專案9

語意切割:辨識腫瘤影像

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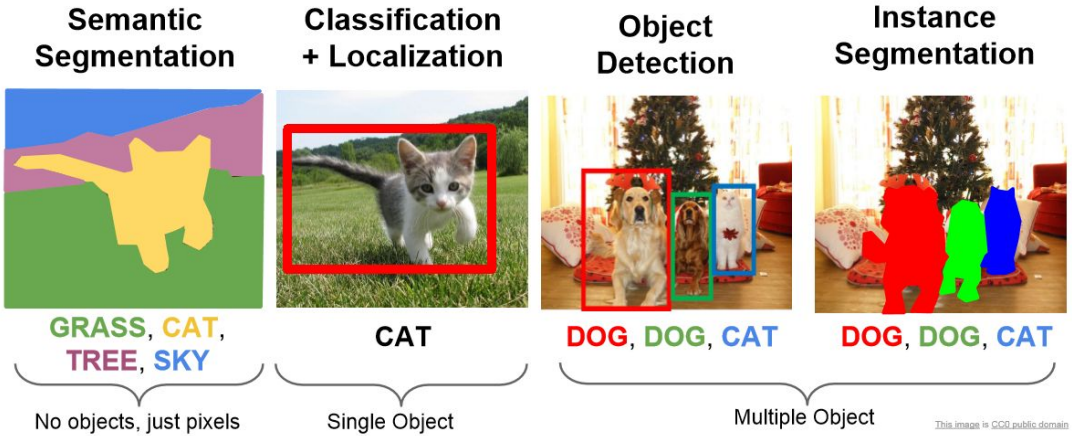
CV Tasks

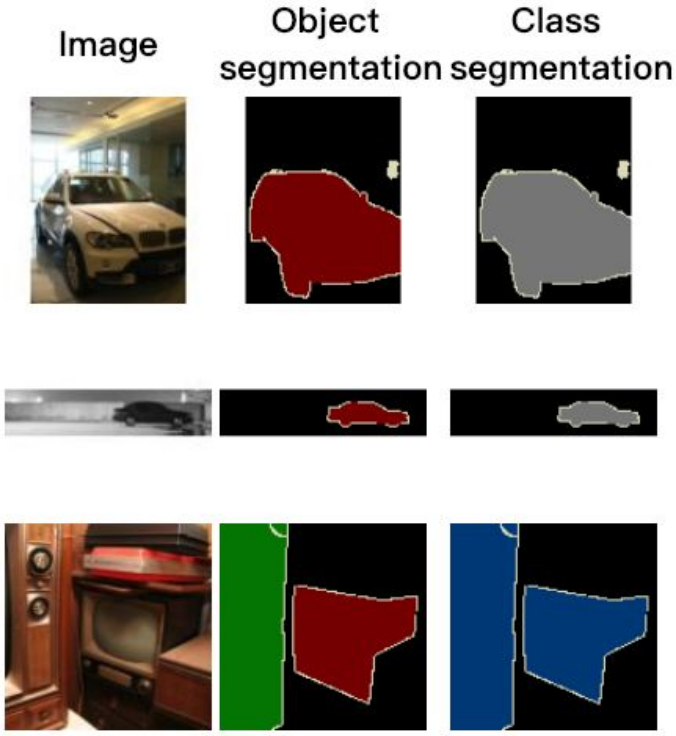
- Classification
- Object Detection
- Semantic (Class) Segmentation
- Instance (Object) Segmentation



source

PASCAL VOC Dataset

- *Person:* person
- *Animal:* bird, cat, cow, dog, horse, sheep
- *Vehicle:* aeroplane, bicycle, boat, bus, car, motorbike, train
- *Indoor:* bottle, chair, dining table, potted plant, sofa, tv/monitor



Miscrosoft COCO Dataset

COCO is a large-scale object detection, segmentation, and captioning dataset. COCO has several features:

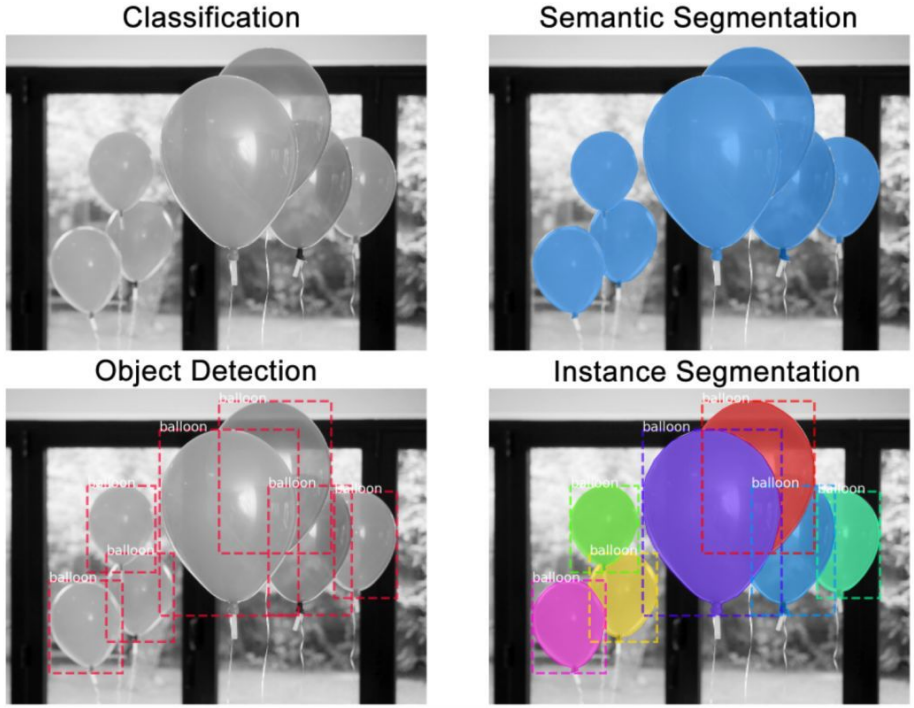
- Object segmentation
- Recognition in context
- Superpixel stuff segmentation
- 330K images (>200K labeled)
- 1.5 million object instances
- 80 object categories
- 91 stuff categories
- 5 captions per image
- 250,000 people with keypoints

Example

a group of people sitting at a dinner table together.
an image of a group of people gathered at a restaurant to eat
people sit at a long table in a restaurant.
a group of people finishing a meal in a restaurant dining room.
a group of people are gathered at a table.

