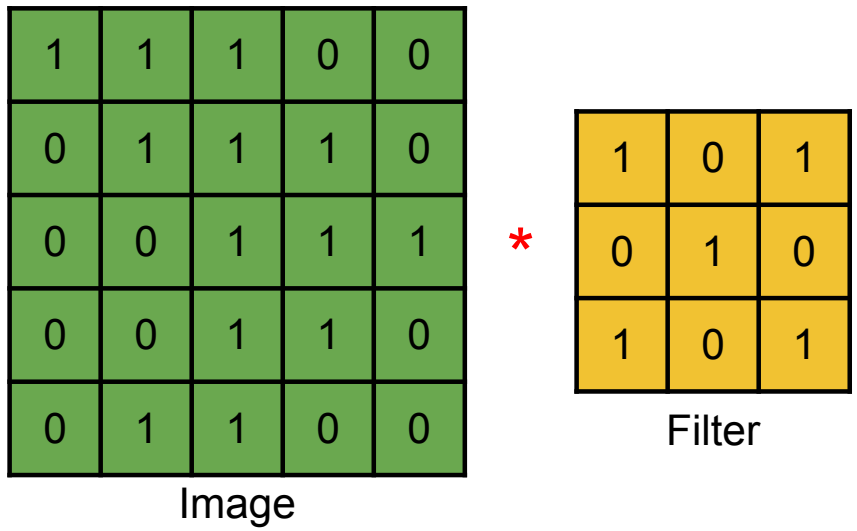
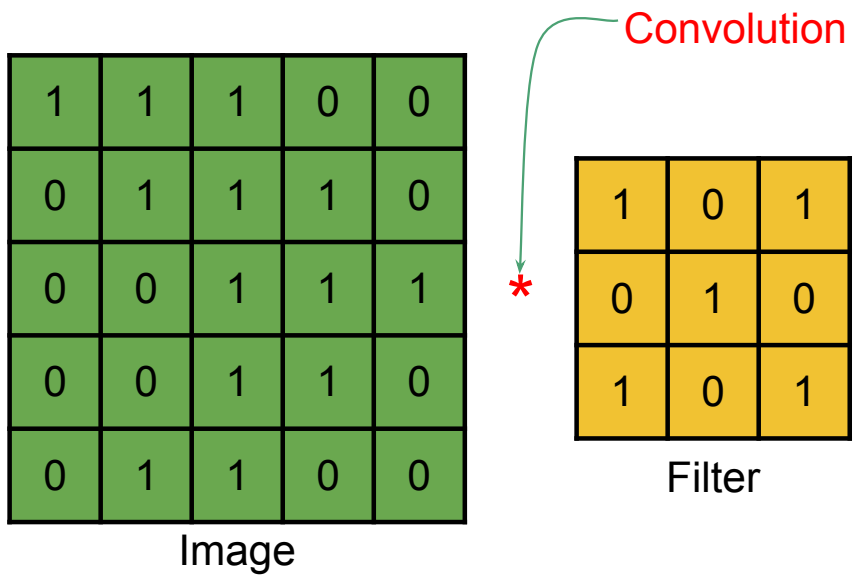
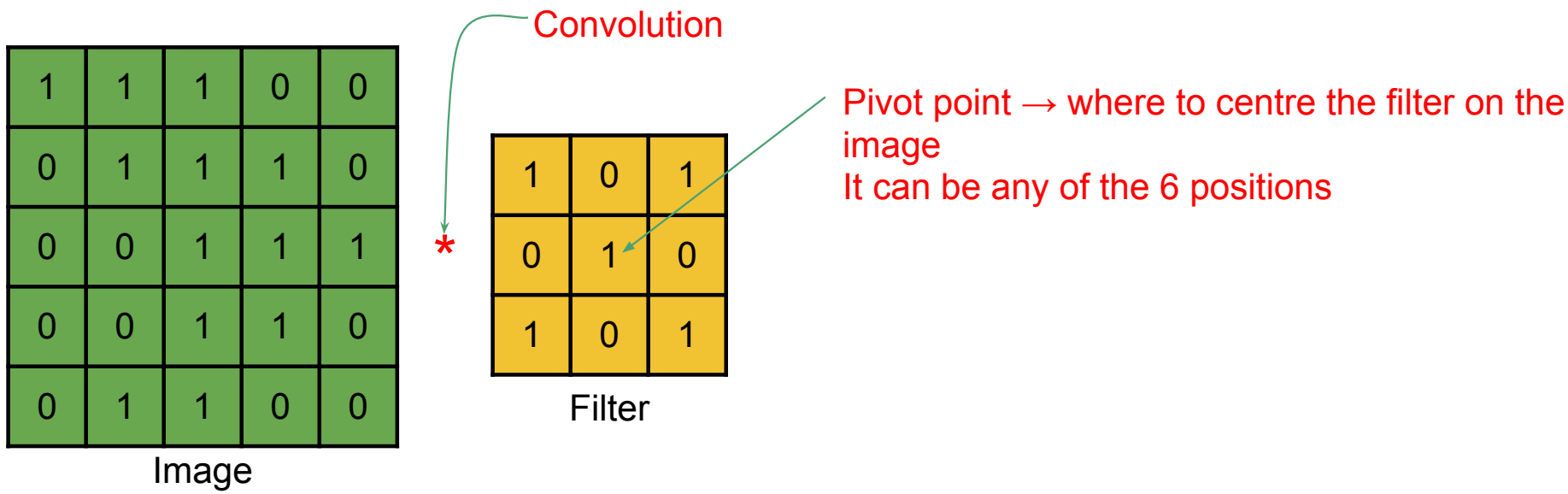
Filters



