

Conv operations

Depthwise conv

Conv 2D

Group conv

Dilated conv

Transposed conv

fxl conv

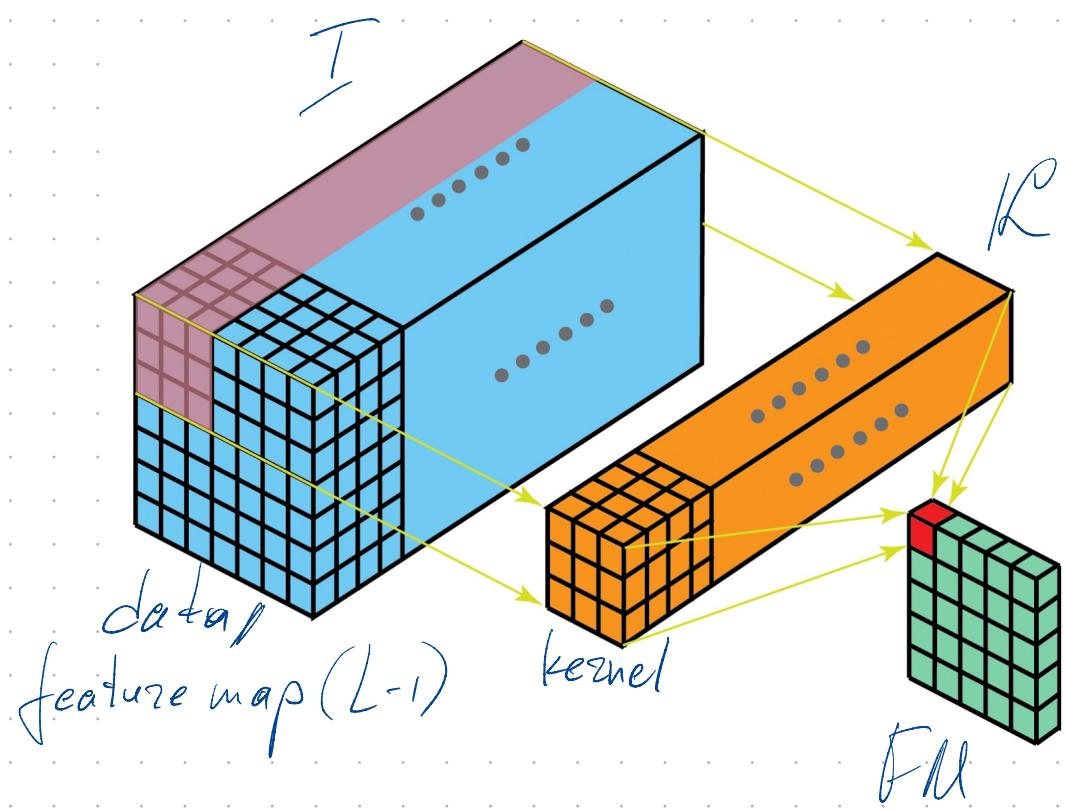
Receptive field

Pooling

