Why look at case studies?

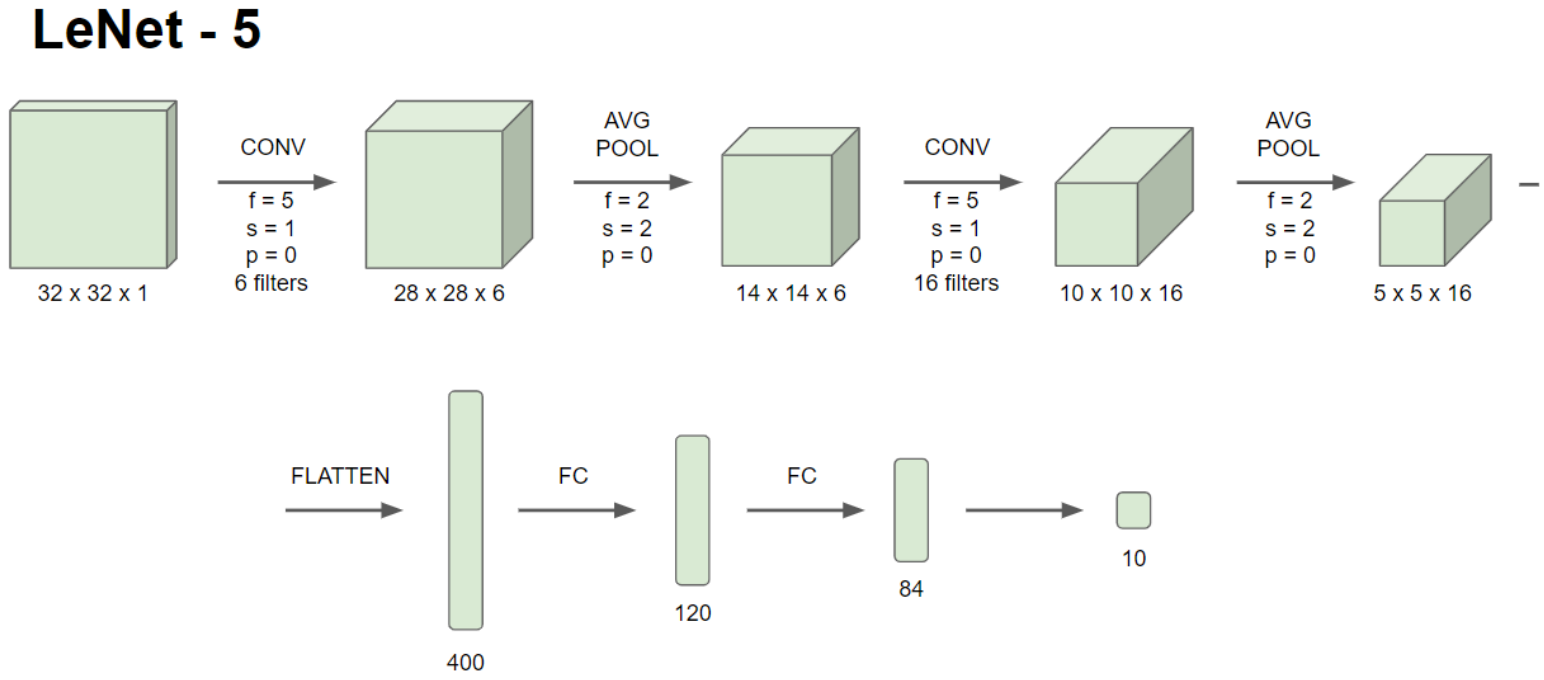
- CNN which works for a task can be worked well in other task.

- LeNet-5
- AlexNet
- VGG

- ResNets
- Inception
- https://www.edwith.org/deeplearningai4/lecture/34897/
- Papers of above networks are linked here.
- Below Figures are come from edwith.