CV Tasks

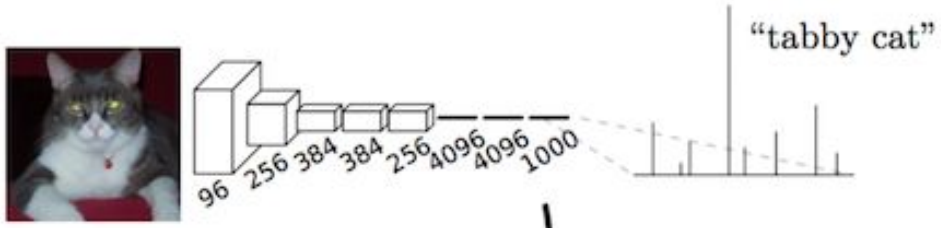
1. Classification
2. Object Detection
3. **Segmentation**
   - Fully Convolutional Network
   - U-Net



Fully Convolutional Network (FCN)

Fully connected -> Convolutional

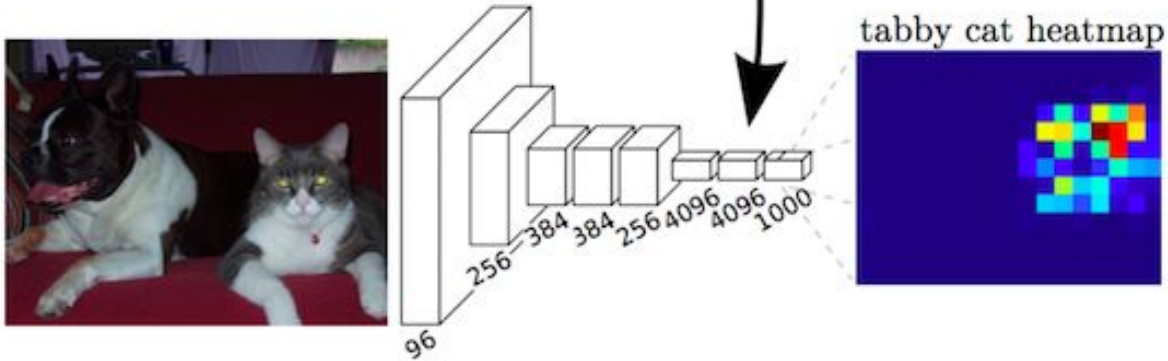
(256, 256, 3)



(1000,) -> (1, 1, **1000**)

