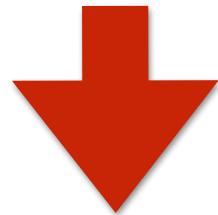
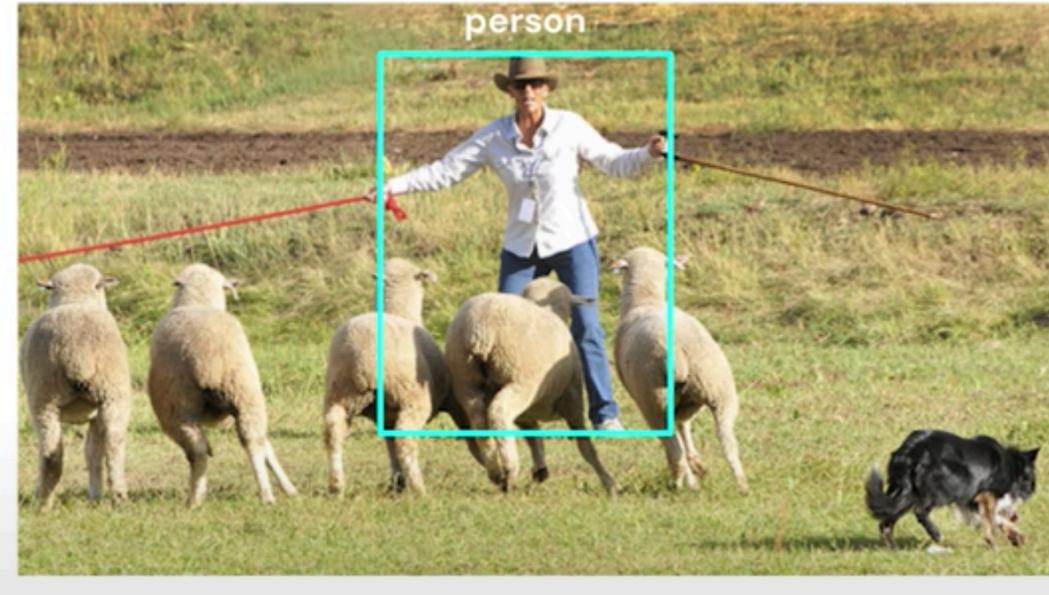
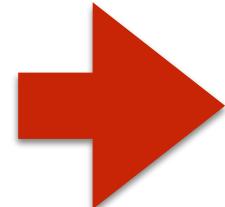


LET'S GO A STEP FURTHER INTO SEMANTIC SEGMENTATION



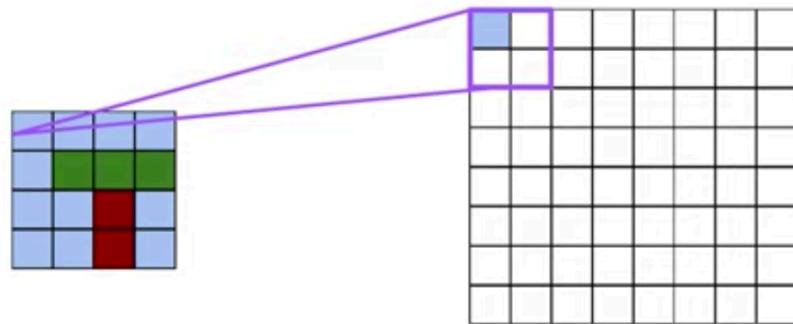
BOUNDING BOXES
ARE NOT ALWAYS
GOOD
REPRESENTATIONS



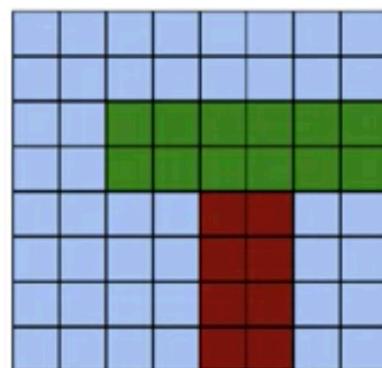
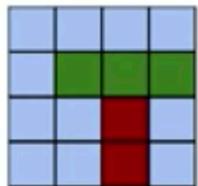
semantic segmentation



UNPOOLING OPERATION (INVERSE OF POOLING)



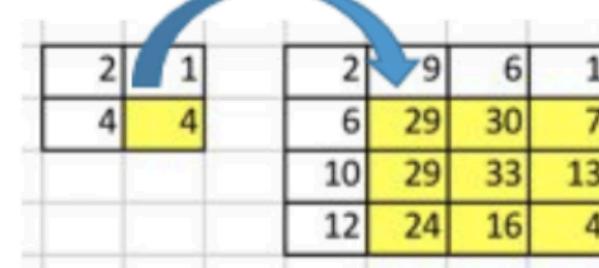
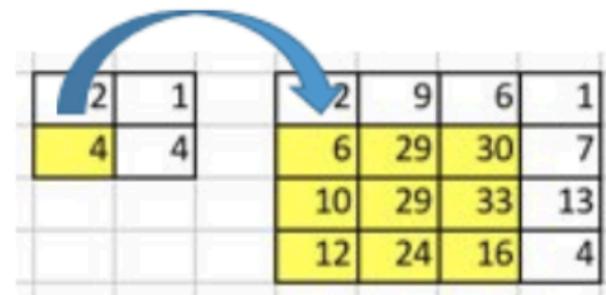
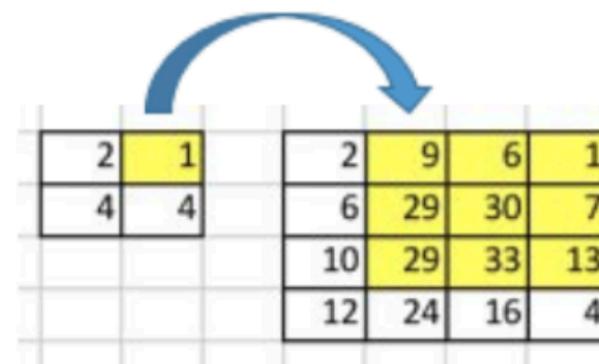
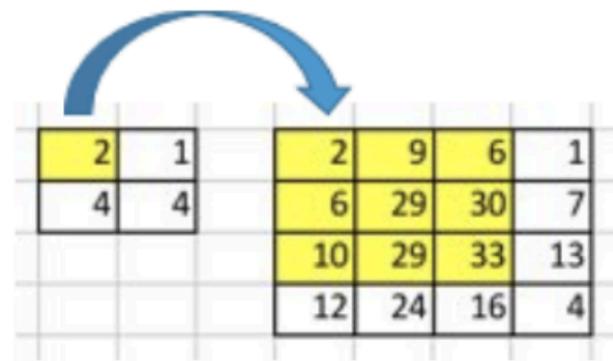
COPY PIXELS IN A
GIVEN WINDOW