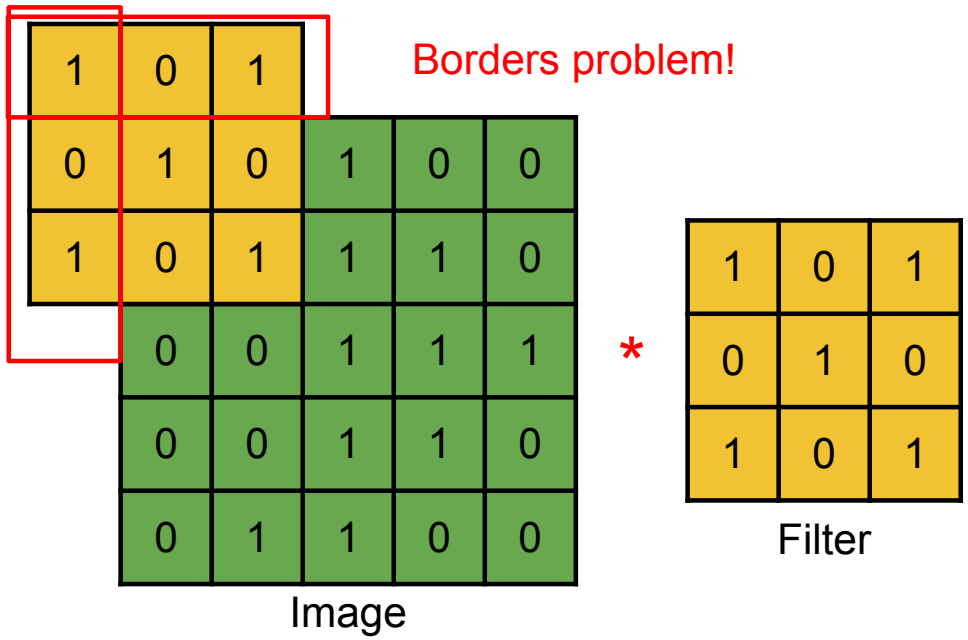
Filters


Convolution
1 1 1 0 0
0 1 1 1 0
0 0 1 1 1
0 0 1 1 0
0 1 1 0 0
Image
*
1 0 1
0 1 0
1 0 1
Filter