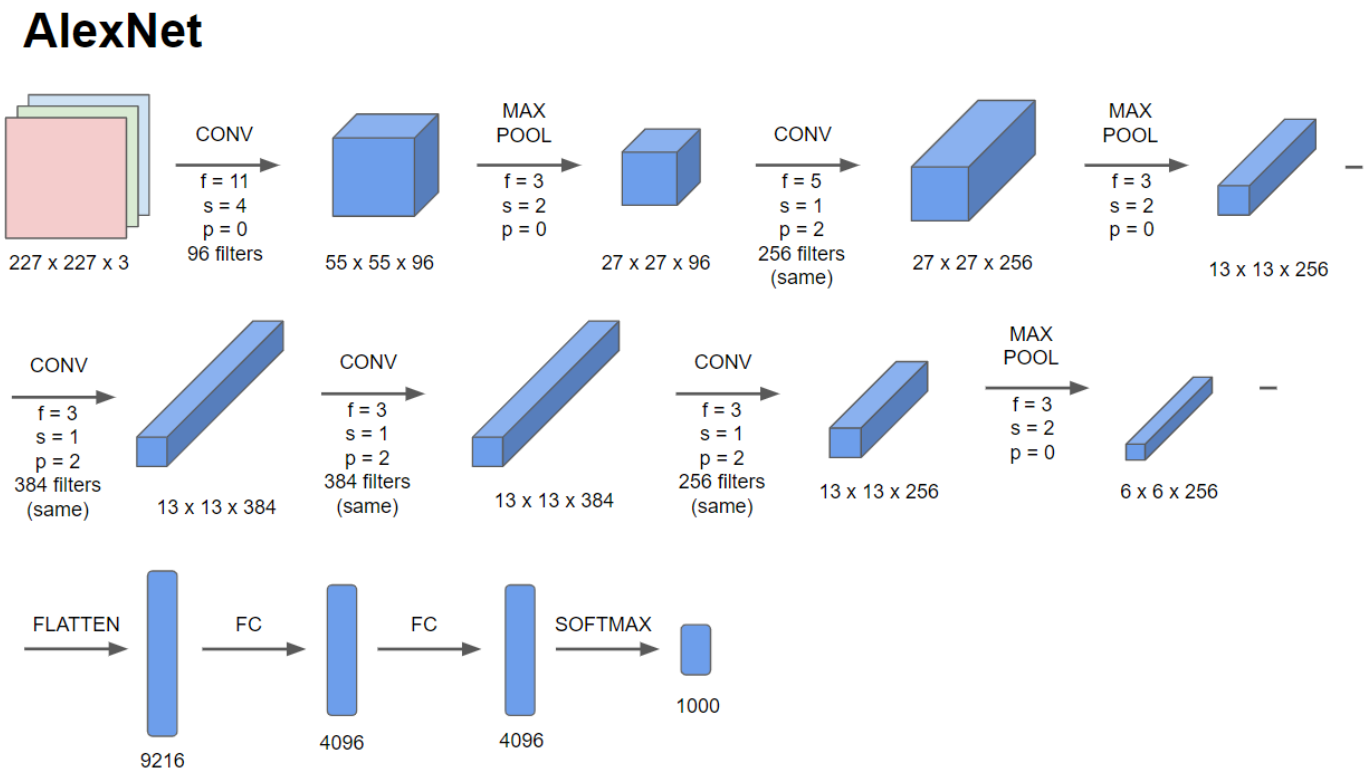
Classical network : LeNet - 5

- Recognition of single color(black) handwriting
- Sigmoid for activation



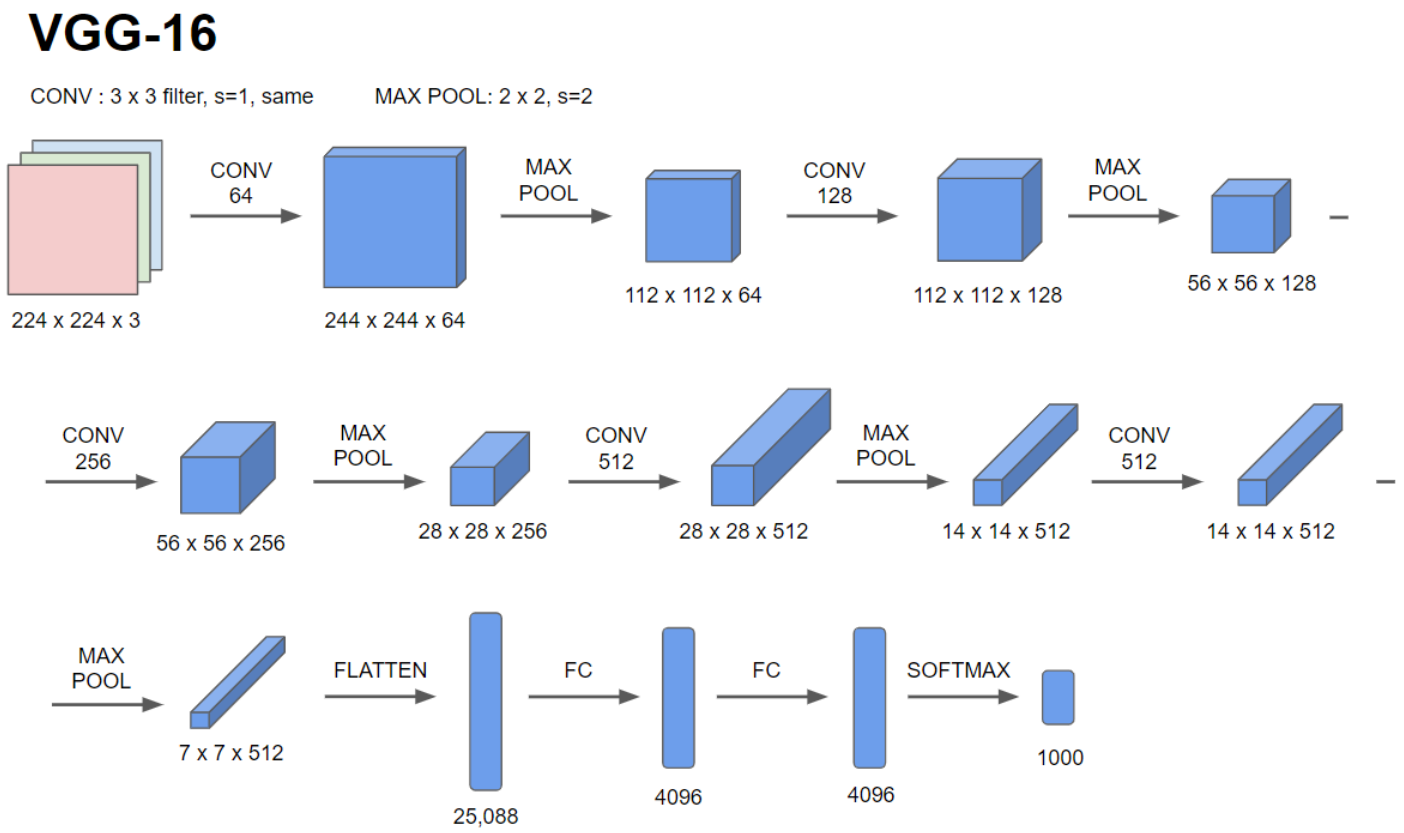