GENERATES
LARGER IMAGES
FROM SMALLER
ONES

TRANSPOSED CONVOLUTION

ALLOWS TO INCREASE THE SIZE



Going Backward of Convolution

EXAMPLE TAKEN FROM HERE

CONVOLUTION MATRIX

	0	1	2
0	1	4	1
1	1	4	3
2	3	3	1

Kernel (3, 3)

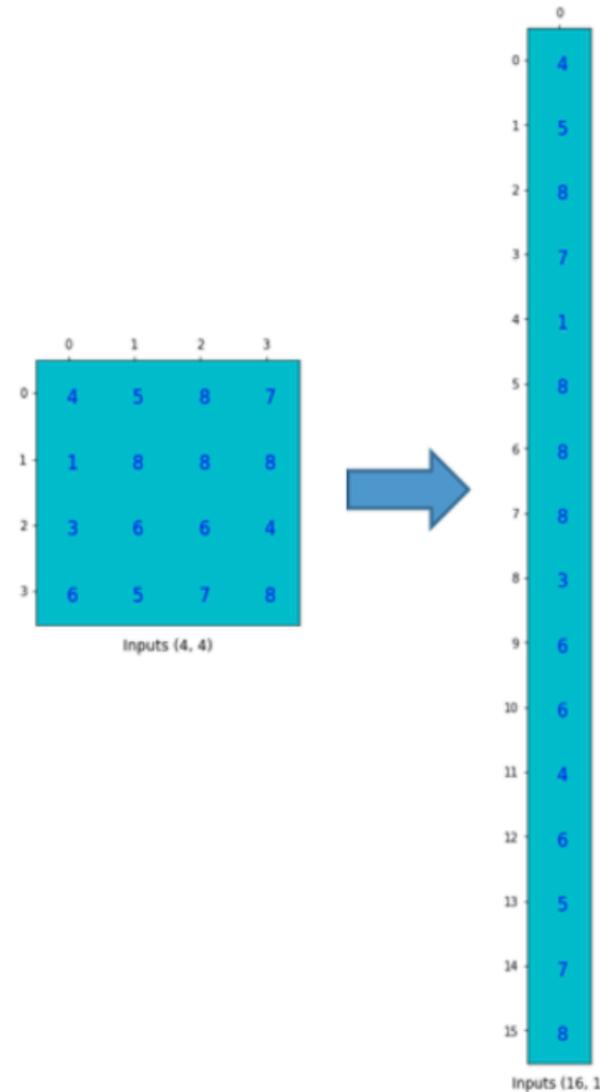
THE KERNEL CAN BE ARRANGED IN FORM OF A MATRIX:

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	4	1	0	1	4	3	0	3	3	1	0	0	0	0	0
1	0	1	4	1	0	1	4	3	0	3	3	1	0	0	0	0
2	0	0	0	0	1	4	1	0	1	4	3	0	3	3	1	0
3	0	0	0	0	0	1	4	1	0	1	4	3	0	3	3	1

Convolution Matrix (4, 16)

