GoogLeNet / Inception v1 (CVPR 2015)

Going Deeper with Convolutions

Szegedy Christian et al.

① Problem Description

improve the performance of deep neural networks:

increase size: depth and width.

drawbacks:

① more prone to overfitting.

② increased use of computational resources.

② Problem Solution:

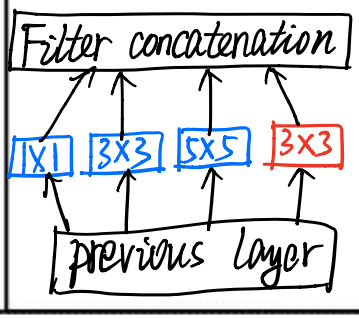
Inception:

increased the depth and width of the network while keeping the computational budget constant.

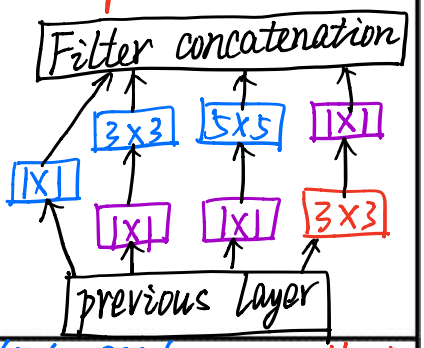
moving dense matrix to sparser architectures

③ Conceptual Understanding

naive version:



Inception module:



① Simultaneous convolution on multiple scales so that it can extract features of different scales.

② Spare matrix using dense matrix decomposition is used to accelerate the convergence speed.

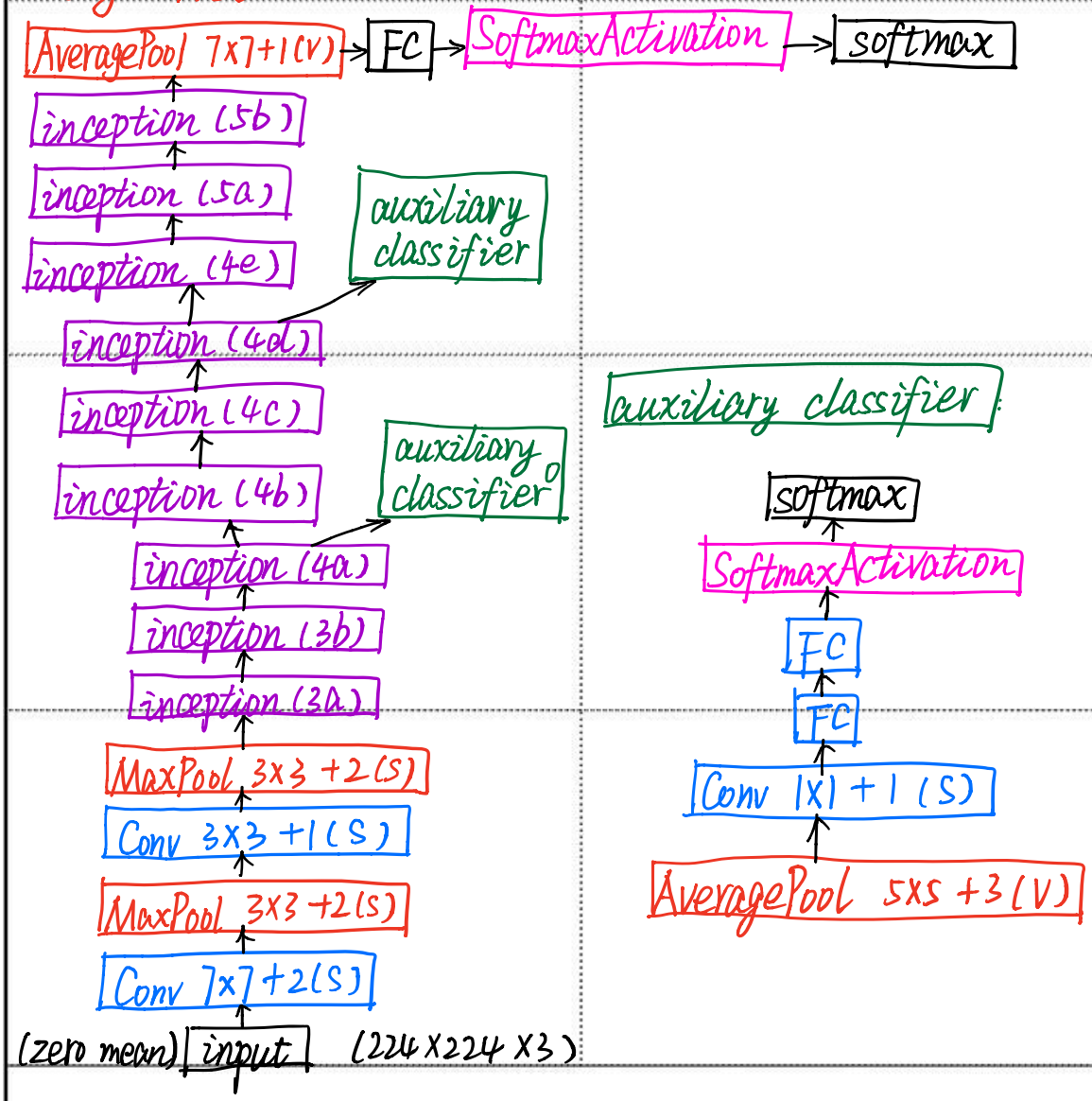
e.g.

$$\begin{bmatrix} 2 & 3 & 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 & 3 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \circledast \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix} \Leftrightarrow \begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix} \circledast \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 0 & 0 & 1 \end{bmatrix} \circledast \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$$

Details of Implementation

GoogLeNet:



Code: (PyTorch Implementation)

① Load data. (e.g. CIFAR-10/100)

② Define GoogLeNet.

③ trainval and test.