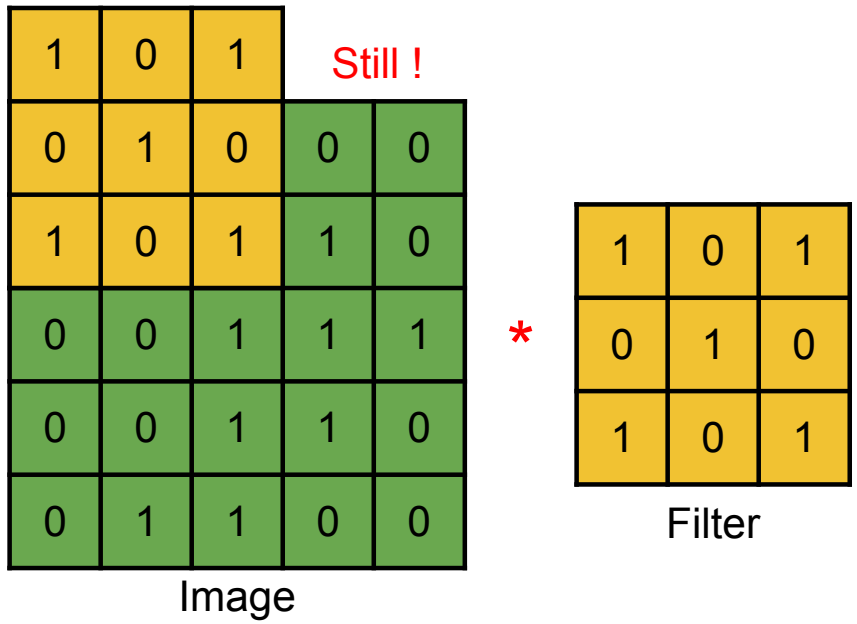
Filters


Convolution
1 1 1 0 0
0 1 1 1 0
0 0 1 1 1
0 0 1 1 0
0 1 1 0 0
Image
*
1 0 1
0 1 0
1 0 1
Filter
Pivot point → where to centre the filter on the image
It can be any of the 6 positions

Filters


1 0 1
0 1 0 1 0 0
1 0 1 1 1 0
0 0 1 1 1
0 0 1 1 0
0 1 1 0 0
Borders problem!
Image
*
1 0 1
0 1 0
1 0 1
Filter