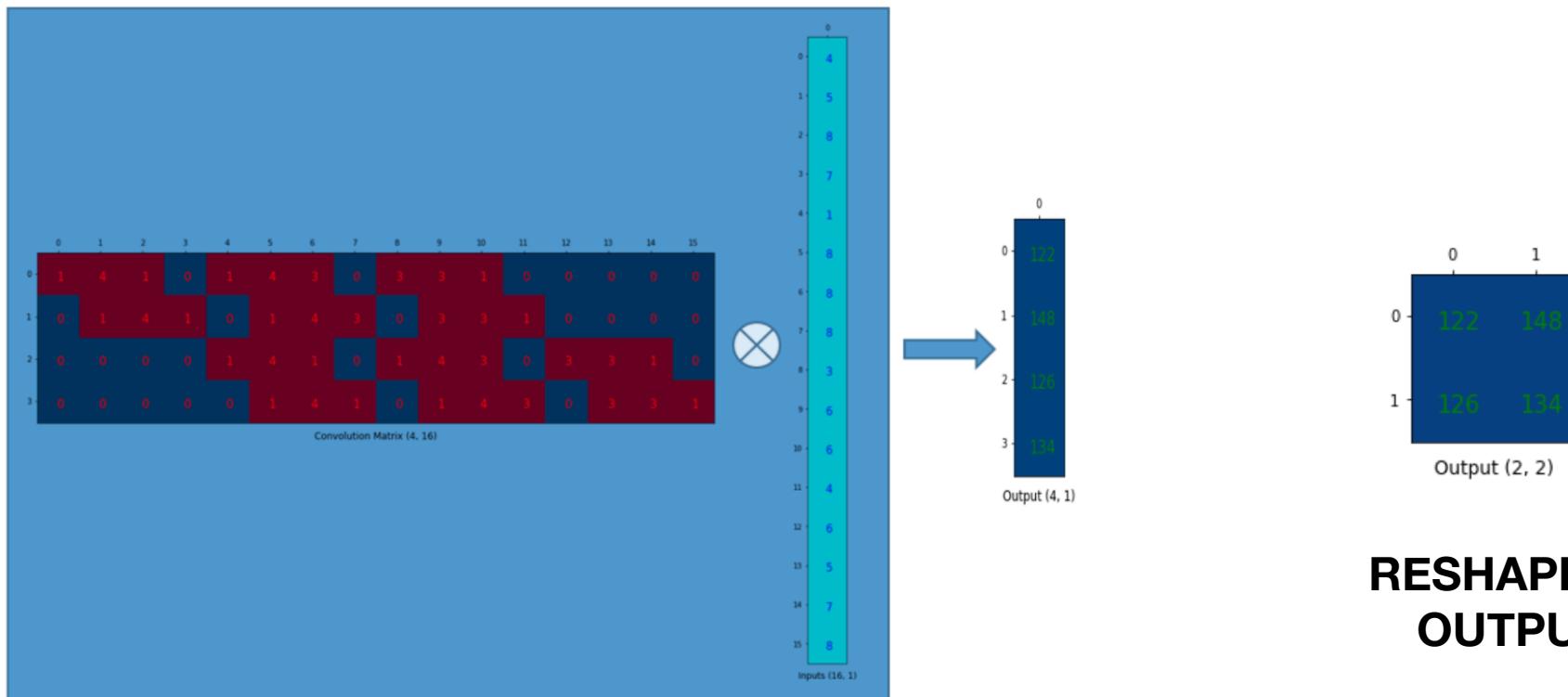
EXAMPLE TAKEN FROM HERE

THE INPUT IS FLATTENED INTO A COLUMN VECTOR



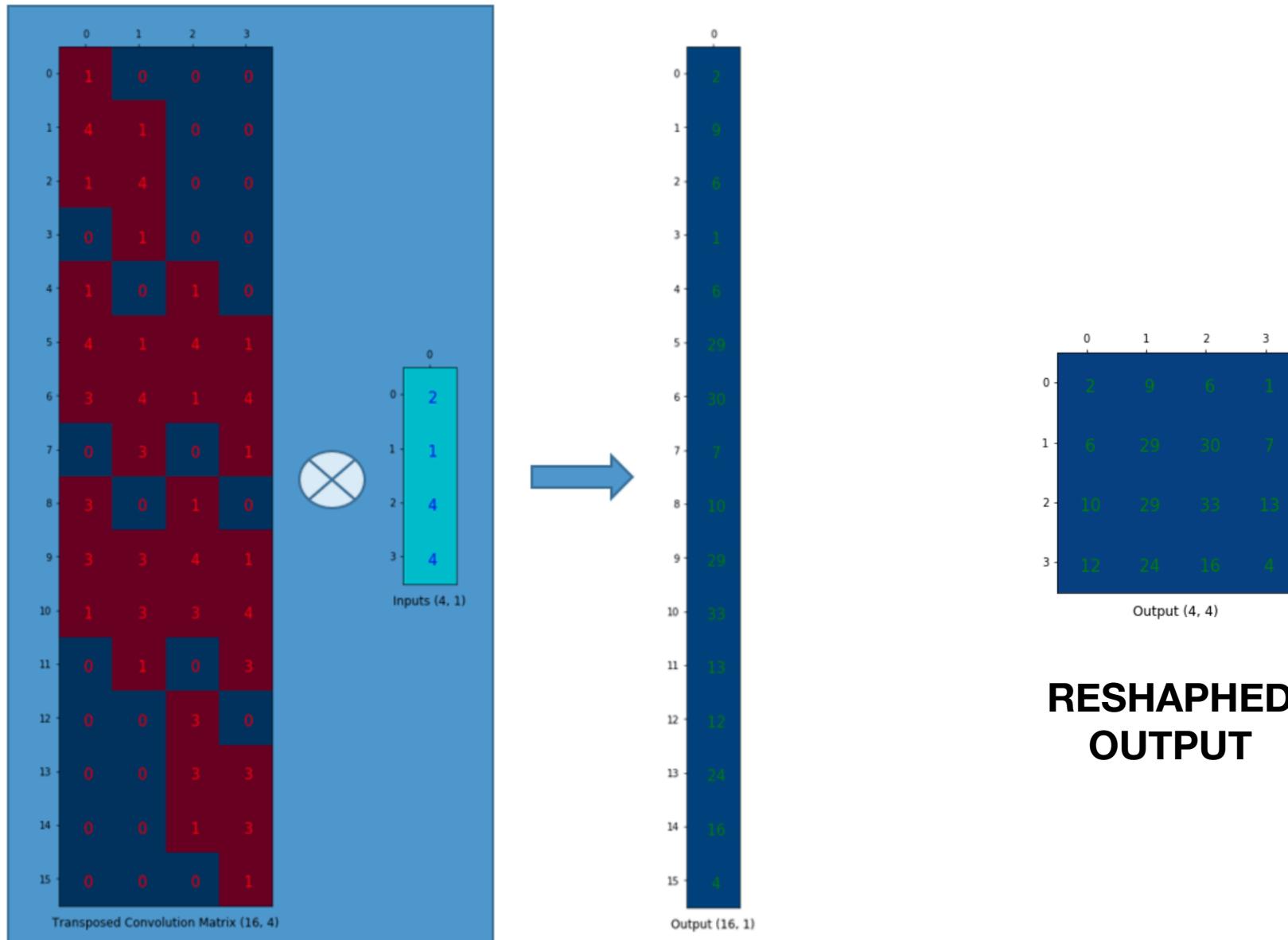
EXAMPLE TAKEN FROM HERE

THE CONVOLUTION IS TRANSFORMED INTO A PRODUCT OF MATRICES