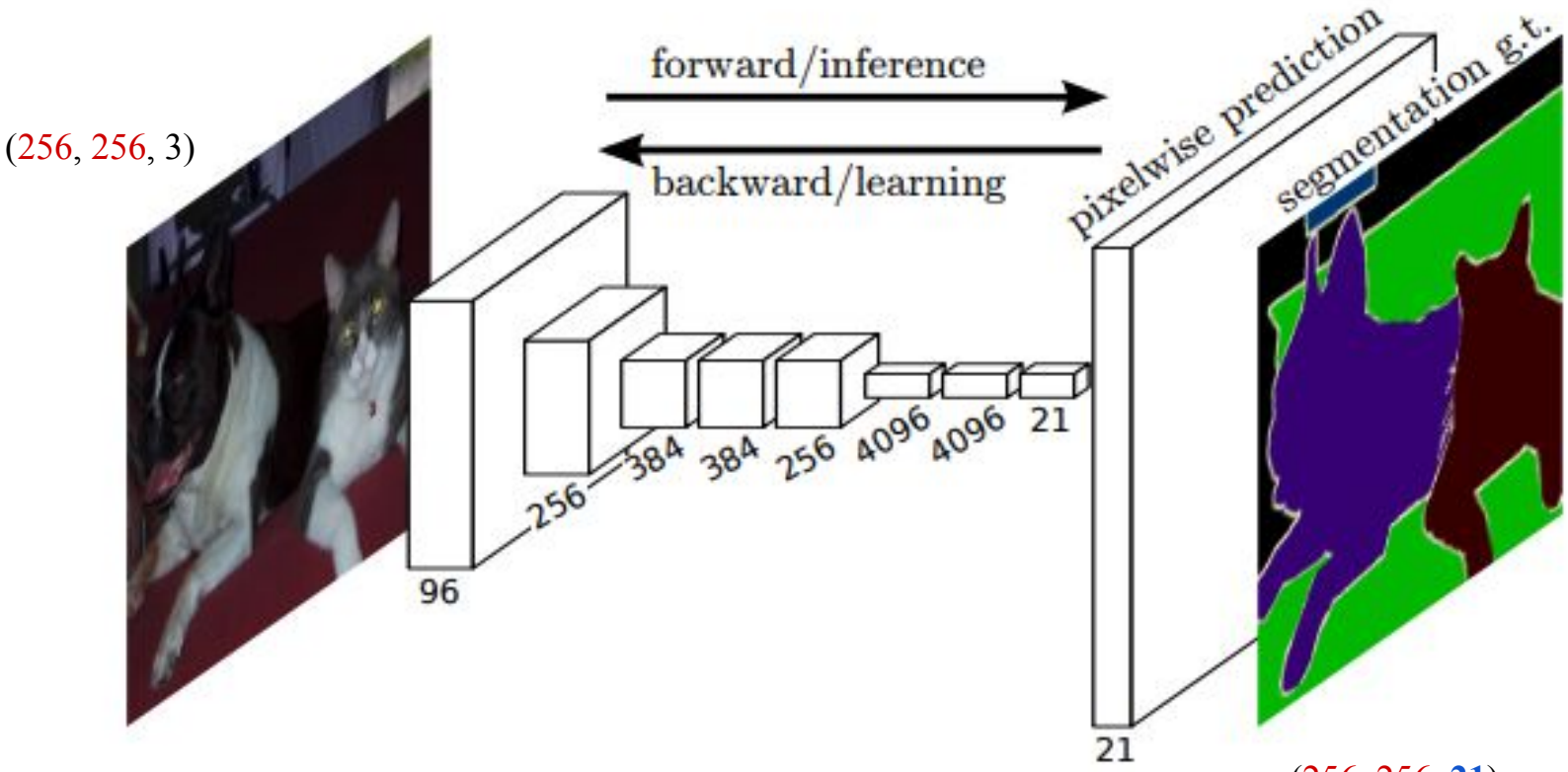
convolutionalization

(256, 256, 3)

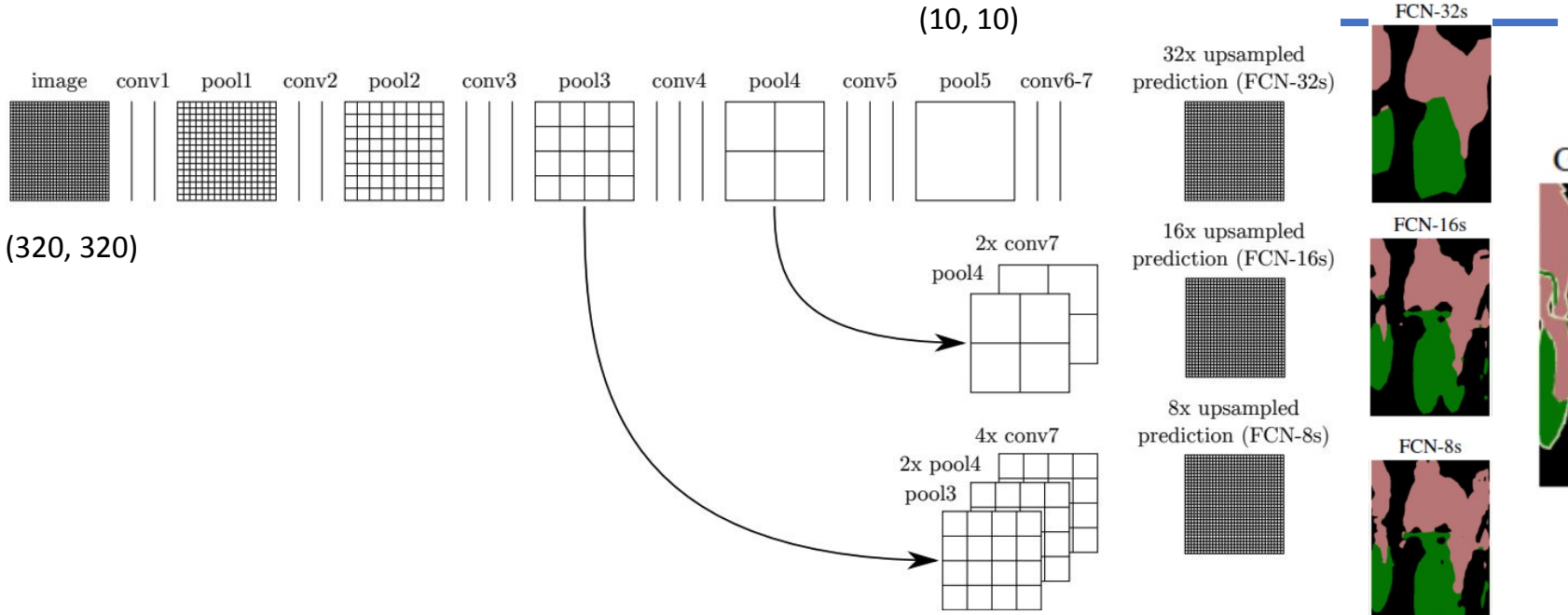


(16, 16, **1000**)

Fully Convolutional Network (FCN)

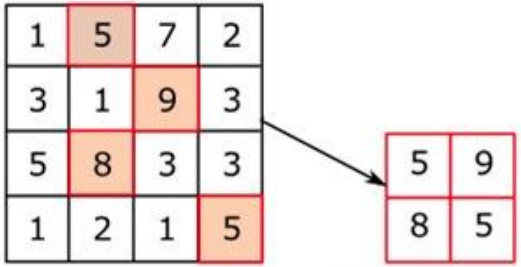


FCN

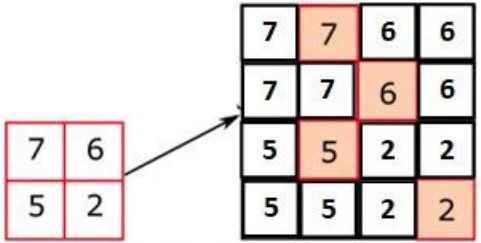


Upsampling, Transposed Convolution

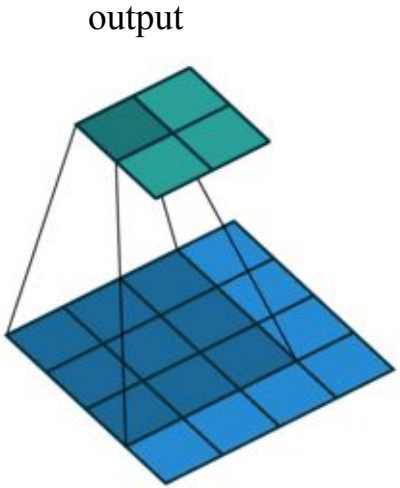
- Make feature maps larger!



