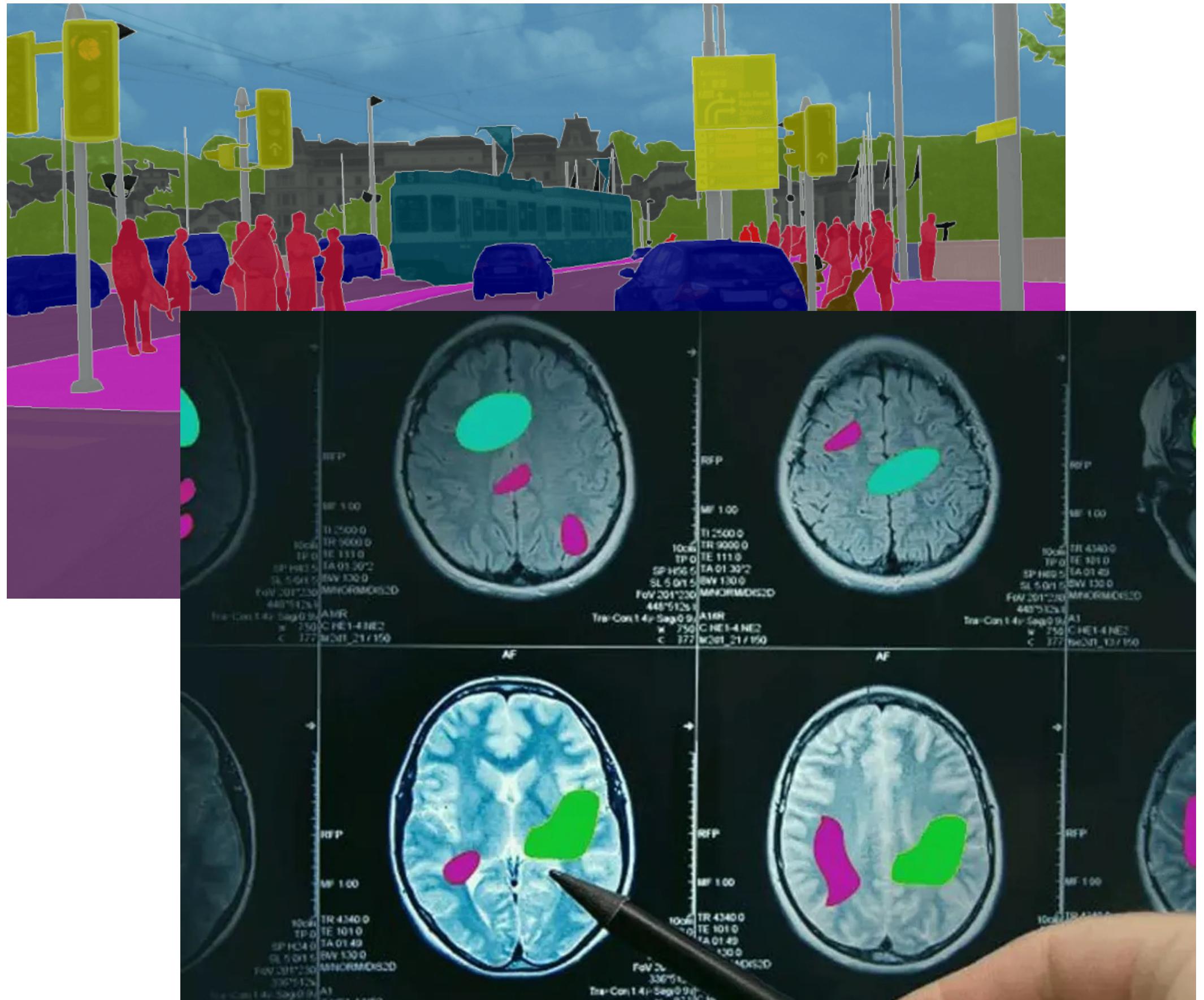


Unet for image segmentation



Practical Deep Learning for Science