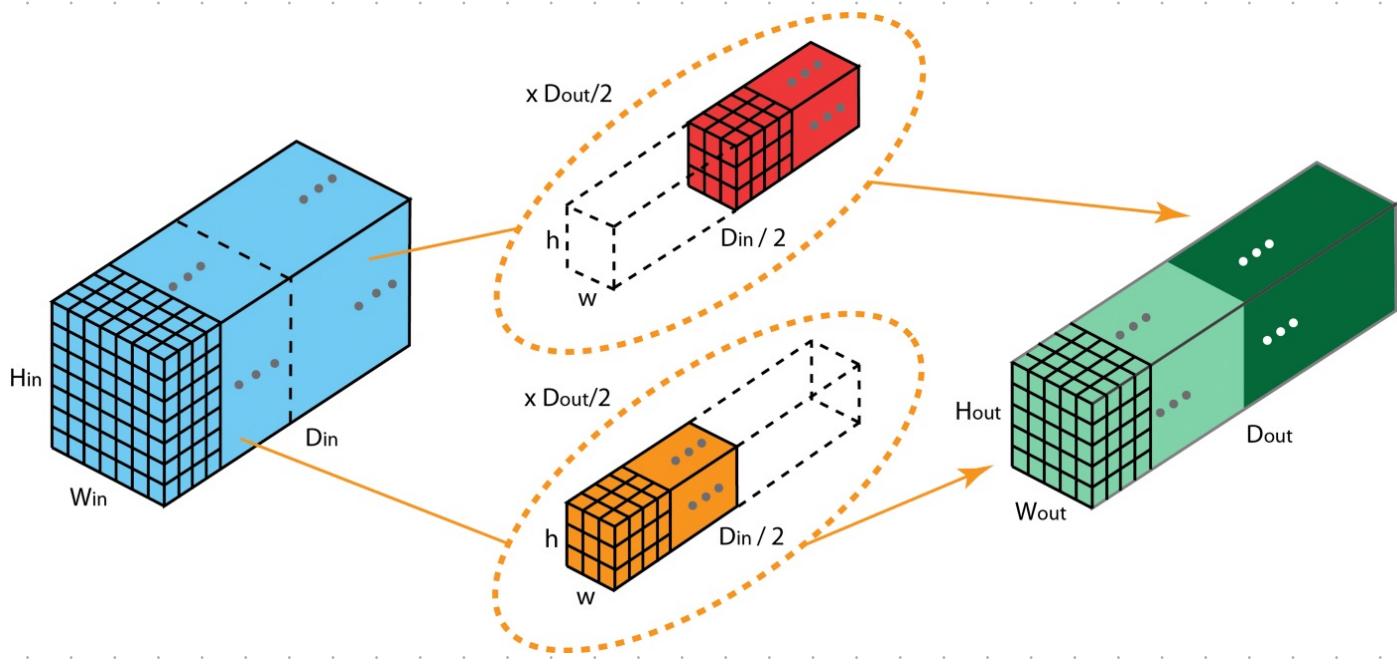
GAP

max  
ave

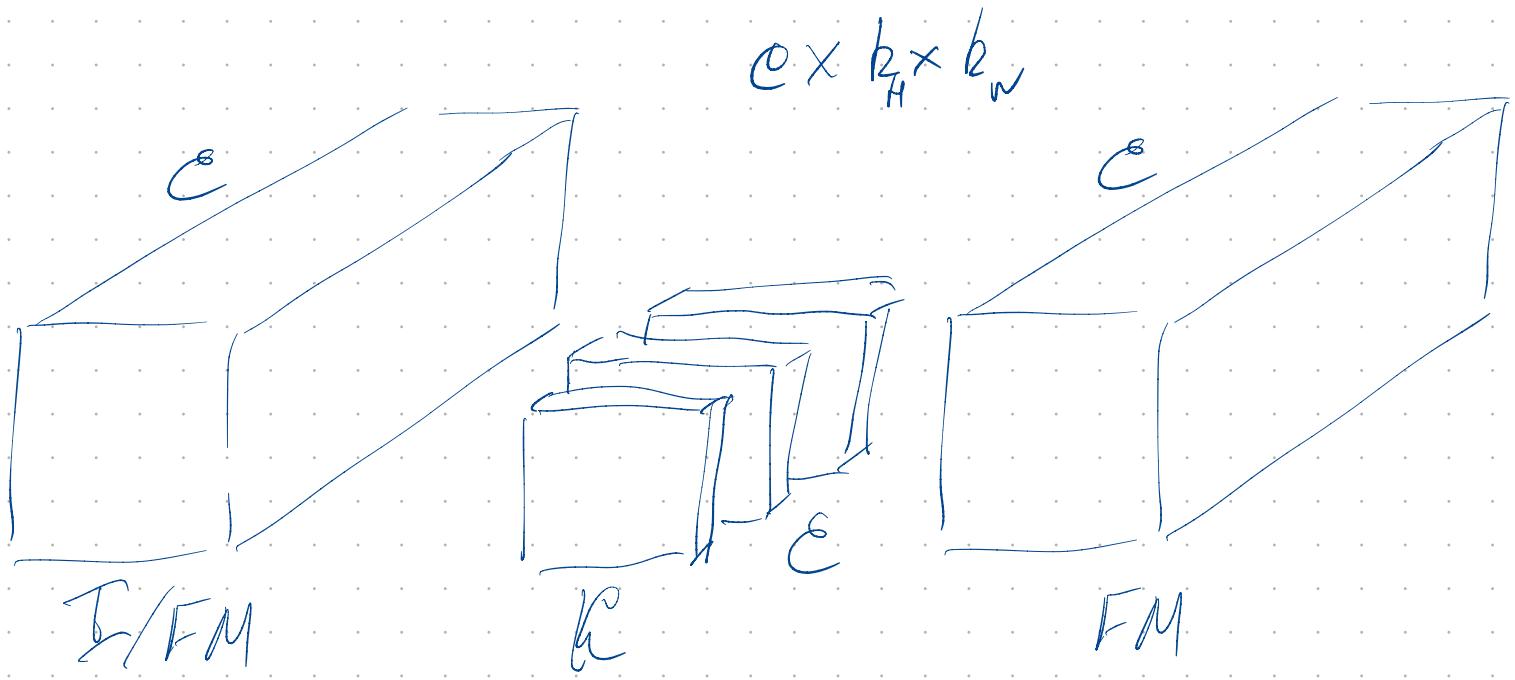
Выда съёмочных и глубоких операций,  
использование в съёмочных нейронных  
сетях.