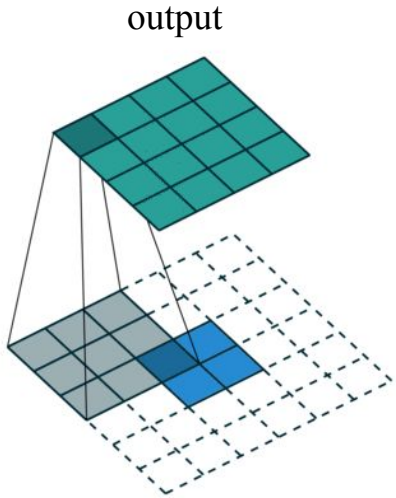
MaxPooling



UnSampling



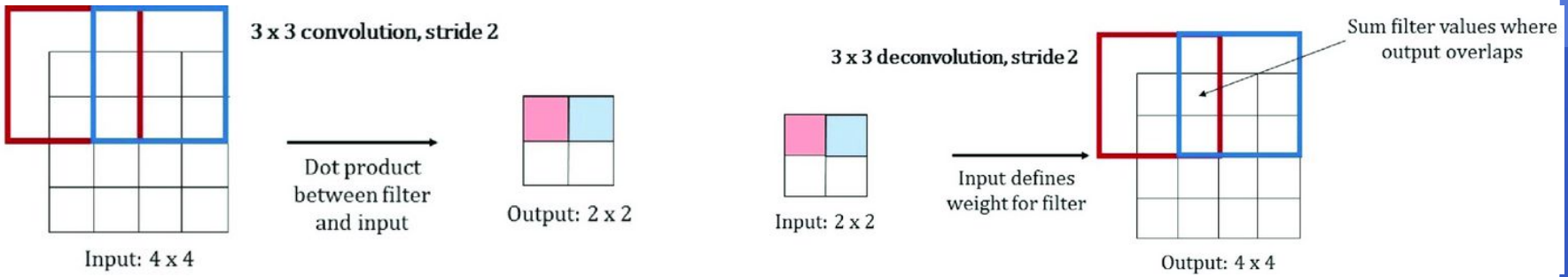
Convolution



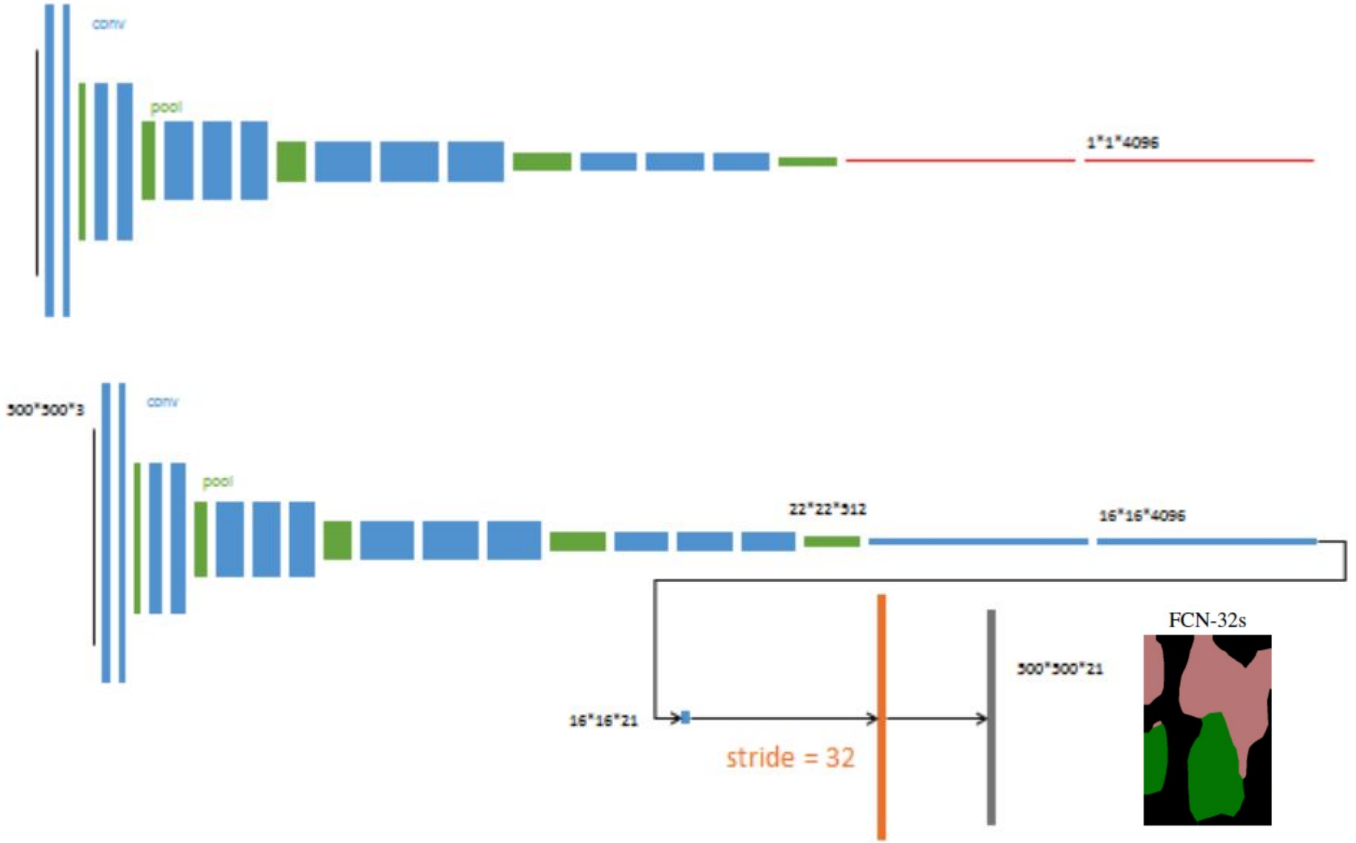
Transpose Convolution

Conv v.s Transpose Conv

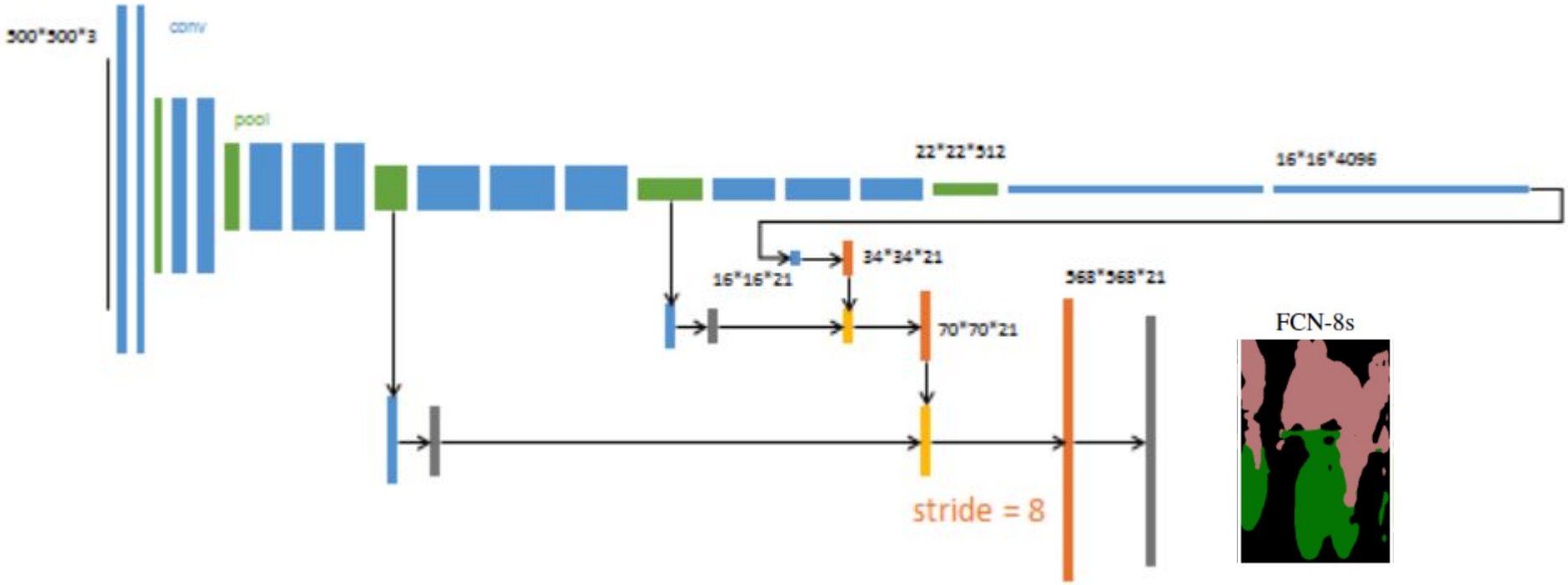
- **Learnable** Upsampling