27 June, 2023

Unet: Two main usage

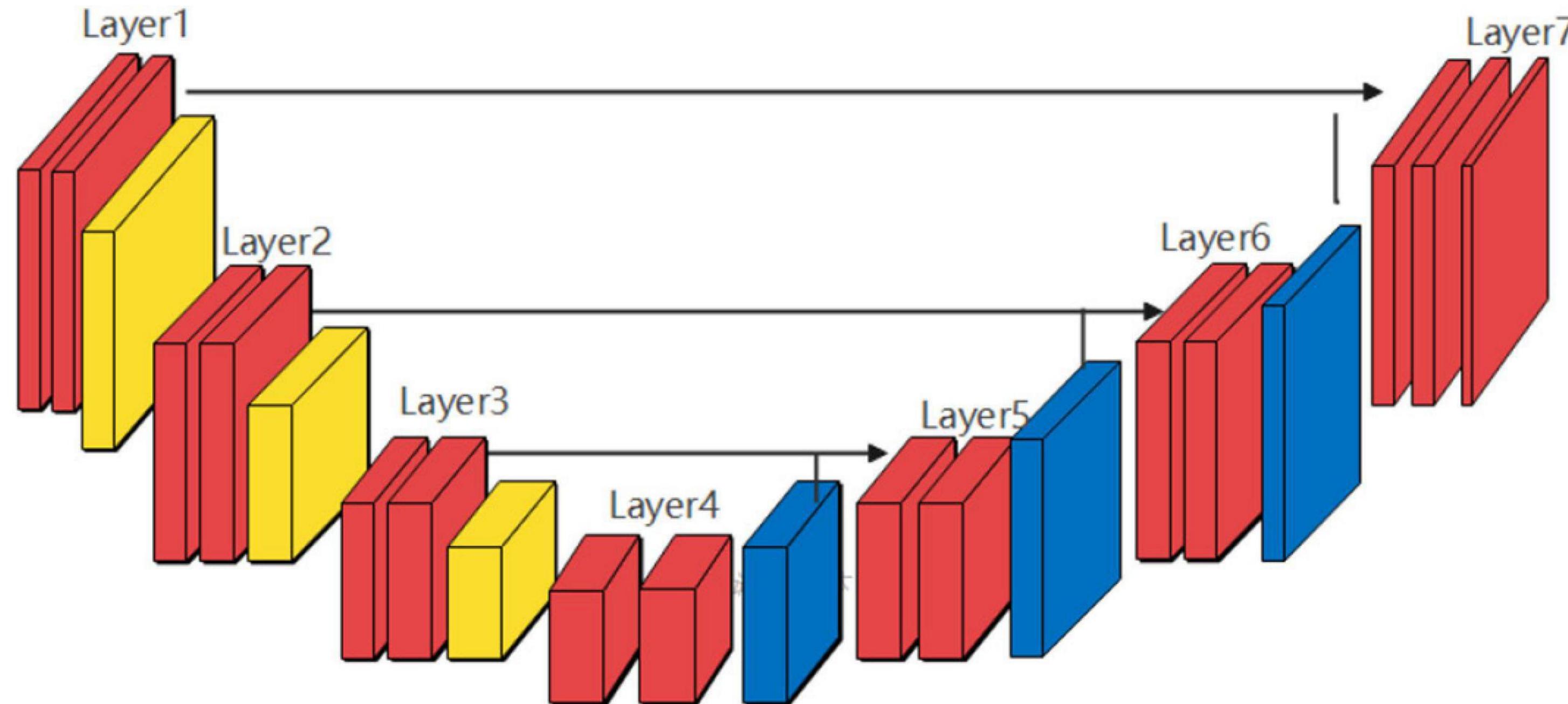


segmentation



Diffusion (next lecture)

