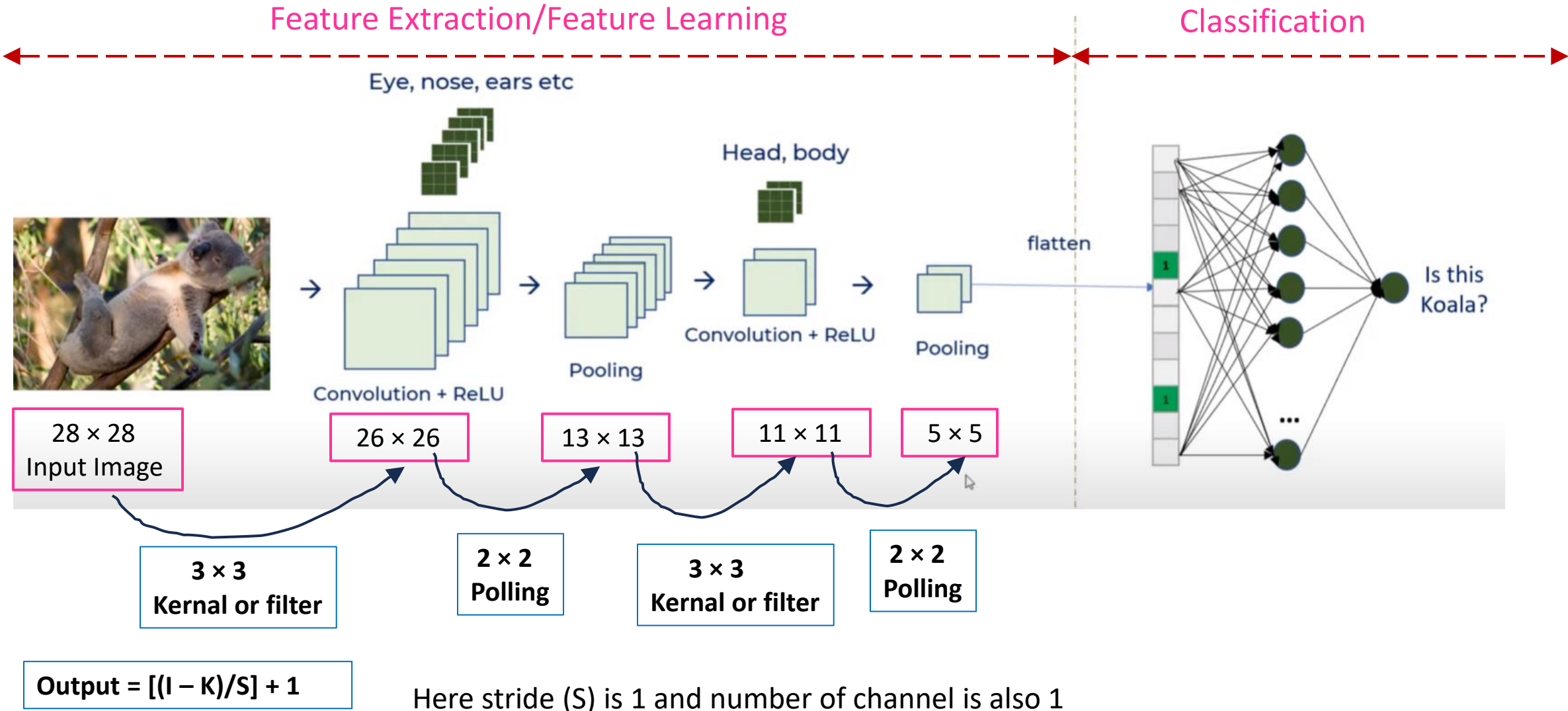


Creation of a Convolutional Neural Network using PyTorch: Image Classification

Convolutional Neural Network (CNN)

CNN is a deep learning algorithm used for image classification, detection, and segmentation.