- Other names
  - Deconvolution
  - Upconvolution
  - Fractionally strided convolution
  - Backward strided convolution



FCN

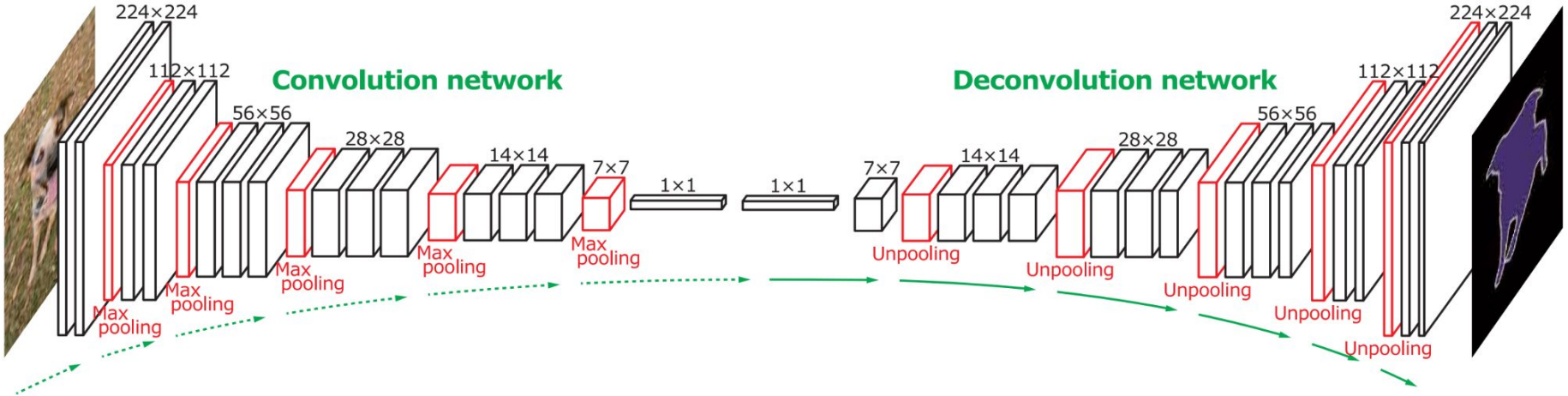

conv
pool
1*1*4096
300*300*3
conv
pool
22*22*512
16*16*4096
16*16*21
stride = 32
300*300*21
FCN-32s