Classical network : AlexNet

- Classification of 1000 classes
- Activation -> ReLU



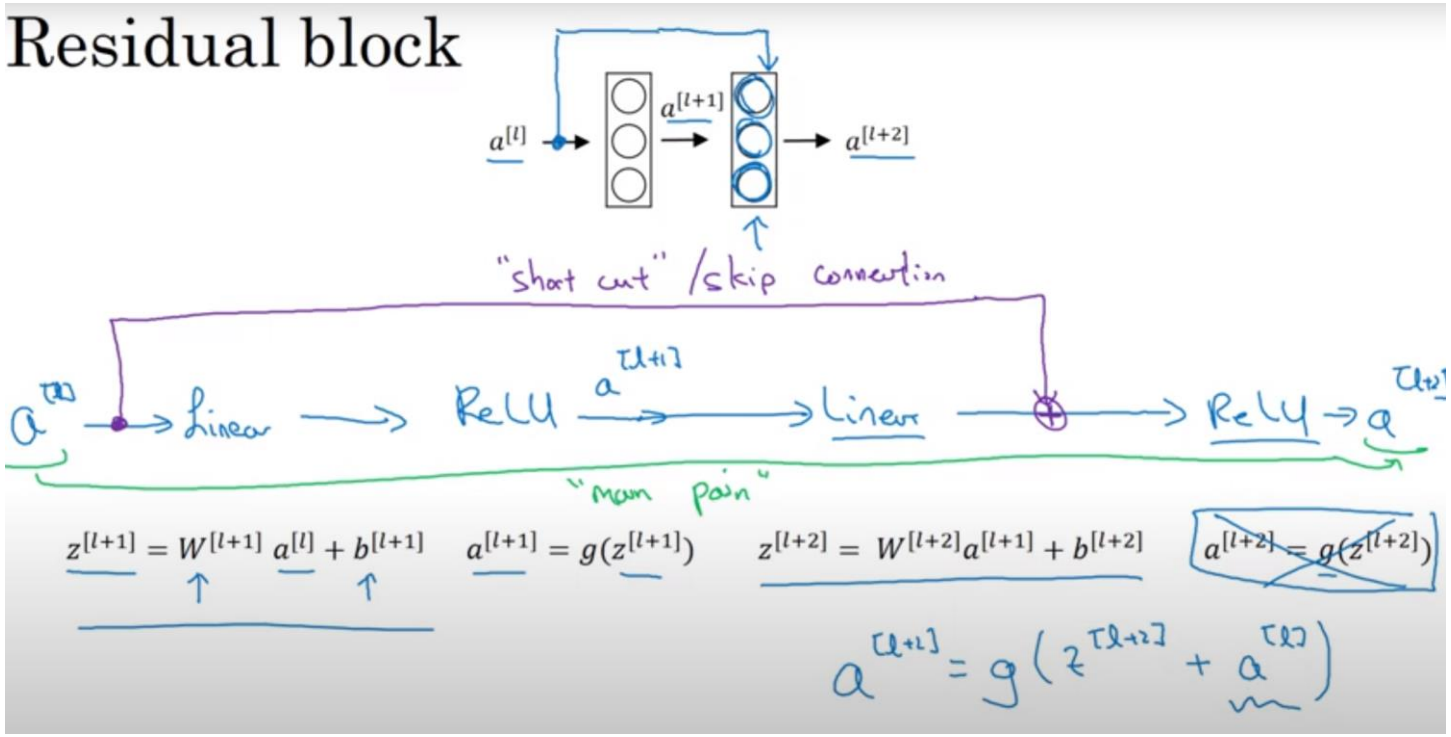
Classical network : VGG-16

- Classification of 1000 classes