Unet



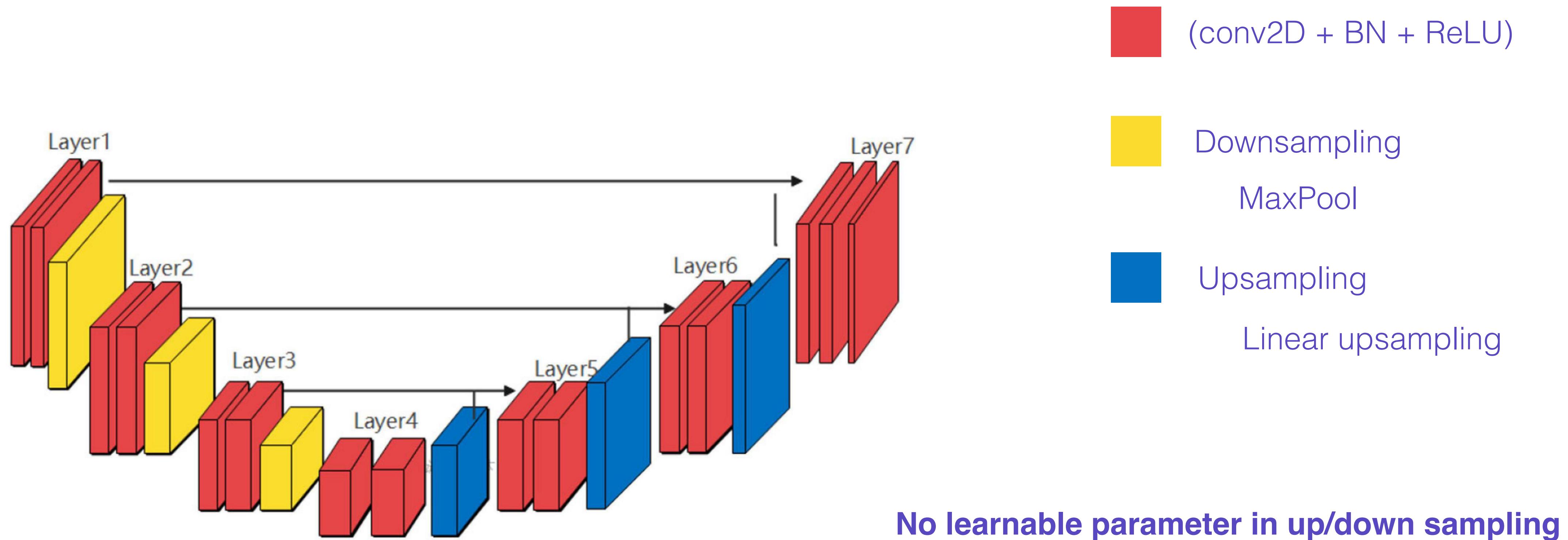
- U-shaped
- Very similar to the VAE
- Differences
 - Input is not the target
 - We won't be sampling.
(No KLD in the middle)
 - Skip connections
 - Helps upsampling