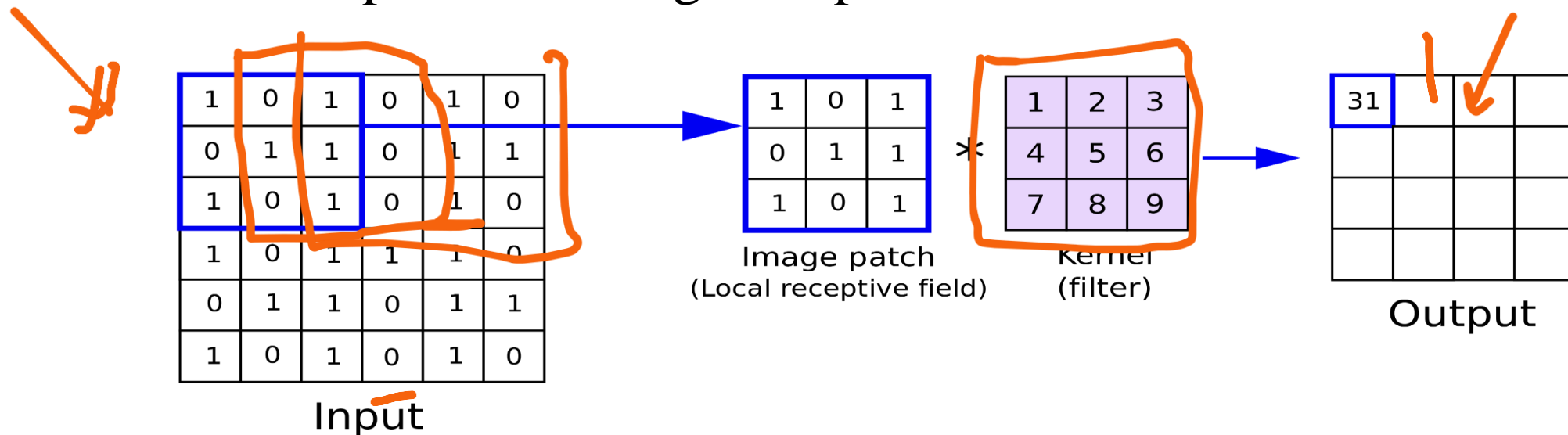
CNN

1. Feature Extraction/Learning:

- Detecting all the feature like ear, eyes.

I. Convolution:

- Kernel can be used to extract the feature
- A kernel is a small matrix (e.g., 3×3 , 5×5) that slides across an image, performing element-wise multiplication and summing up the results to produce a single output value.



II. ReLu activation function:

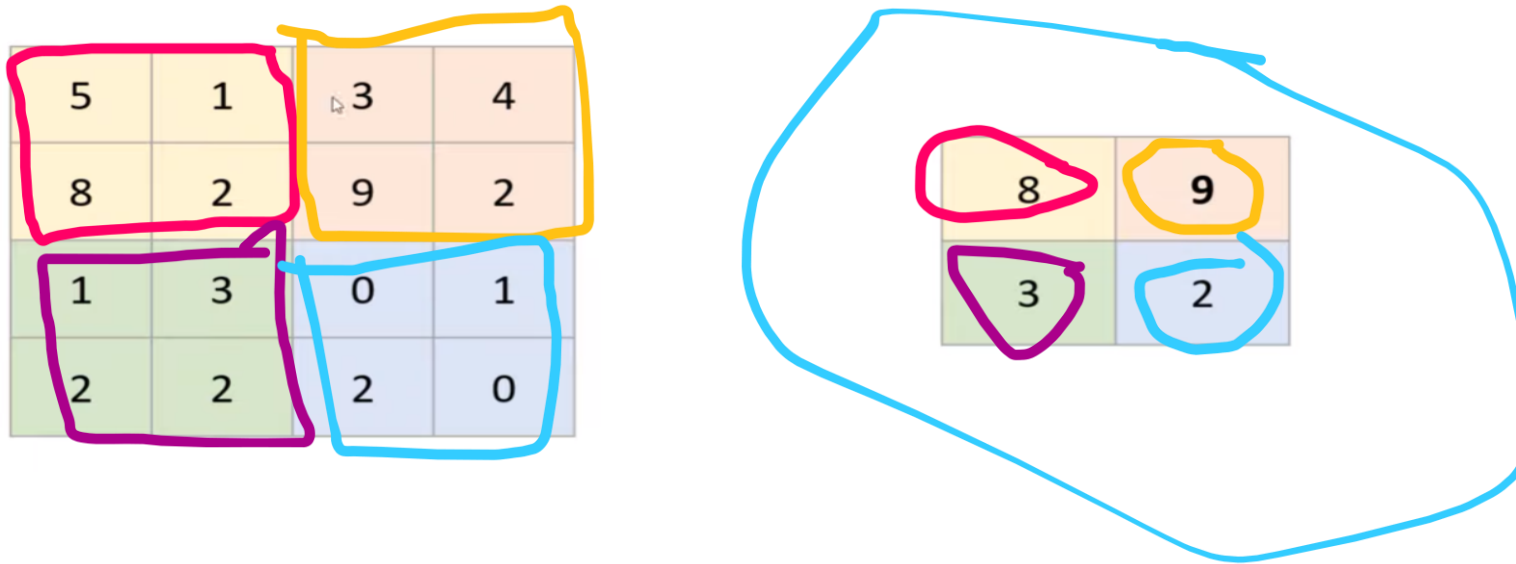
- ReLu activation function takes your feature value: $\text{Relu} = \max(0, x)$
- If the value is negative, it will replace it with 0. If it is more than zero it will be keep it same
- It makes the model to non-linear
- It also speed up the training

III. Polling layer: It is used to reduce the size of an image, i.e., it reduce the dimensions

- The max polling:
- Average polling

The max polling:

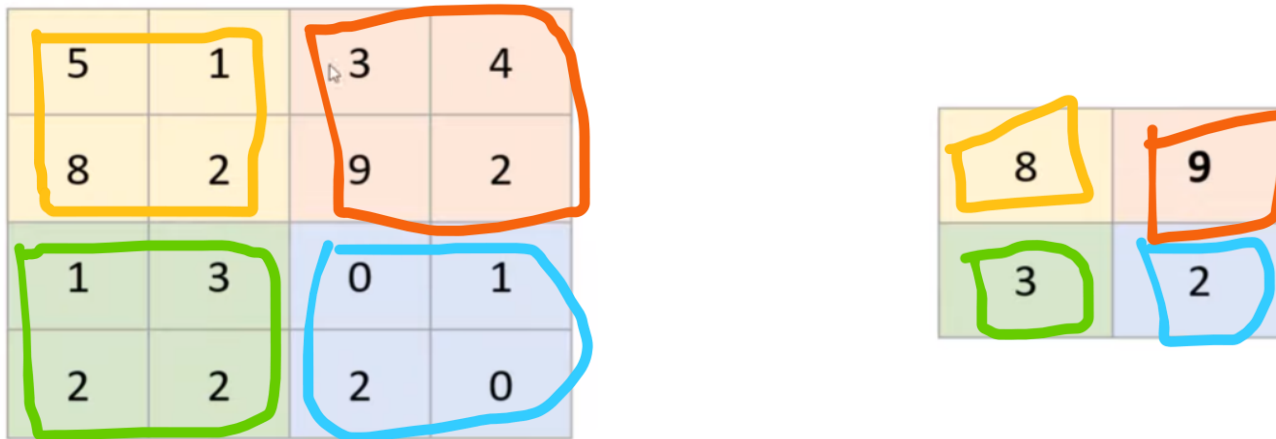
- Window of 2 by 2 is taken



2 by 2 filter with stride = 2

4 By 4 is reduced to 2 by 2

The max polling:



2 by 2 filter with stride = 2

4 By 4 is reduced to 2 by 2

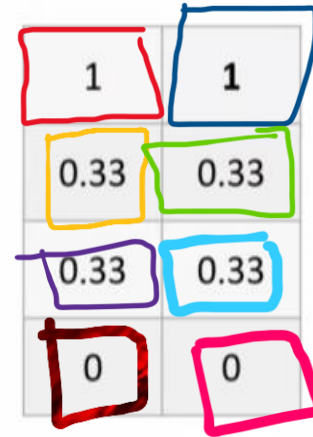
The max polling:

0	1	0
0	0.11	0
0	0.33	0
0	0	0
0	0	0

1	1
0.33	0.33
0.33	0.33
0	0

2 by 2 filter with stride = 1

The max polling:

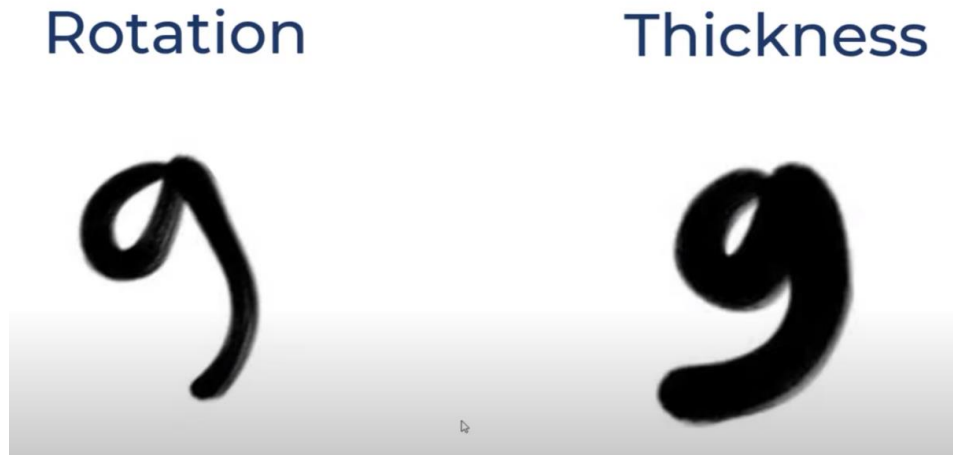


2 by 2 filter with stride = 1

- Average polling is same as max polling, we take the average in place of maximum
- **Benefits of polling:**
 - Reduce dimension and computation
 - Reduce overfitting because there are less parameter
 - Overfitting or high variance occurs when the accuracy of your training dataset is greater than your testing accuracy.

CNN

- CNN can not handle rotation and scale by itself



- Due to this, **training dataset** should have **rotated and scaled sample**
- If it does not have than pick some of the sample from training data set and **rotate and scale them** using **Data Augmentation** or **Spatial Transformer Networks (STN)**