- Structure is simple but the network is bigger



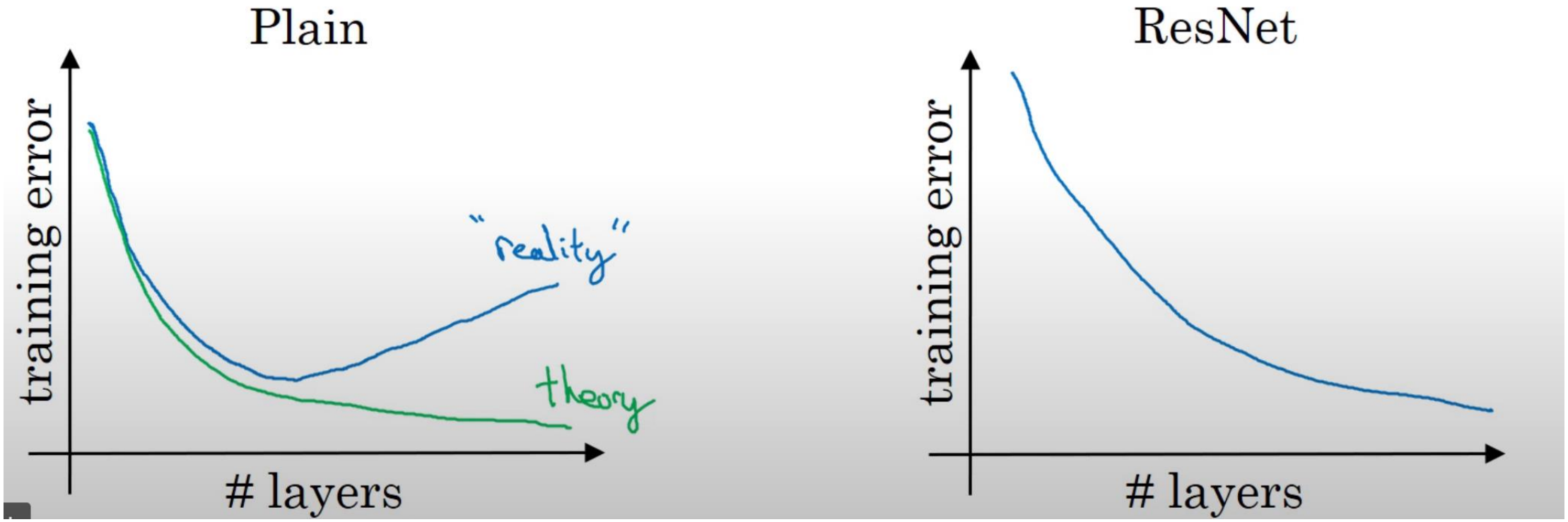
ResNets (Residual networks)

- Machine cannot learn very deep network because of gradient issues.
- ResNet solve the problem with “skip connection”

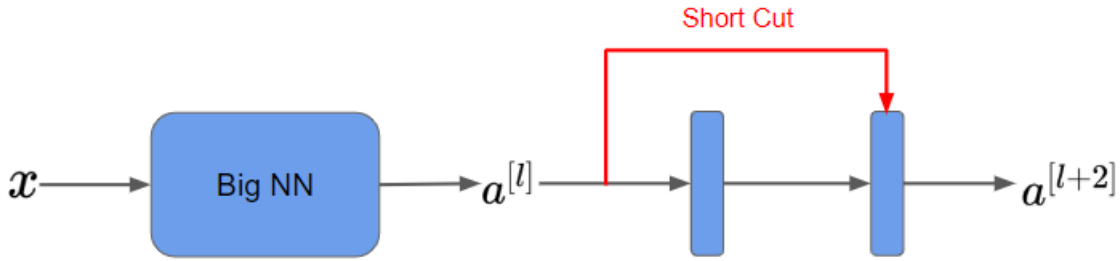


From Andrew Ng’s lecture

ResNets


Plain
training error
"reality"
theory
layers
ResNet
training error
layers

Why ResNets work?