EXAMPLE TAKEN FROM HERE

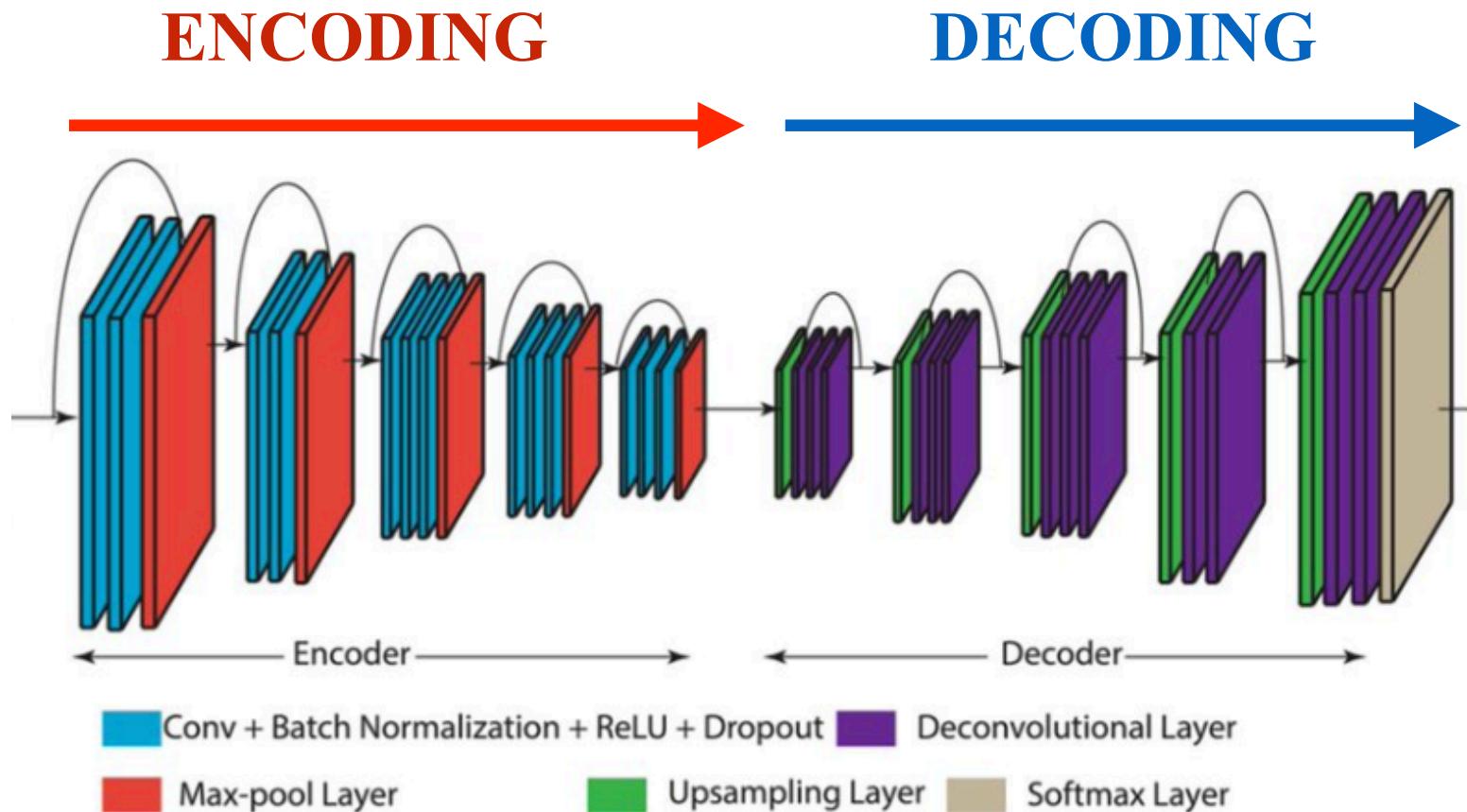
THE TRANSPOSED CONVOLUTION IS THE INVERSE OPERATION



**RESHAPED
OUTPUT**

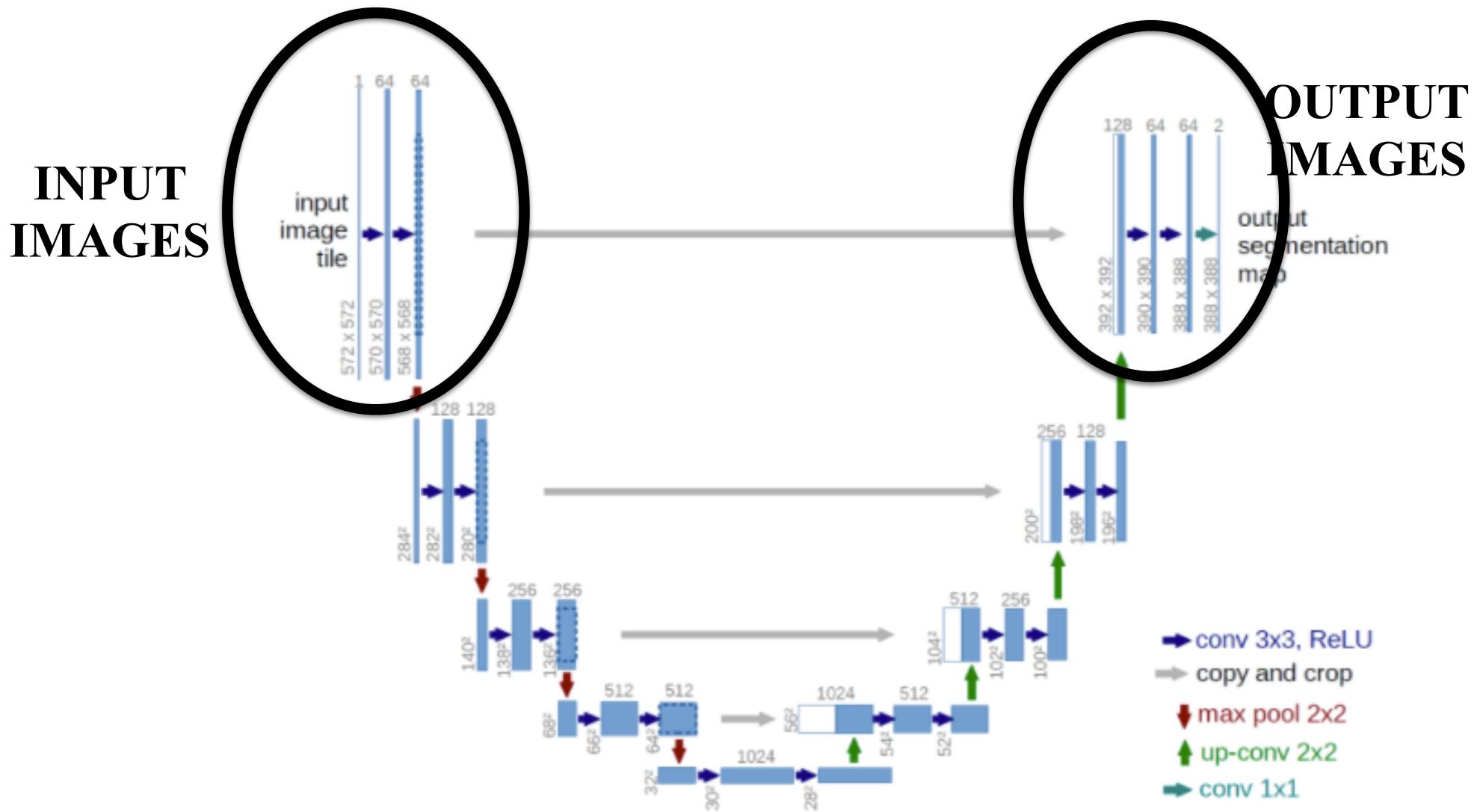
EXAMPLE TAKEN FROM HERE

ENCODER-DECODERS GO FROM IMAGE 2 IMAGE