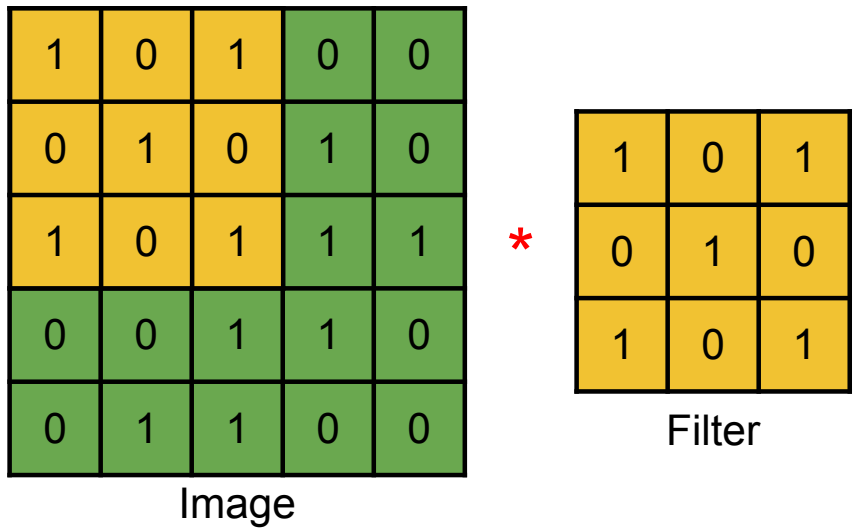
Filters


1 0 1
0 1 0 0 0
1 0 1 1 0
0 0 1 1 1
0 0 1 1 0
0 1 1 0 0
Still !
Image

*

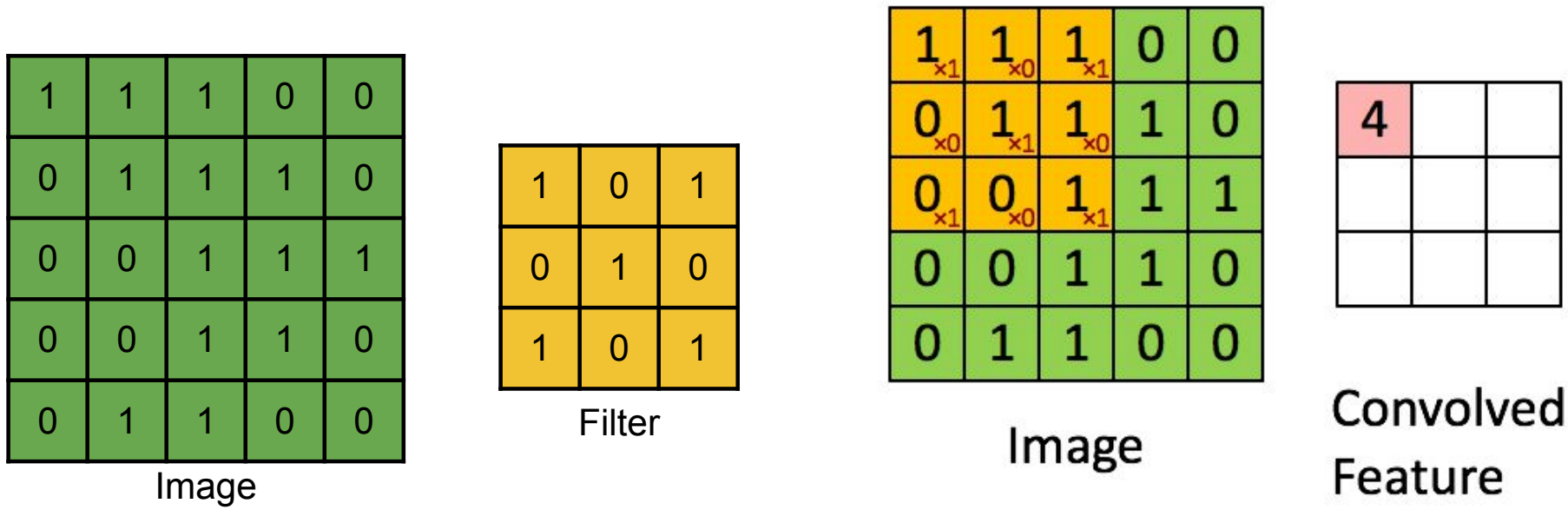
1 0 1
0 1 0
1 0 1
Filter

Filters



Output size?

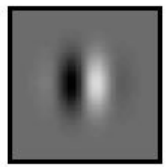
Filters

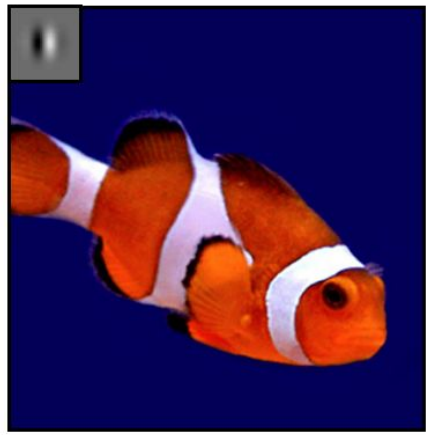

1 1 1 0 0
0 1 1 1 0
0 0 1 1 1
0 0 1 1 0
0 1 1 0 0
Image
1 0 1
0 1 0
1 0 1
Filter
1 1 1 0 0
0 1 1 1 0
0 0 1 1 1
0 0 1 1 0
0 1 1 0 0
Image
4
Convolved Feature

Filters

- Detect ‘features’ in an image

What does this filter detect?

filter 



Filters

- Detect ‘features’ in an image

What does this filter detect?

Average Filter

- Can you think of a filter that take average of the neighbourhood?

Average Filter

- Can you think of a filter that take average of the neighbourhood?

$$\frac{1}{9} \times \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

Average Filter

- Can you think of a filter that take average of the neighbourhood?

Average Filter

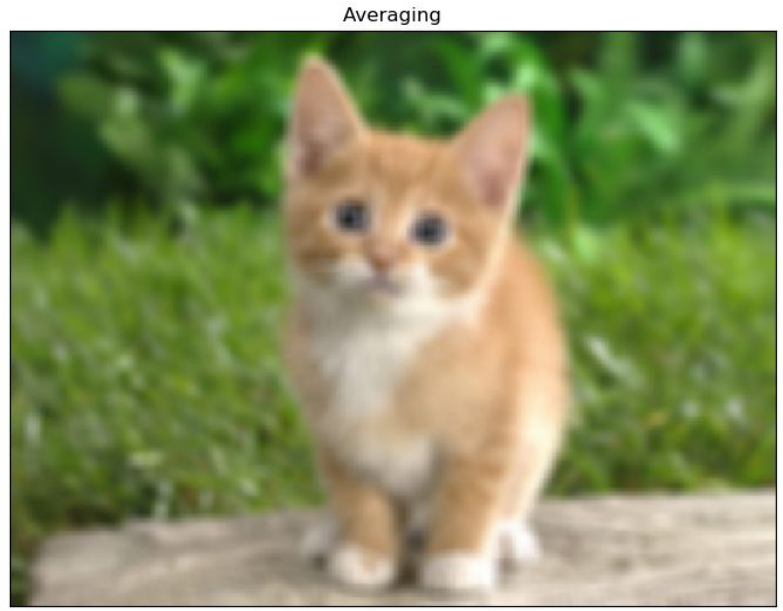
- 9 * 9 average filter?

1/81 *

1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1

Average Filter

- 9 * 9 average filter?



Part I Computing linear filters

- A code is available for a Laplacian filter.
- Modify the code to implement these filters:
- [0,0,0]
  [0,1,0]
  [0,0,0]

- [0,0,0]
  [0,0,1]
  [0,0,0]

- Im + (Im - Im*average_filter)

Part II Median and Gaussian filter

- image corrupted with salt & pepper noise.

- Apply a median filter to remove the noise. Also, apply a Gaussian filter to the same noisy image. Which filter was more successful? You can use any scikit-image functions you like.

Check

http://scikit-image.org/docs/dev/api/skimage.filters.html