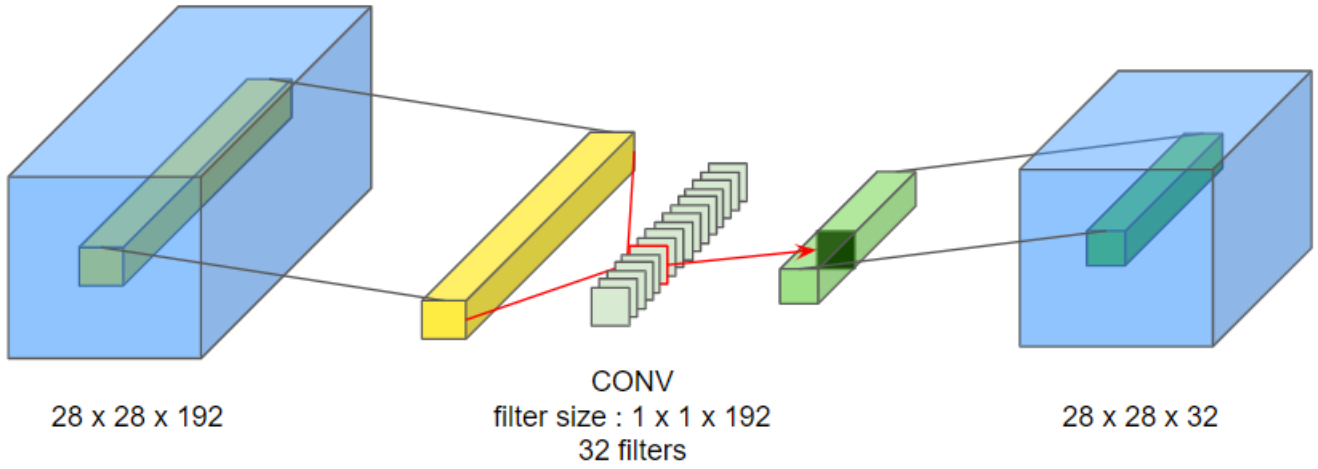


$$a^{[l+2]} = g(z^{[l+2]} + a^{[l]})$$
$$= g(W^{[l+2]}a^{[l+1]} + b^{[l+2]} + a^{[l]})$$

- It makes $a^{l+2} = a^{l}$ if $W^{l+2} = b^{l+2} = 0$. some kinds of identity.
- No loss of performance, surely increase the performance when w, b are nonzero(learned).
- It should be $\dim(z^{l+2}) = \dim(a^{l})$
- Sometimes multiply W_s to a^{l} to fit the dimension.
- W_s -> padding 0 or trained values