FCN



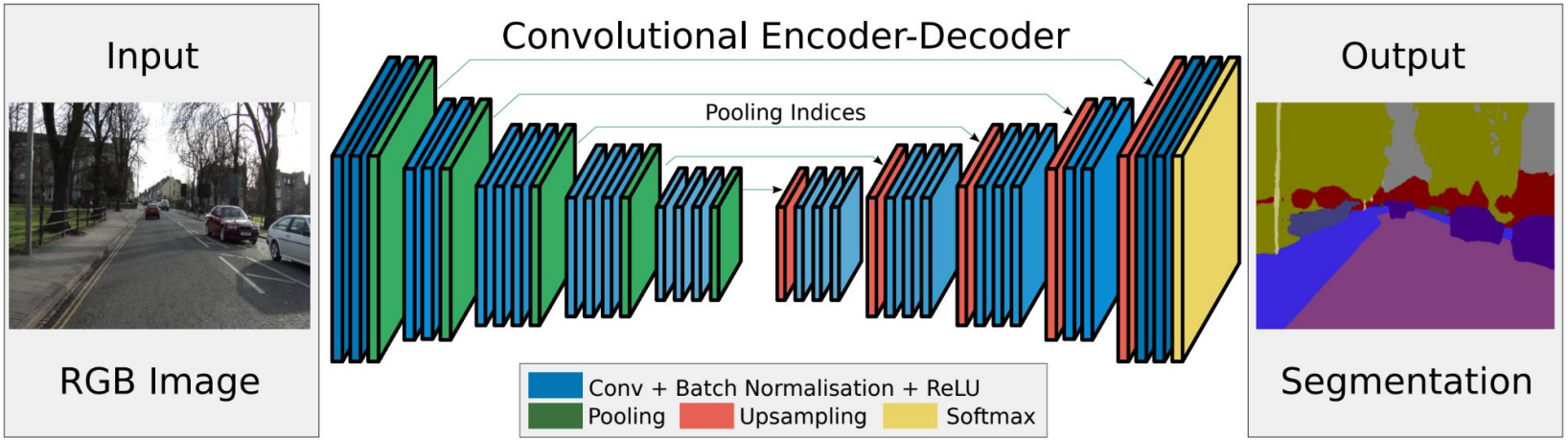
Encoder-Decoder

Learning Deconvolution Network for Semantic Segmentation 2015



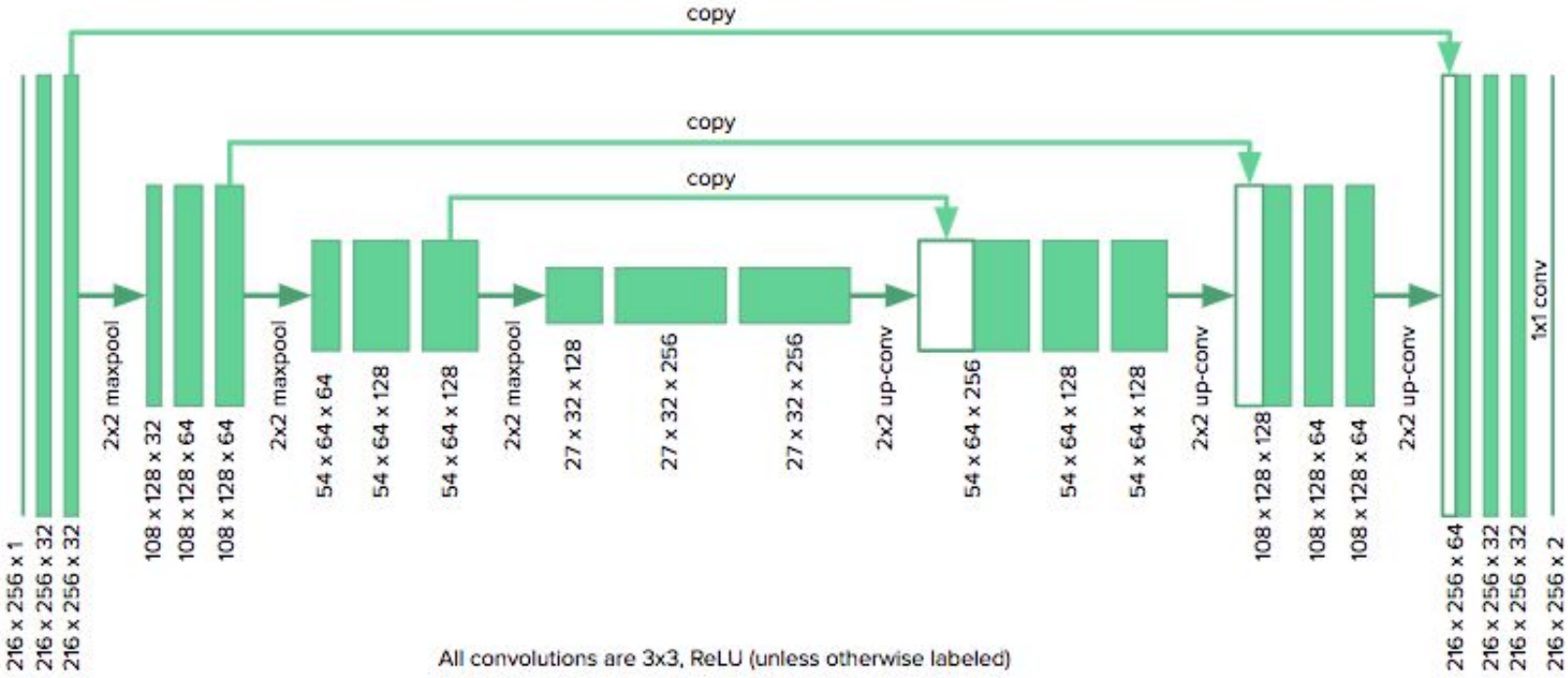
SegNet

SegNet: A Deep Convolutional Encoder-Decoder Architecture for Image Segmentation 2015