Upsampling

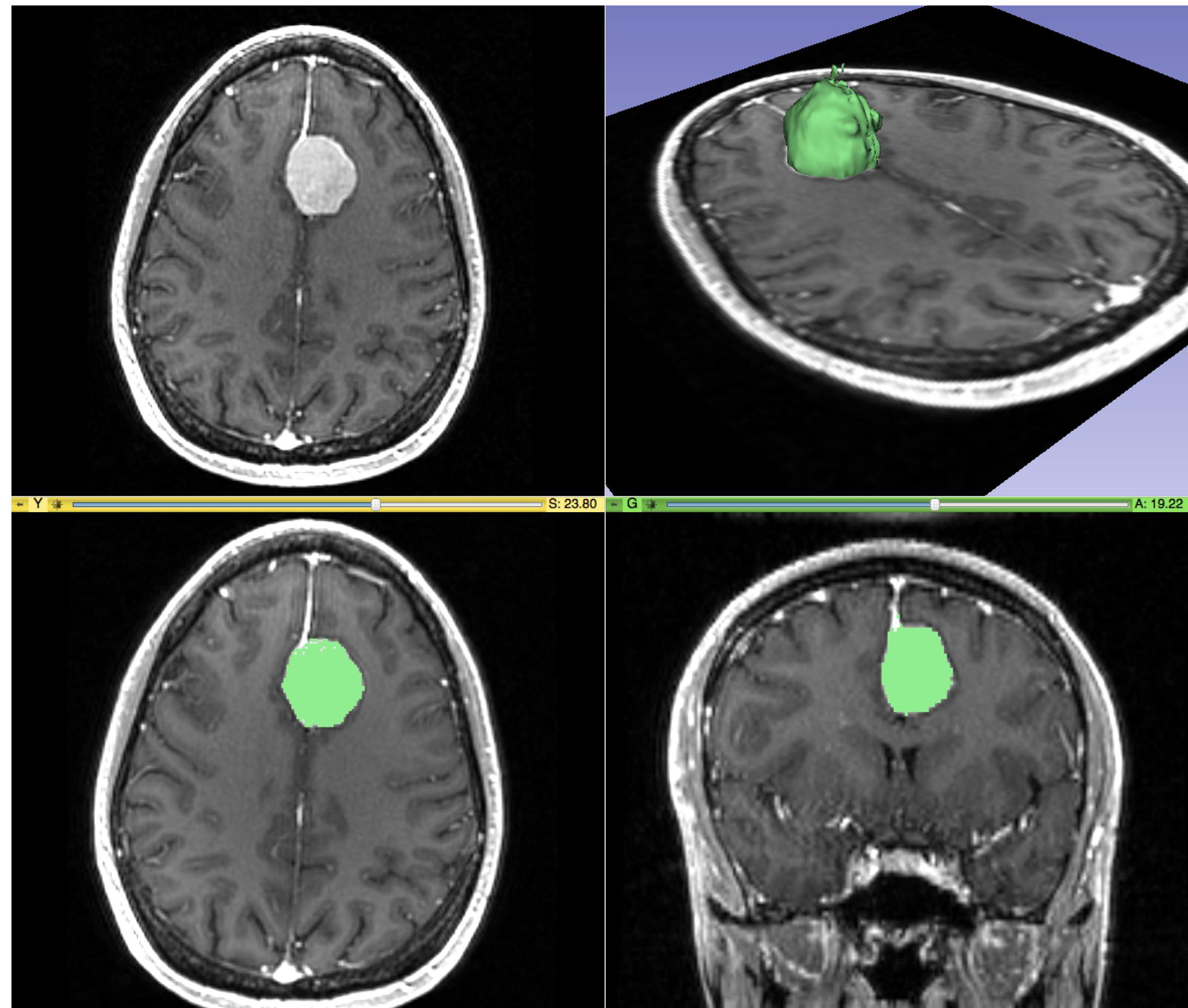
- For VAE, we used transposeConv2D
- Today we'll try (linear upsampling + conv2D)
 - Conceptually easier
- Linear upsampling => insert new pixel between already existing pixel
 - The new pixel value can be computed using different types of interpolation
 - Eg. Bilinear interpolation: new pixel value is the weighted average of the surrounding pixels

DoubleConv

- (conv2D + batchNorm + ReLU) x2 + upsampling/downsampling



Dice loss: why?

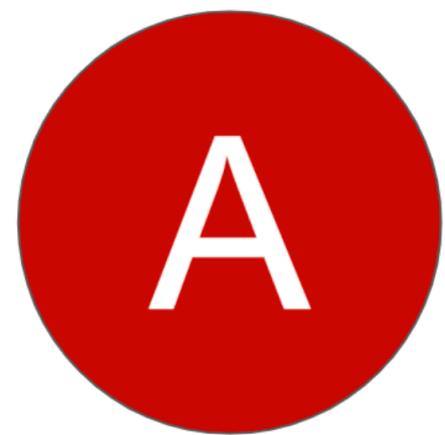


- Classification on each pixel
- Way more background (0) pixels than signal (1)
- Class imbalance!
- Network will biased to predict 0