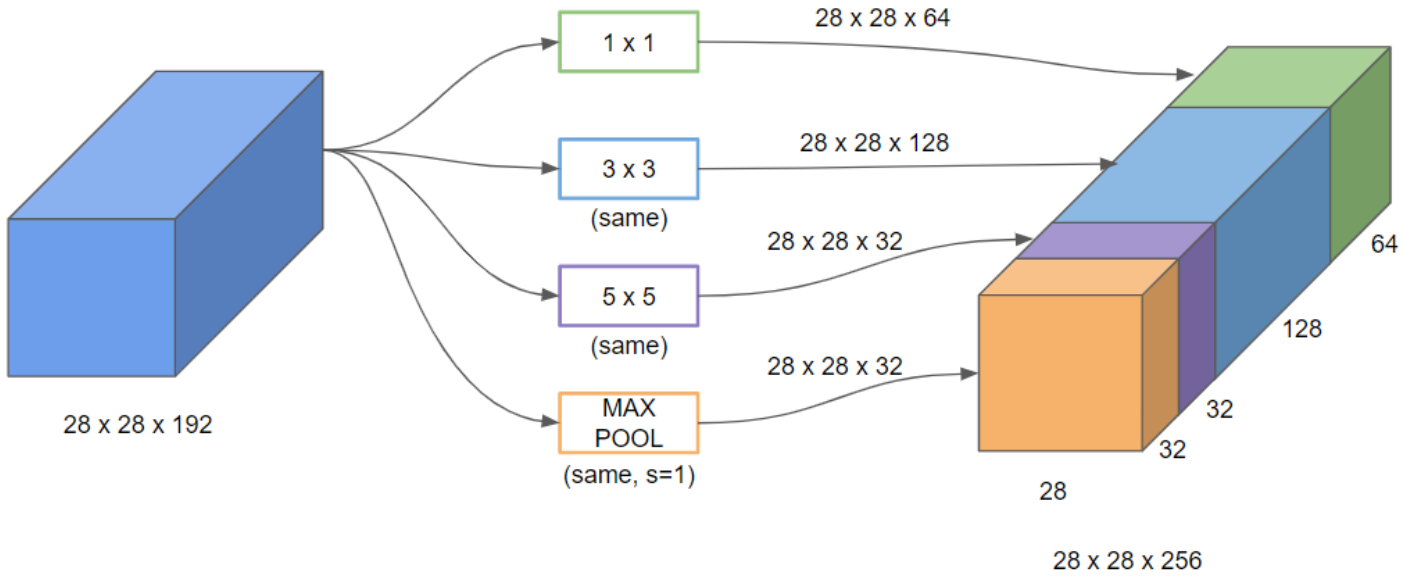
Network in Network 1x1 convolutions

- It is used to adjust the channel numbers.
- Adding nonlinearity to network.



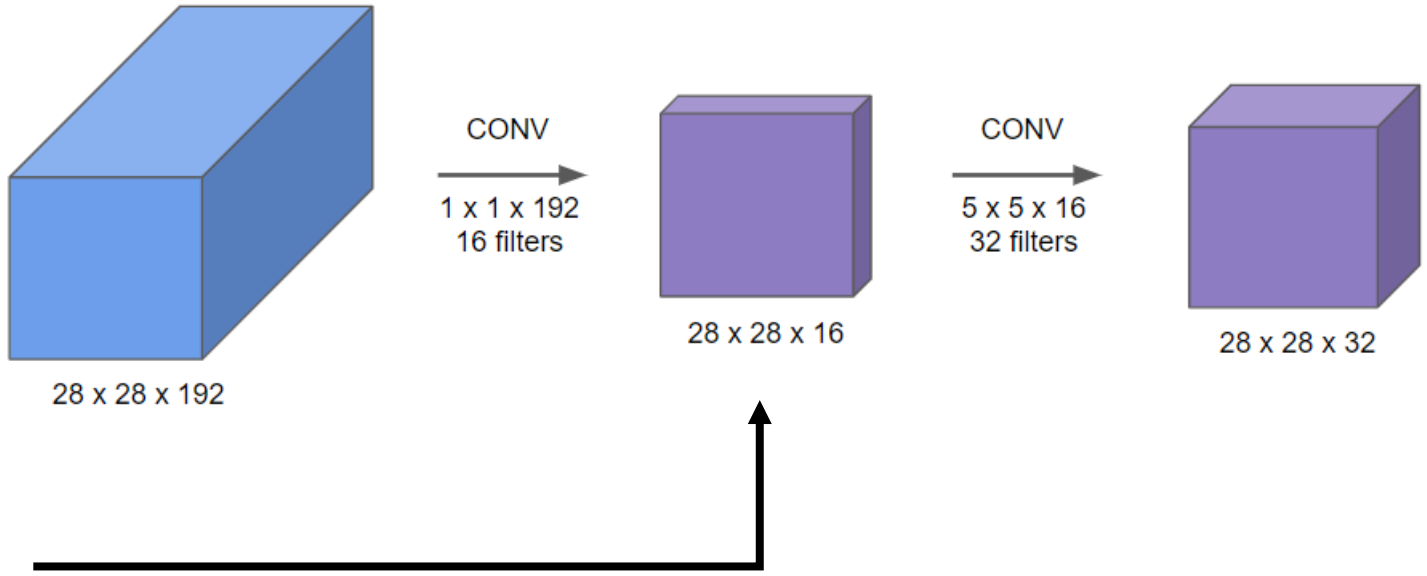
Inception network

- Let the network choose the filter size and pooling
- But the calculation cost is a problem.
- 5x5 filter : 28x28x192x5x5x32 ~ 120 million calculation

