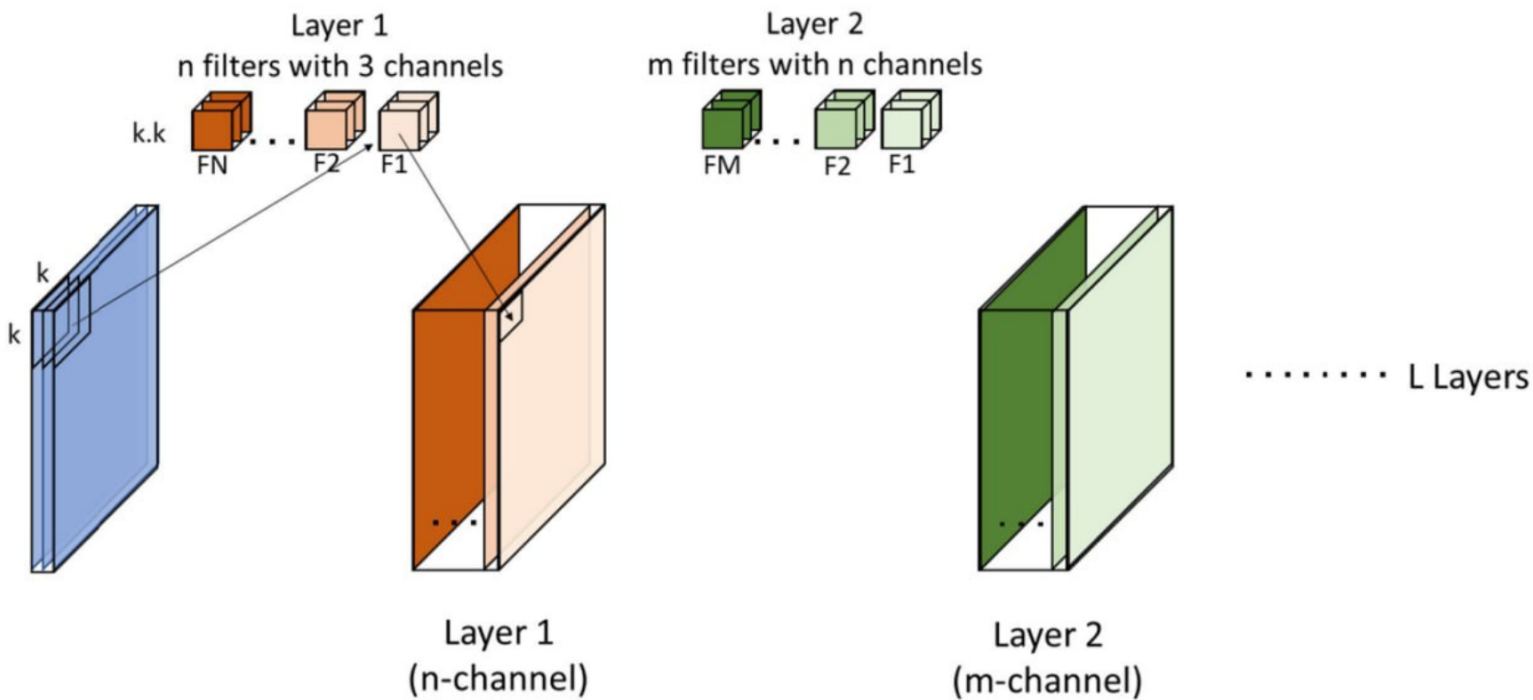


# Approach for Convolution

Let input size be  $28 \times 28 \times 10$

kernel size be  $3 \times 3 \times 10$

↳ Let us use 20 such kernels for 20 output channels



## 1) kernels partition



Layer 1 of all 20 kernels      Layer 2 of ... all 20 kernels      Layer 10 of all 20 kernels

## 2) Input

→ Fetch only one layer of input

→ Store and reuse it until convolution with layer 1 of all 20 kernels is completed

## 3) 2D - Convolution

$a_{00}$	$a_{01}$	$a_{02}$	$a_{03}$	$a_{04}$	...		$k_{00}$	$k_{01}$	$k_{02}$
$a_{10}$	$a_{11}$	$a_{12}$	$a_{13}$	$a_{14}$	...	$\otimes$	$k_{10}$	$k_{11}$	$k_{12}$
$a_{20}$	$a_{21}$	$a_{22}$	$a_{23}$	$a_{24}$	...		$k_{21}$	$k_{22}$	$k_{23}$
$a_{30}$	$a_{31}$	$a_{32}$	$a_{33}$	$a_{34}$	...				

$a_{00}$	$a_{01}$	$a_{02}$	$a_{10}$	$a_{11}$	$a_{12}$	$a_{20}$	$a_{21}$	$a_{22}$
----------	----------	----------	----------	----------	----------	----------	----------	----------

 $\otimes k = p_{0, [0,0]}$

$a_{01}$	$a_{02}$	$a_{03}$	$a_{11}$	$a_{12}$	$a_{13}$	$a_{21}$	$a_{22}$	$a_{23}$
----------	----------	----------	----------	----------	----------	----------	----------	----------

 $\otimes k = p_{0, [0,1]}$

⋮

⋮

$p_{0, [n,n]}$

$k =$ 

$k_{00}$	$k_{01}$	$k_{02}$	$k_{10}$	$k_{11}$	$k_{12}$	$k_{20}$	$k_{21}$	$k_{22}$
----------	----------	----------	----------	----------	----------	----------	----------	----------

↓  
All the partial outputs of 1<sup>st</sup> channel are calculated

- Now continue the above process with 1<sup>st</sup> layer of Kernel 2 → This will give  $PO_2$
- Once all 20 kernels are used, now we have 20 channels of partial outputs
- Next use 2<sup>nd</sup> input layer, and 2<sup>nd</sup> layer of 20 kernels → This will again give 20 channels of partial outputs, which we need to add with previous partial outputs