https://mphy0026.readthedocs.io/en/latest/segmentation/segmentation_methods.html

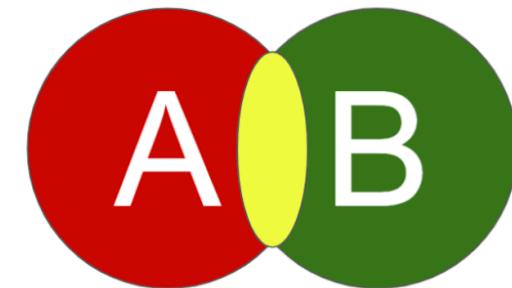
Dice loss

Traget mask



Pred mask



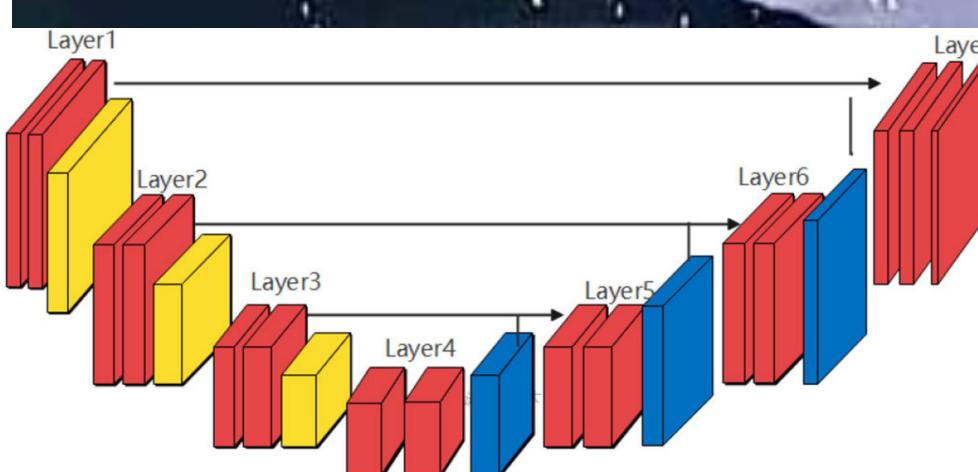
$$\text{Dice coeff} = \frac{2 \times \text{A} \cap \text{B}}{\text{A} + \text{B}}$$
A Venn diagram illustrating the Dice coefficient calculation. It shows two overlapping circles, one red labeled 'A' and one green labeled 'B'. The overlapping region is yellow and labeled 'A ∩ B'.

A and B have zero overlap => 0 (minimum)

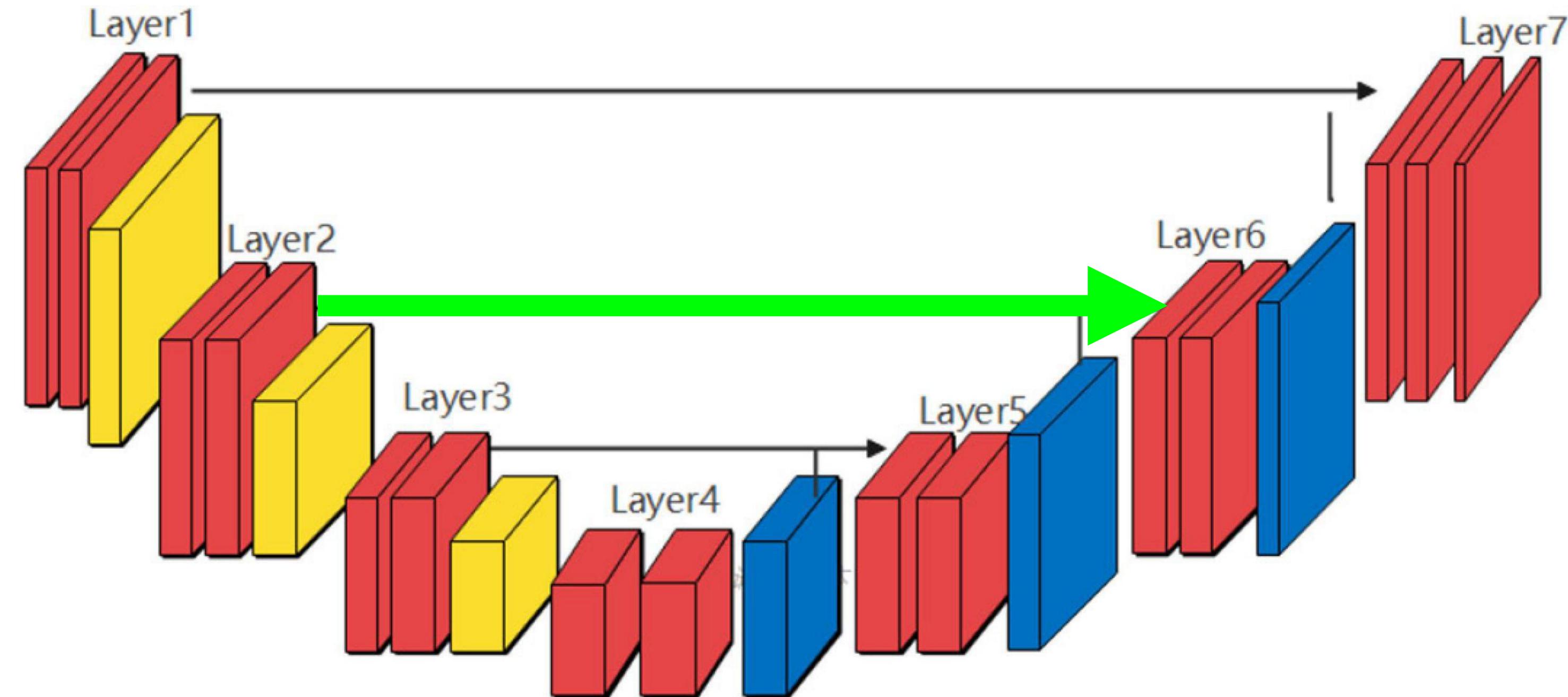
A and B are same => 1 (maximum)