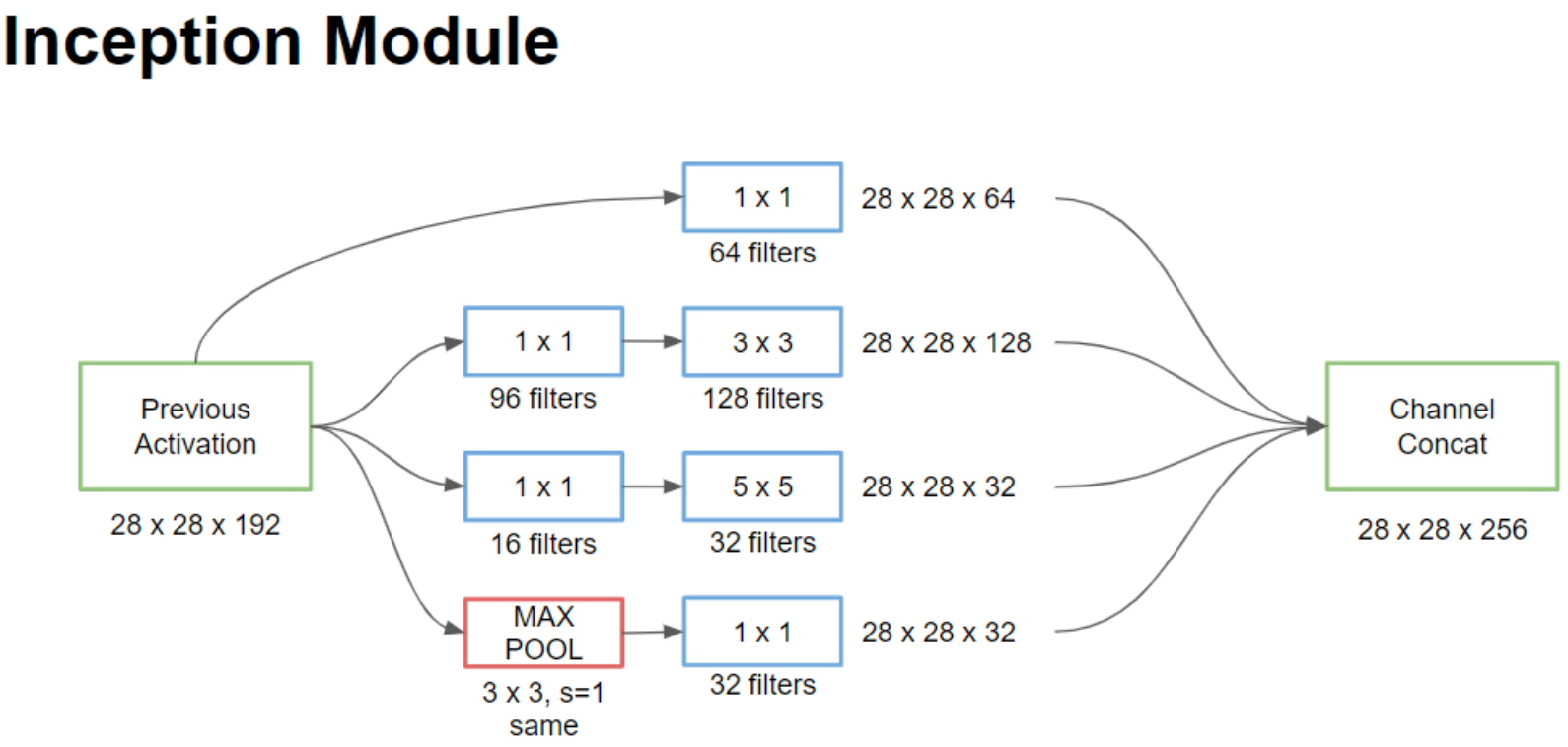


Inception network

- Using 1x1 convolution, we can make the calculation smaller.
- 28x28x192x192: 1st CONV ~ 2million
- 28x28x16x5x5x16: 2nd CONV ~ 10 million



Inception module



Example of inception network

- GoogLeNet