### Group convolution



# Depthwise convolution



$$W' = \frac{W - k_w + 2P}{S} + 1$$

$$S=1$$

$$W' = W$$

$$W - k_w + 2P + 1 = W$$

$$2P = k_w - 1$$

$$k_w = 3 \quad k_w = 5$$

$$P = 1 \quad P = 2$$

# Strided convolution

$$W' = \left\lceil \frac{W - k + 2P}{S} \right\rceil + 1$$

$S=2$

$$W' = W/2$$

$$\frac{W}{k} = \frac{W}{2} - \frac{k}{2} + P + 1$$

$$P = \frac{k}{2} - 1$$

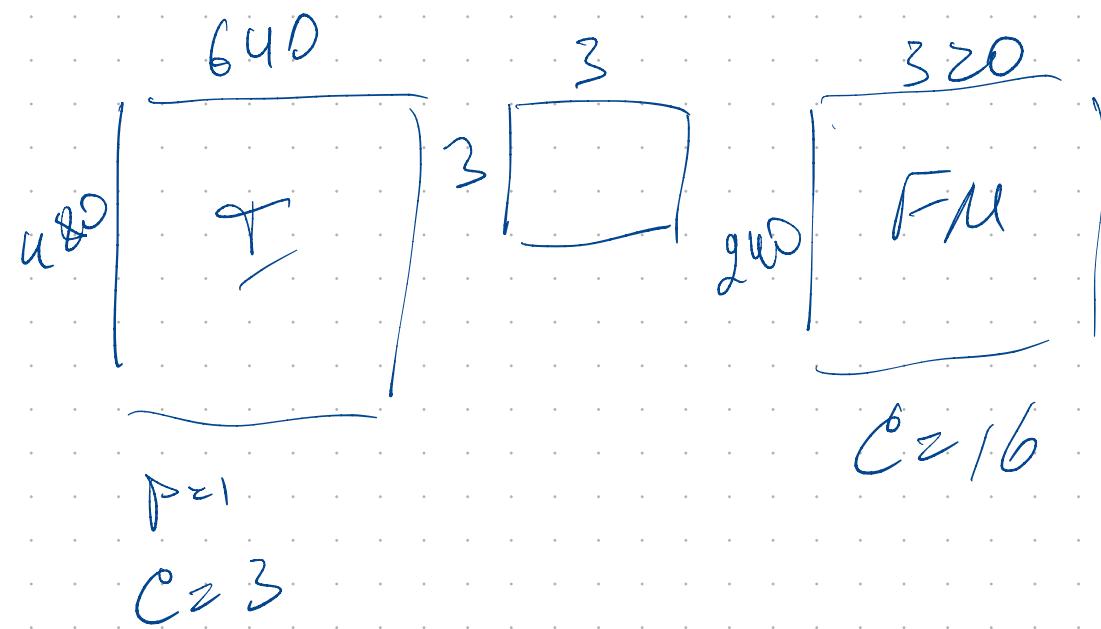
$$k=4 \quad b=3 \quad P=1$$

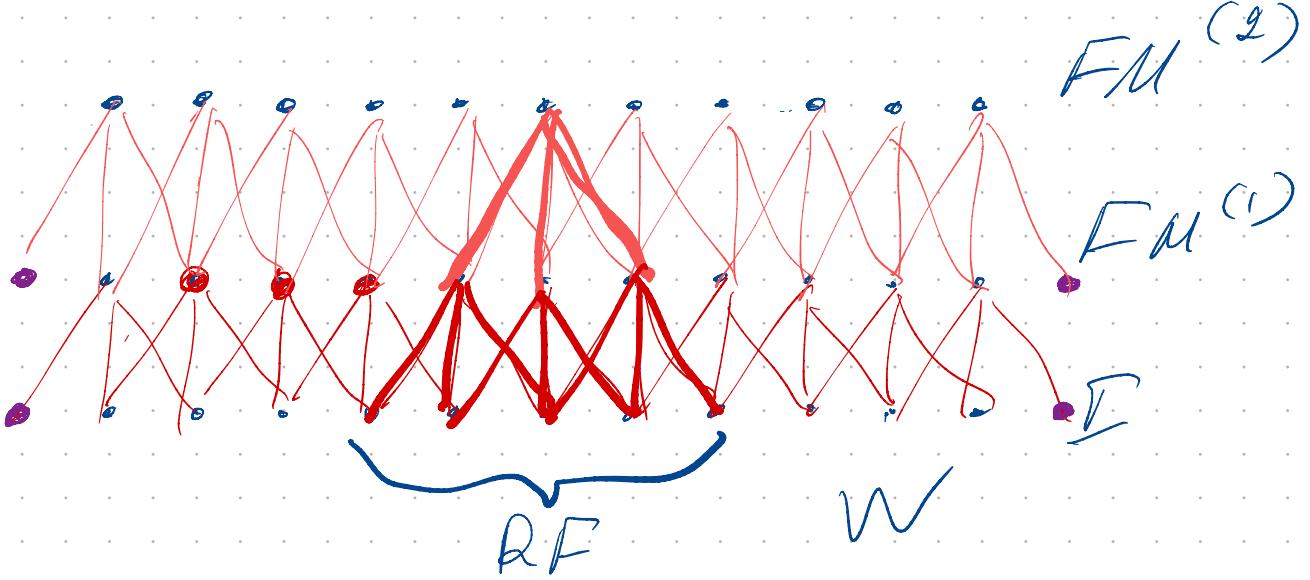
$$P=1 \quad W=640$$

$$W' = 320$$

$$320 = \frac{640 - 3 + 2}{2}$$

$$639 \\ 319 + 1 \\ 320$$

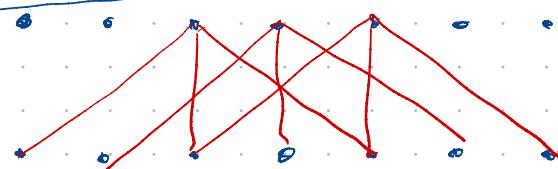




