Simple application of convolutional neural network in computer vision

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Outline

Convolution in singal processing

Definiation:

$$s(t) = \int x(a)w(t-a)da$$

where $s(t)$ is the single at time t, and $w(t-a)$ is the weight of singal(probability density function)
replace the convolution opeartion with star:

$$s(t) = (x * w)(t)$$

Convolution in machine learning

the time in computer is discrete

$$s(t) = (x * t)(t) = \sum_{a=-\infty}^{\infty}$$

use convolution over more than one axis at a time

$$S(i,j) = (I * K)(i,j) = \sum_m \sum_n I(m,n)K(i-m.i-n)$$

convolution is commutative, we can rewrite

$$S(i,j) = (I * K)(i,j) = \sum_m \sum_n I(m-i,n-j)K(m.n)$$

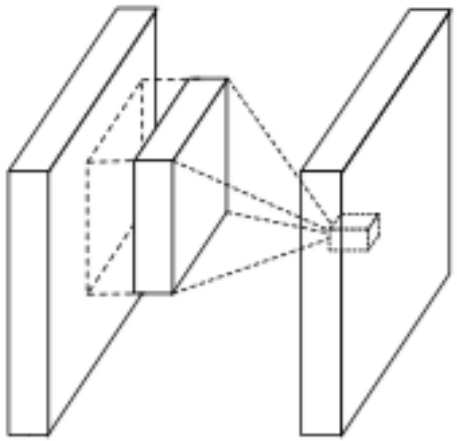
Motivation of convolution

- sparse connection-making the kernel size smaller than the input size
- parameter sharing-using the same parameter for more than one function in a model
- equivariant representations

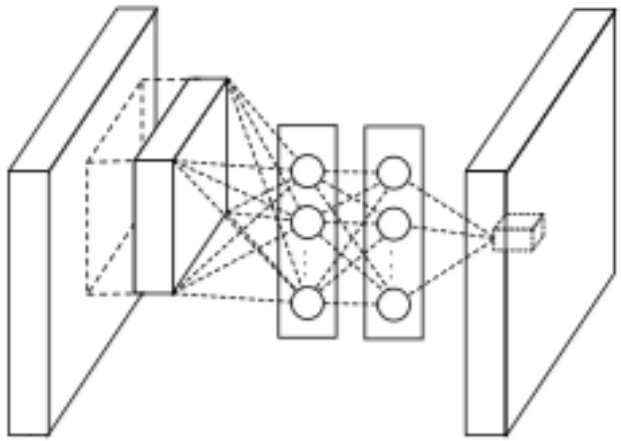
Network in network(NIN)

Network in network Min Lin 2013

- micro neural networks with mlp - imporve the non-lineaity
- globla average pooling - improve the robust of spital information



(a) Linear convolution layer

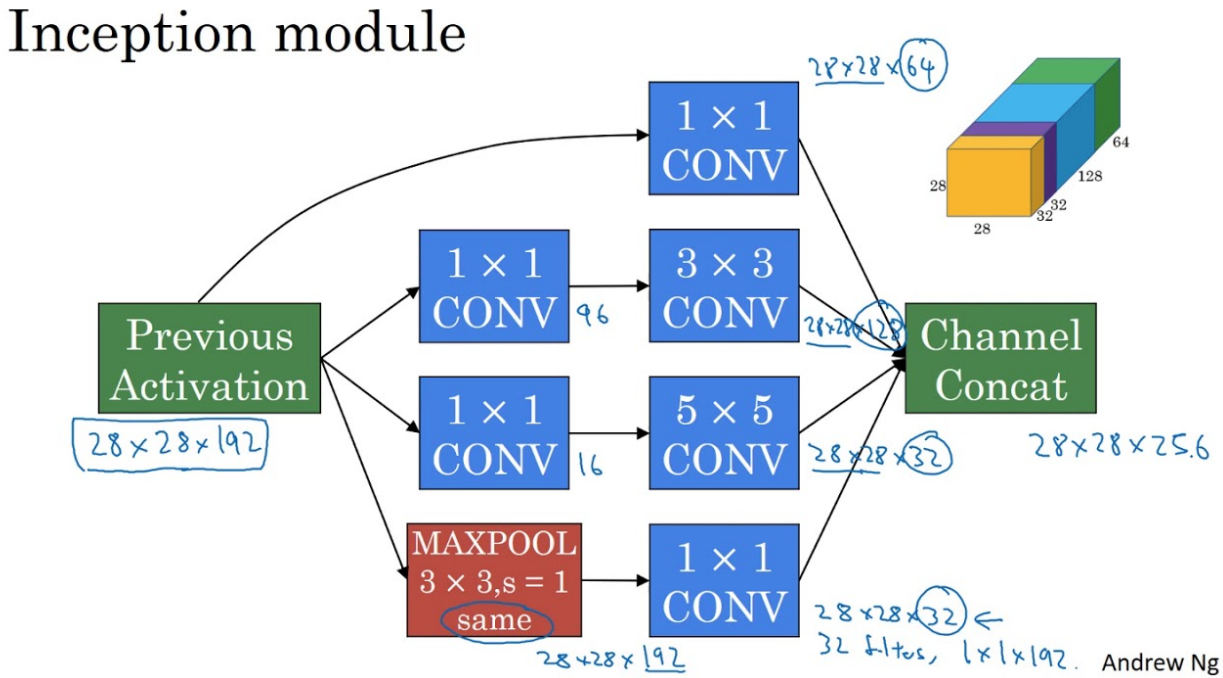


(b) Mlpconv layer

The Google Incepetion net

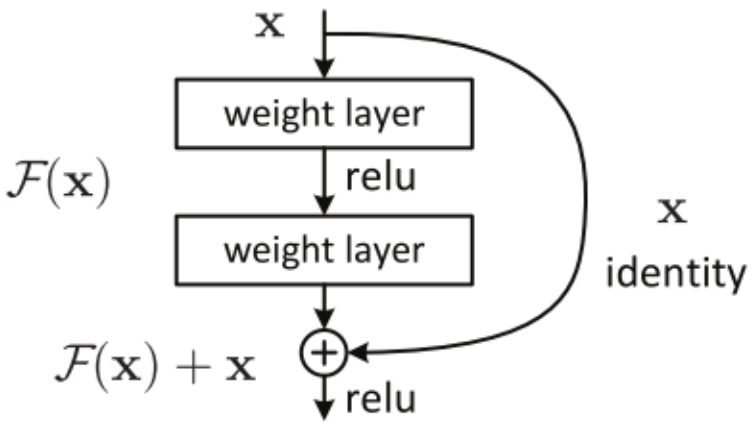
Going Deeper with Convolutions Christian, Szegedy et al, CVPR 2015

The google Incepetion net



ResNet

- *Deep Residual Learning for Image Recognition Kaiming He et al. 2015* the building block of ResNet
- Problems of very deep network: Vanish gradient and gradient exploding



ResNet demo

Res-50 simple demo for image classification

Not suitable for work(NSFW) image classification

- design: three classes, matrix of pixel as input after simple imgae transformation(resize)
- data size: 10,000-scale
- current method: traditional machine learning methods, SVM, KNN
- plan: Res-50

Reference I


Kaiming He 2015 *Deep Residual Learning for Image Recognition*


Min Lin 2015 *Network In Network*


Christian Szegedy 2015 *Going Deeper with Convolutions*

Q&A

feel free to disscuss!