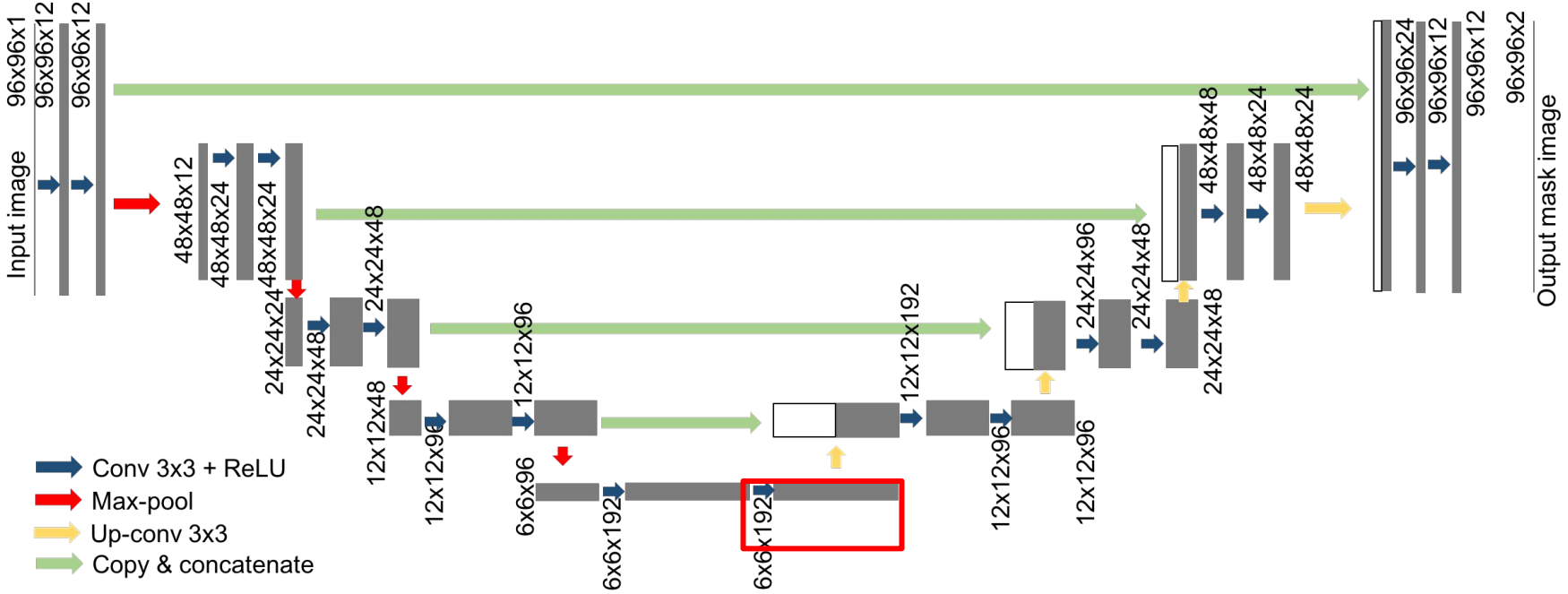


UNet

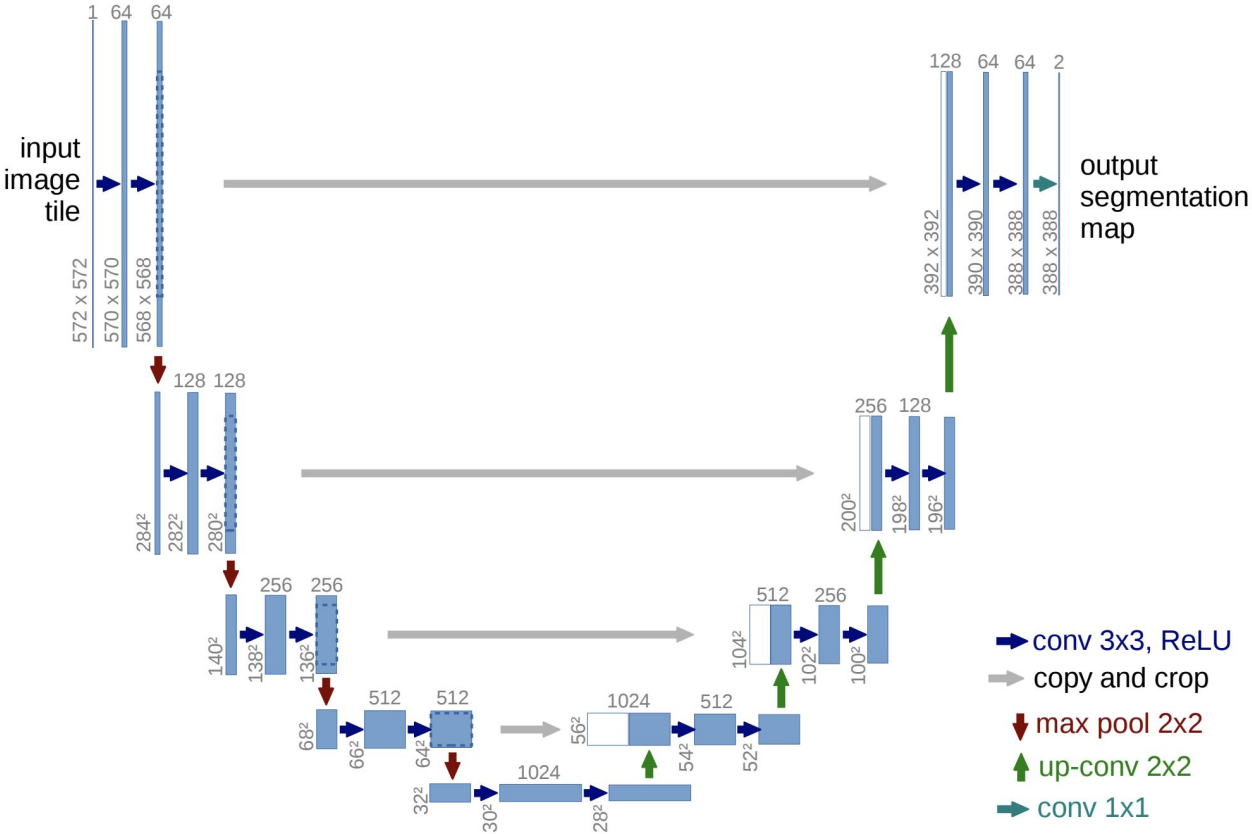
U-Net: Convolutional Networks for Biomedical Image Segmentation 2015