RF: receptive field  
сфера визуализации

$$W = 640$$

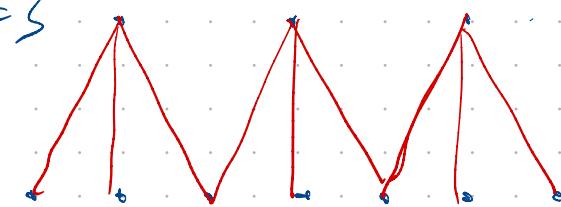
### Dilated Convolution



$$\text{spacing} = 2 \quad k = 5$$

### Strided Convolution

$$W = 3$$



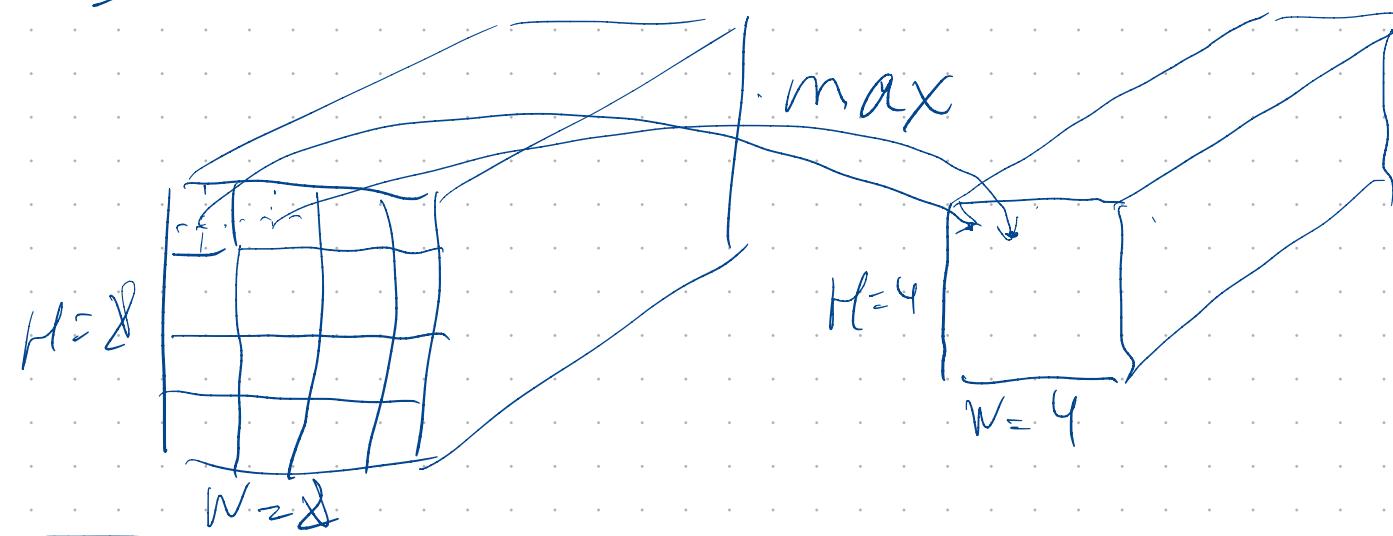
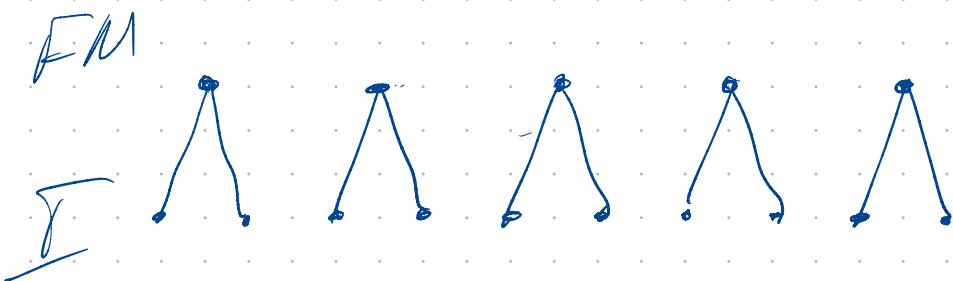
$$W = 7$$

