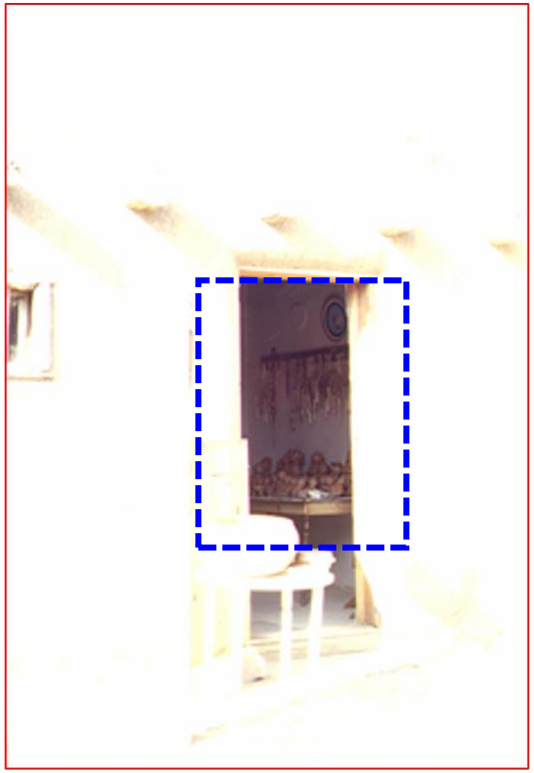
HDR Image (Fused)

典型卷积神经网络-应用

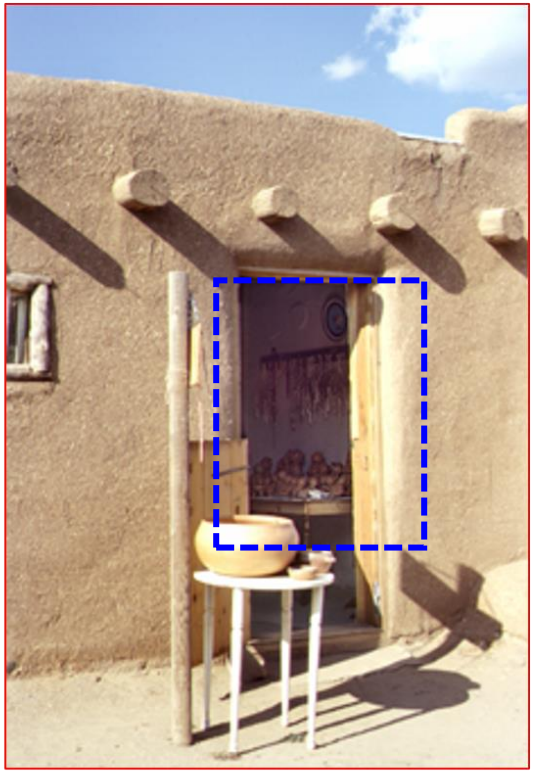
HDR结果



Under-Exposure



Over-Exposure



HDR Image (Fused)

模式识别-神经网络分类器

模式识别-神经网络分类器