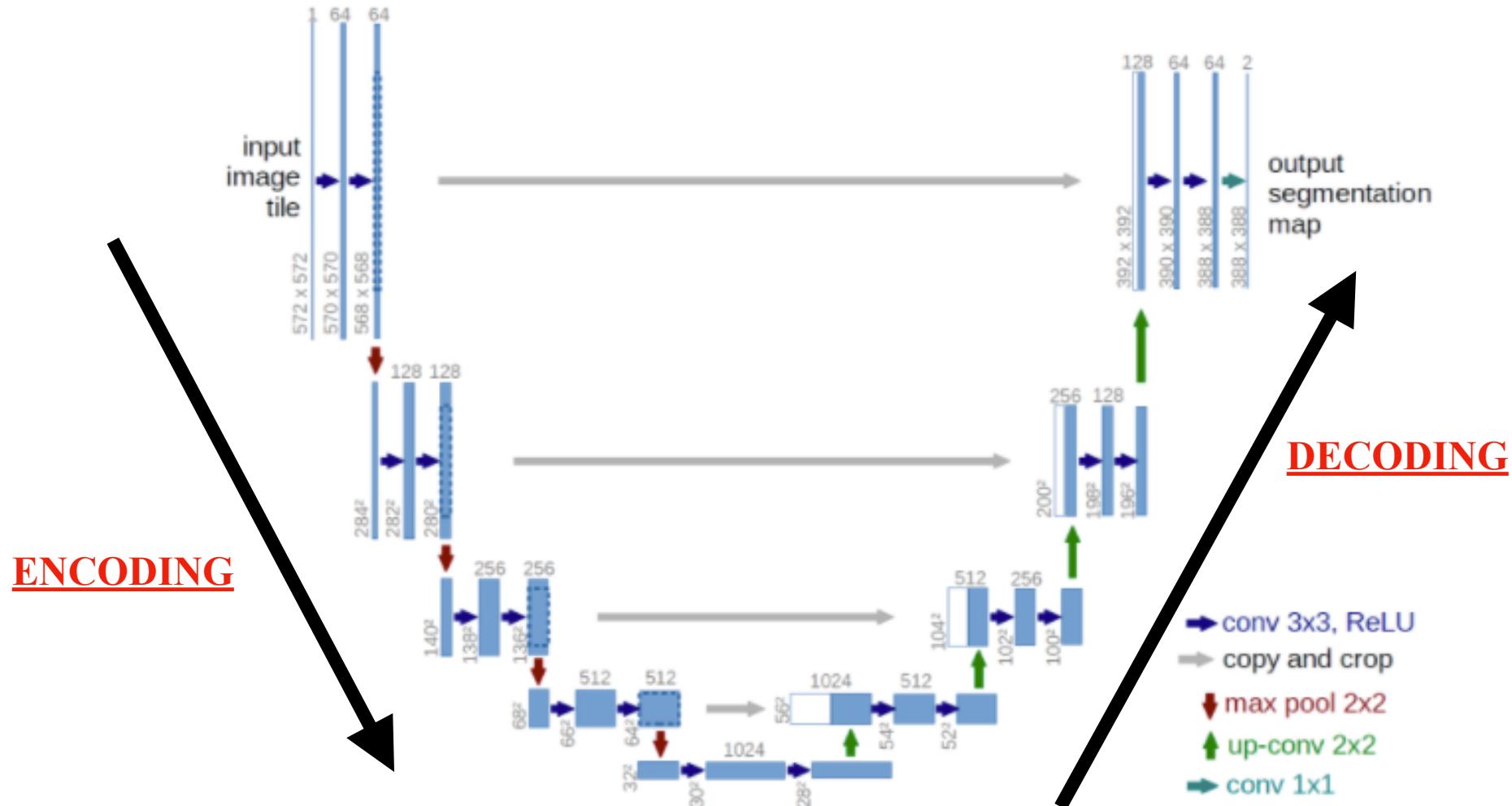


WE CALL THIS FULLY CONVOLUTIONAL
NEURAL NETWORKS

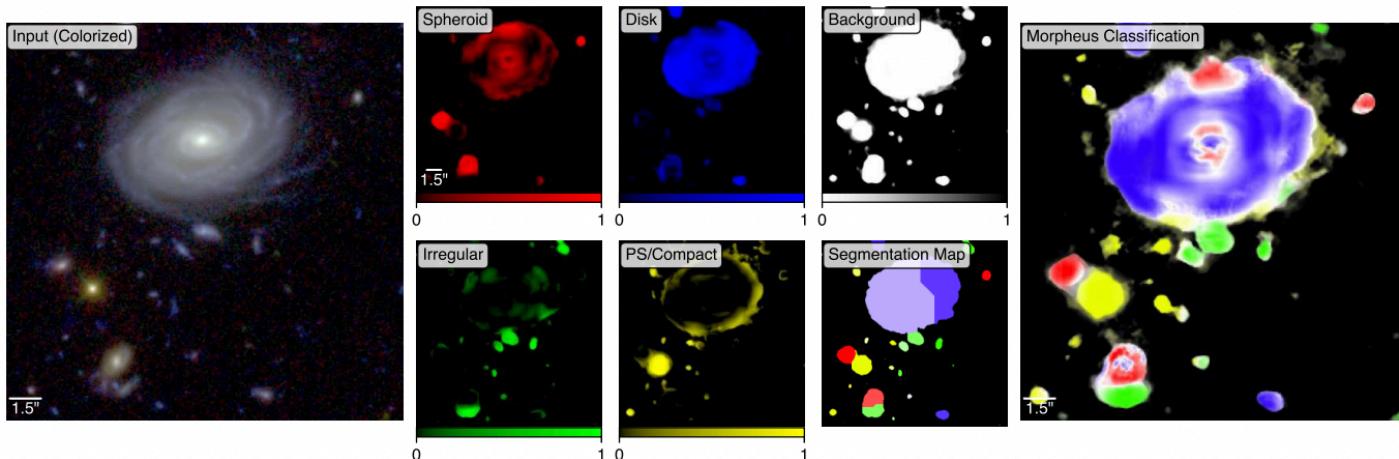
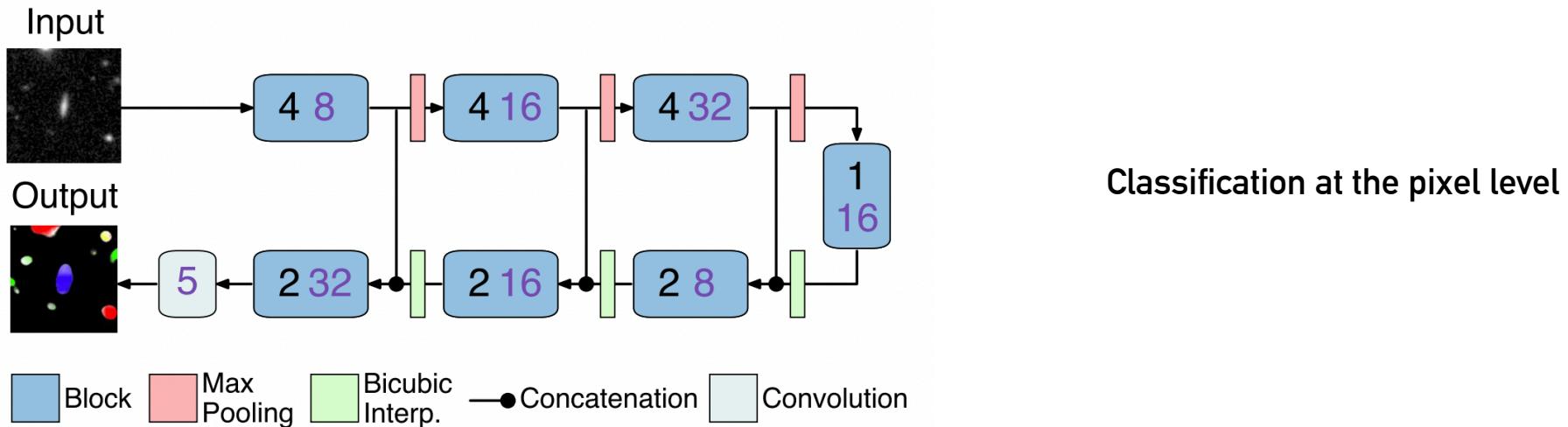
ENCODING-DECODING TO EXTRACT IMAGE FEATURES: U-NET