# Pooling

↳ Logique et logique

$$e_{ij} = \text{avg}_{k_i, k_j} I(i - k_i, j - k_j)$$

avg: mean  
max



$$\textcircled{1} \quad W^{(L)} \times H^{(L)} \times C^{(L)} \rightarrow l \times (W^{(0)} \cdot H^{(0)} \cdot C^{(0)})$$

$$l \times f^{(0)} \rightarrow FC(f^{(0)}, f^{(1)})$$

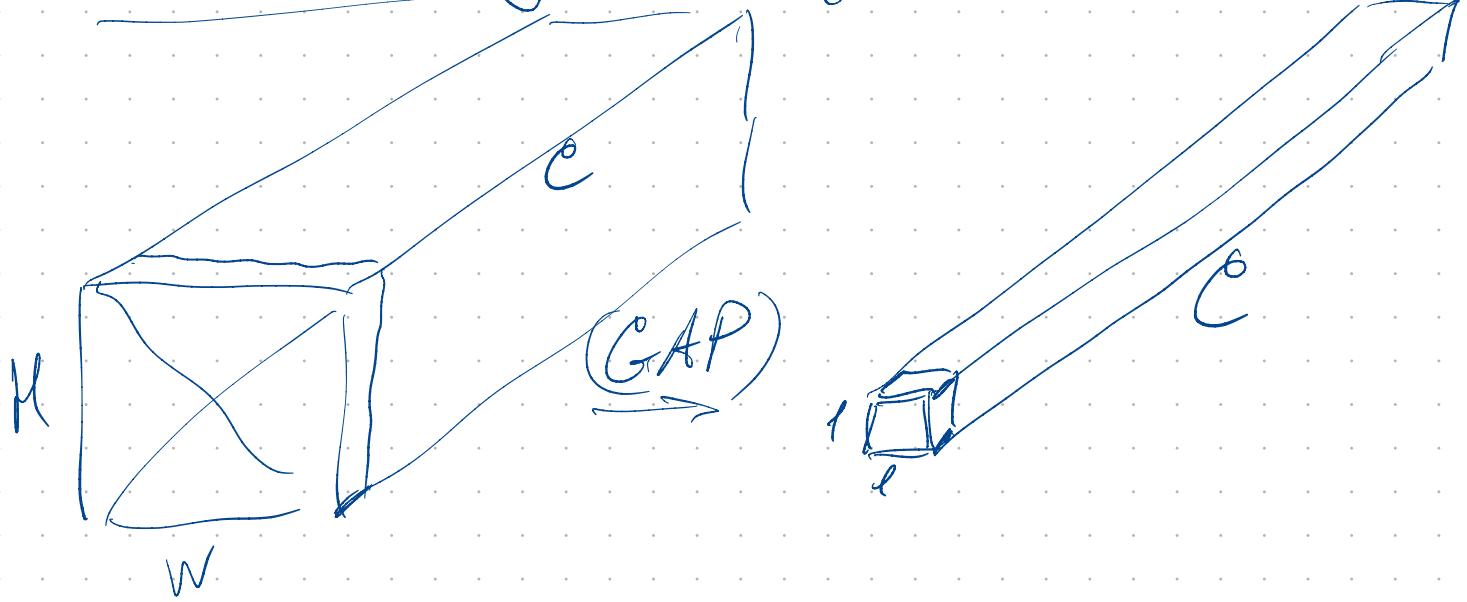
$$\theta^{(1)}: f^{(0)} \times f^{(1)}$$