Dice loss = 1 - dice coefficient

<https://pycad.co/the-difference-between-dice-and-dice-loss/>

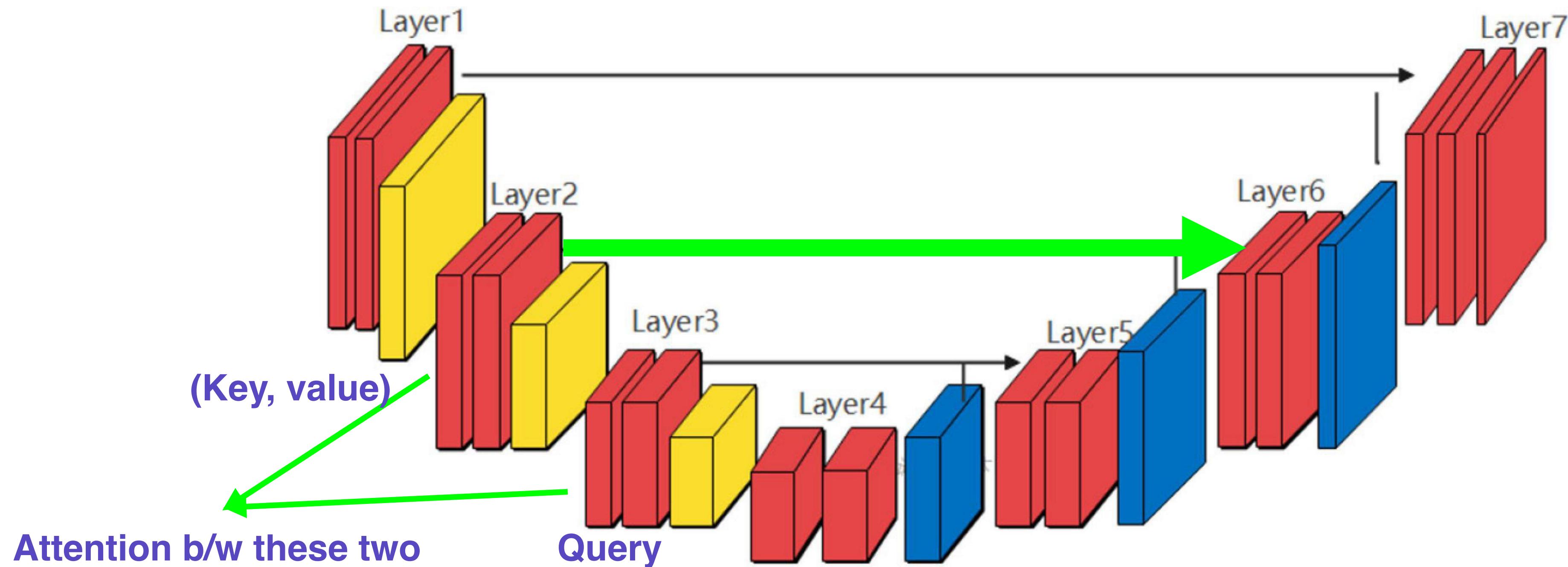


Attention Unet



- Skip connection helps with upsampling
- But also can bring redundant information
 - Counterproductive considering we wanted to extract important information

Attention Unet



- Skipconnect only the information that was useful when downsampling

COCO data format

- Common Objects in COntext
- Pretty common in object detection, instance segmentation...
- Contains - images, annotations, categories