ENCODING-DECODING TO EXTRACT IMAGE FEATURES: THE U-NET

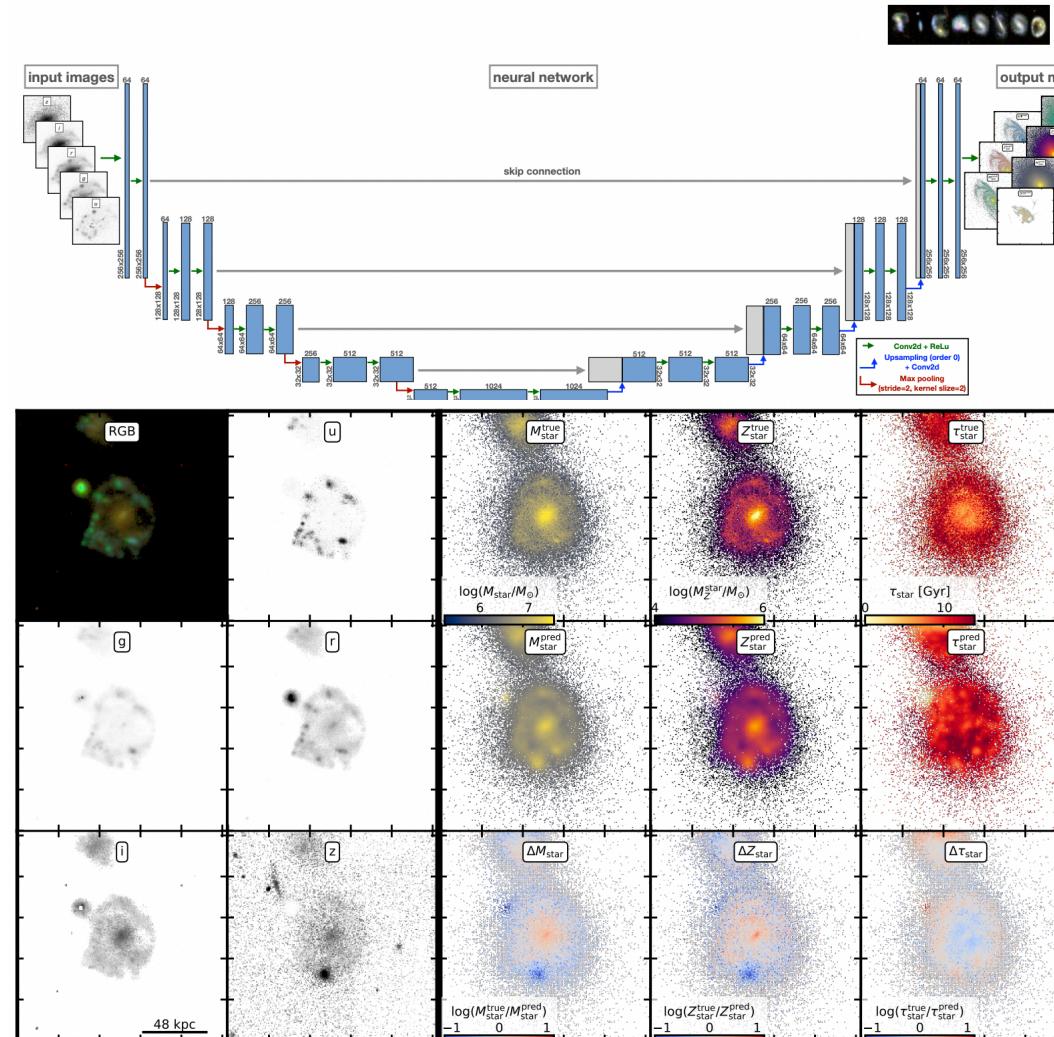


2. Segmentation



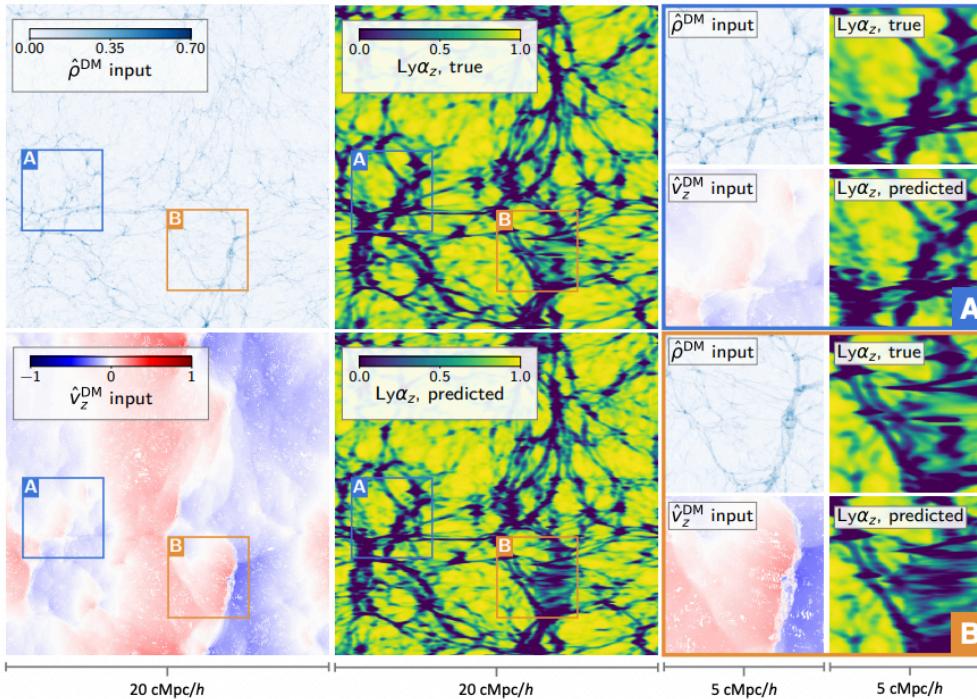