UNet



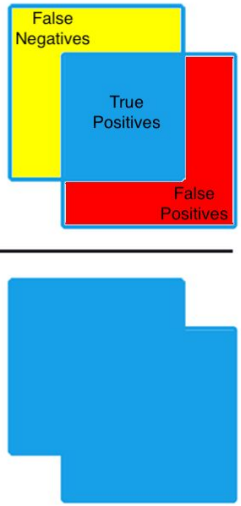
U-Net


input image tile
1
64
64
572 x 572
570 x 570
568 x 568
128
128
284²
282²
280²
256
256
140²
138²
136²
512
512
68²
66²
64²
1024
32²
30²
28²
512
256
104²
102²
100²
256
128
200²
198²
196²
128
64
64
2
392 x 392
390 x 390
388 x 388
388 x 388
output segmentation map
conv 3x3, ReLU
copy and crop
max pool 2x2
up-conv 2x2
conv 1x1

IoU & Dice coefficient

Intersectin over Union

$$IoU = \frac{\text{Area of Overlap}}{\text{Area of Union}}$$

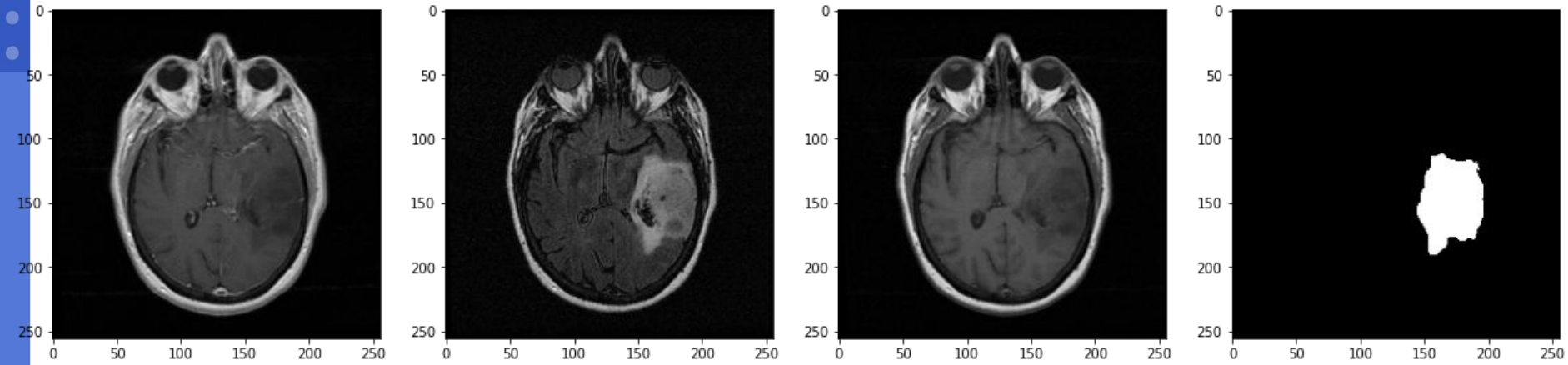


$$Dice = \frac{2 \times TP}{(TP + FP) + (TP + FN)}$$

$$\frac{2 * |X \cap Y|}{|X| + |Y|}$$

Ex: Brain Tumor Segmentation

brain_tumor_segmentation.ipynb



Label Tool: LabelMe

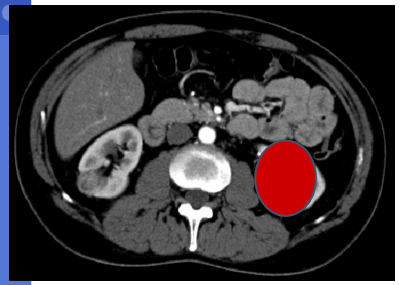
https://github.com/wkentaro/labelme

(Installed by ***Anaconda***)

```
# create new environment for 1st time only
conda create --name=labelme python=3.6
# activate environment
conda activate labelme
pip install pyqt5
pip install labelme
# run LabelMe
labelme
```

demo: https://youtu.be/PoQ2IgMemao

Annotation Process



(256, 256, 1)

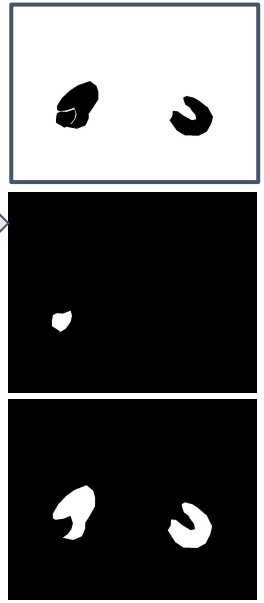
annotation tool


```
{
  "version": "4.2.10",
  "flags": {},
  "shapes": [
    {
      "label": "kidney",
      "points": [
        [
          722.1968503937007,
          397.98425196850394
        ],
        [
          729.2834645669291,
          415.3070866141732
        ],
        [
          748.1811023622047,
          427.11811023622045
        ],
        [
```


annotation file

convert

(256, 256, 3)
1 mask per class
ex: background, tumor, kidney



HW: Retina Vesssel Segmentation

https://www.kaggle.com/c/sai-vessel-segmentation/