$$\sim 10^5 \times 512$$

$$\theta^{(2)}: 512 \times 32$$

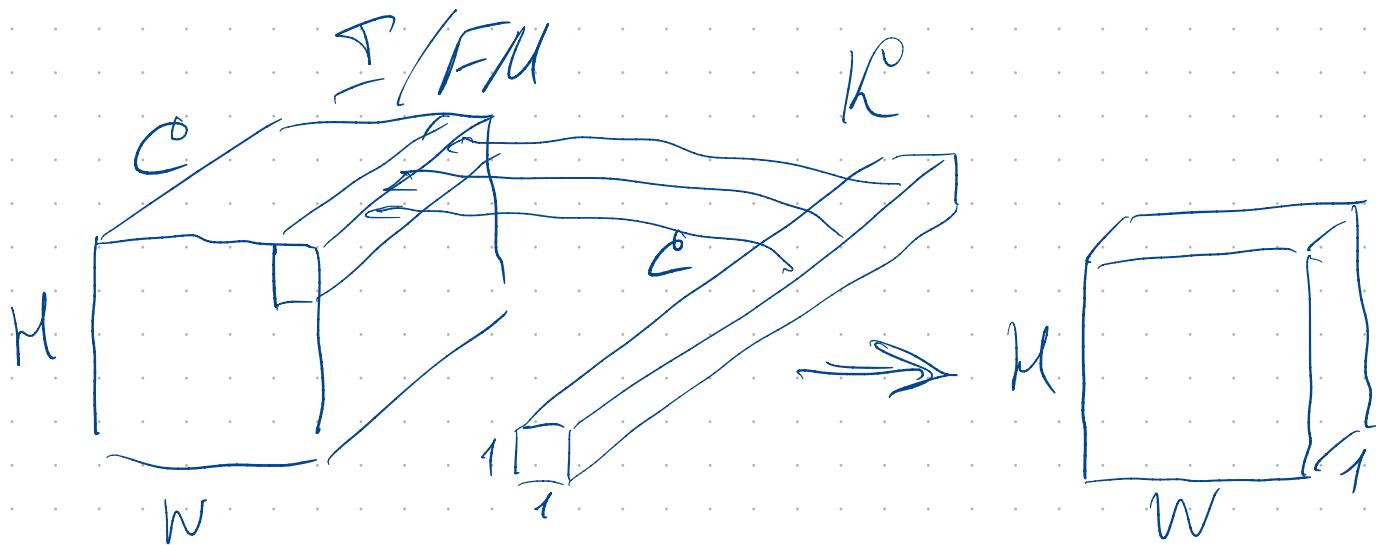
$$\theta^{(3)}: 32 \times 1$$

# Global average pooling GAP



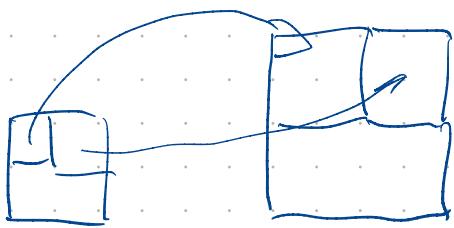
$$H_I \times W_I \times C_I$$

# $1 \times 1$ convolution



## Upsample

$\times 2$

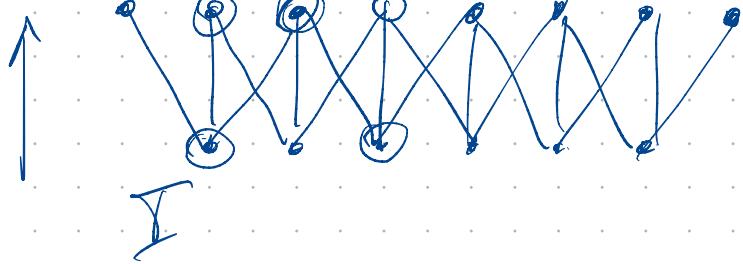


→ interp

} nearest neighbour  
bilinear  
bicubic

## Transpose Convolution

FM



FM