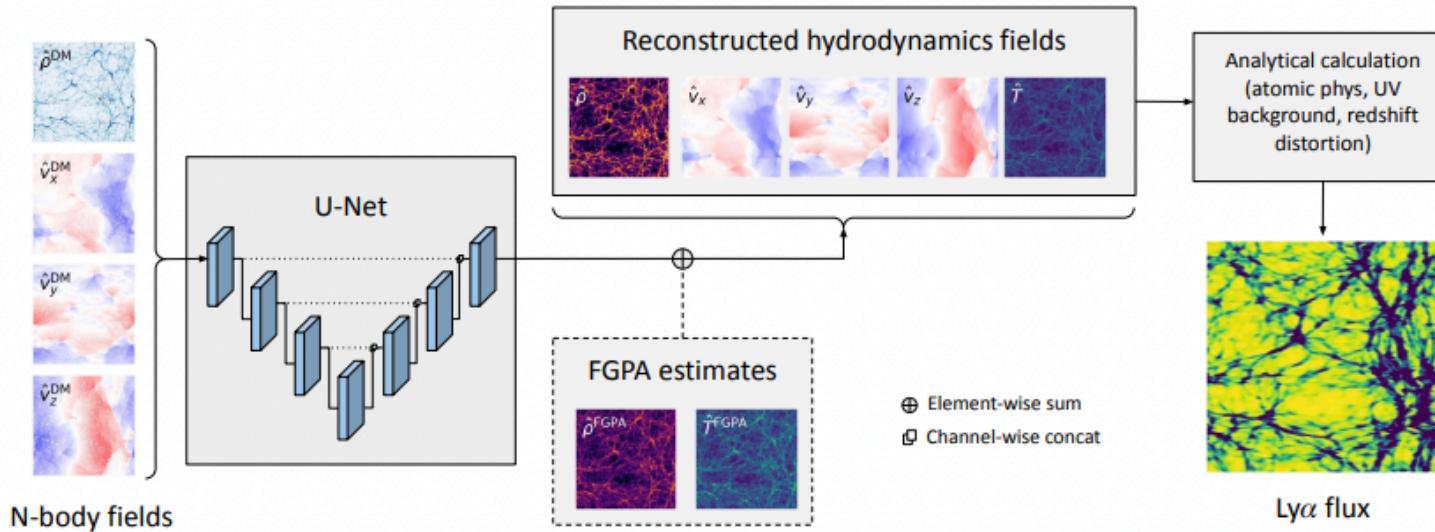
Hausen+20

Stellar Populations



Buck+21

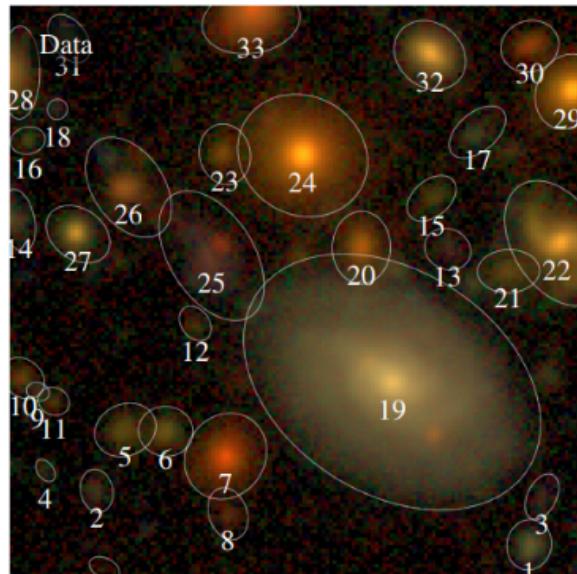
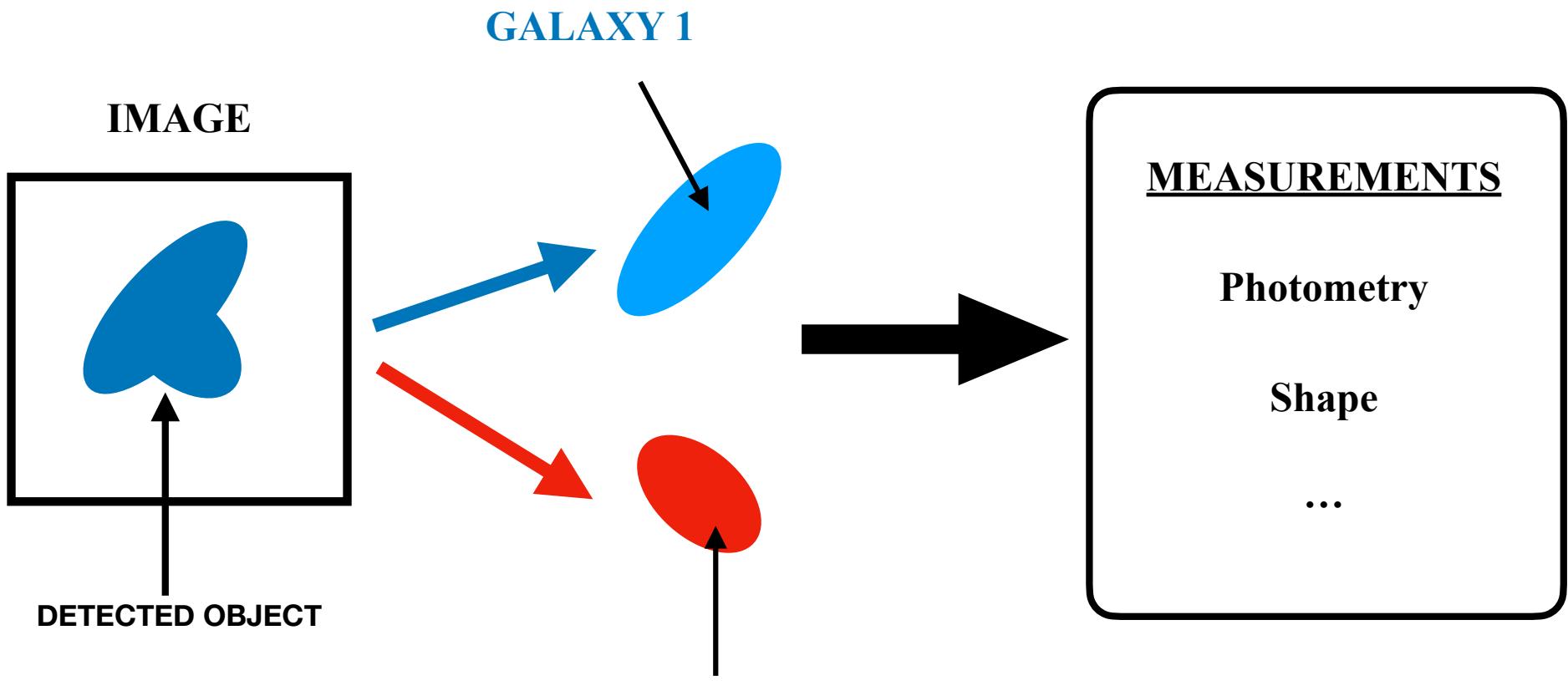
Painting Baryons



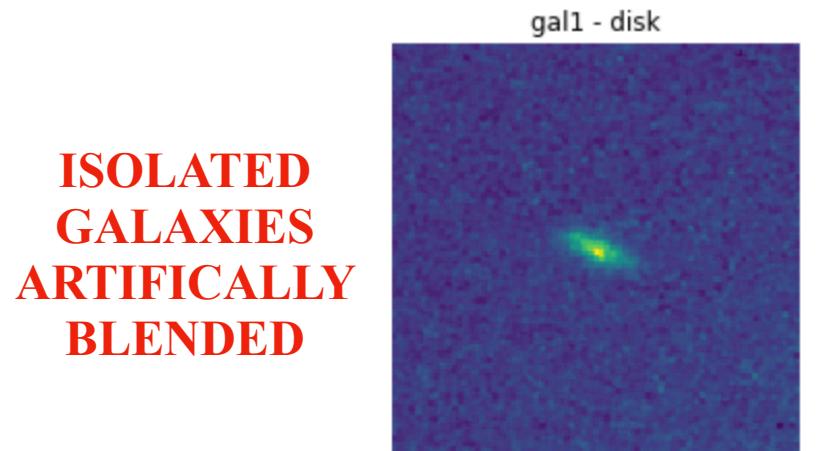
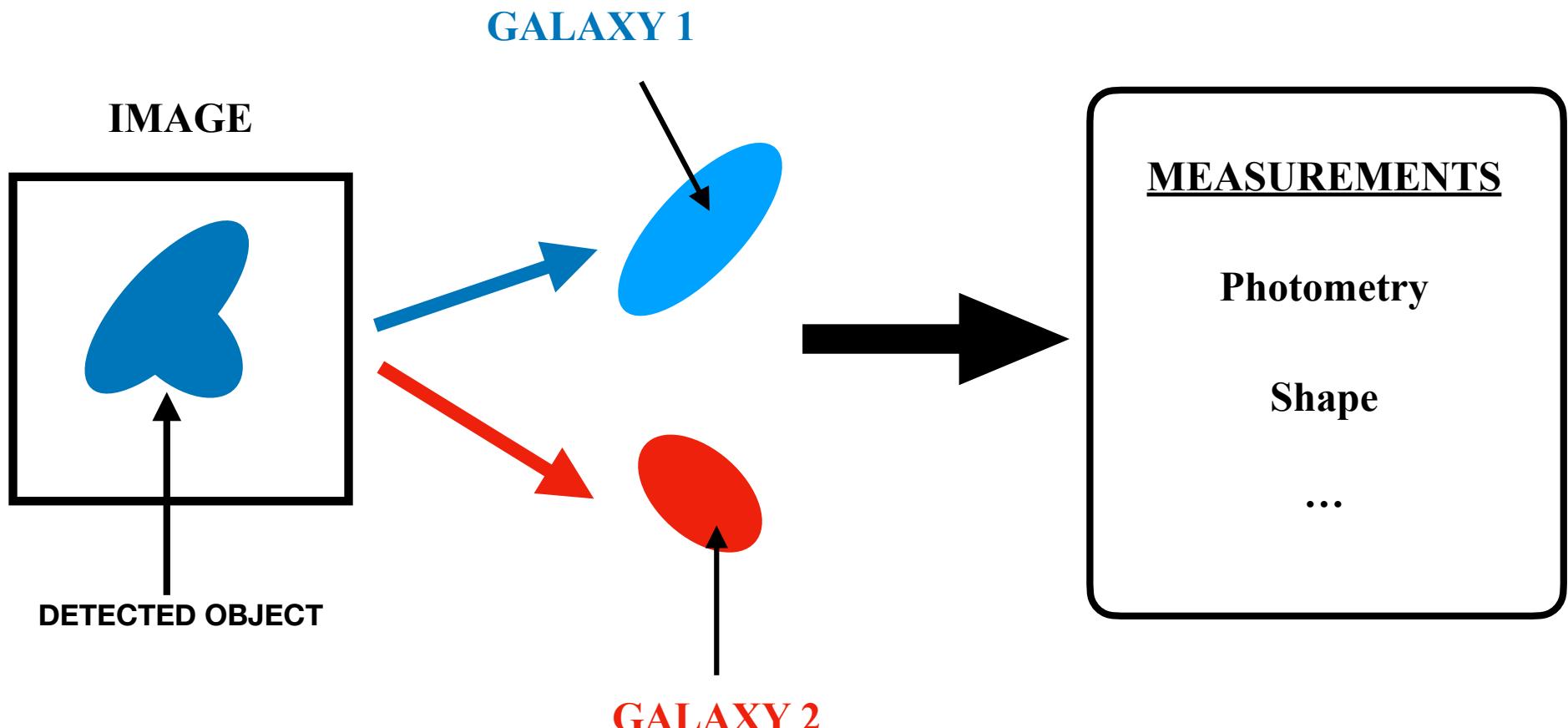
Harrington+21

Neural Networks are used to learn the non-linear mapping between cheap dark matter only simulations to expensive baryonic physics

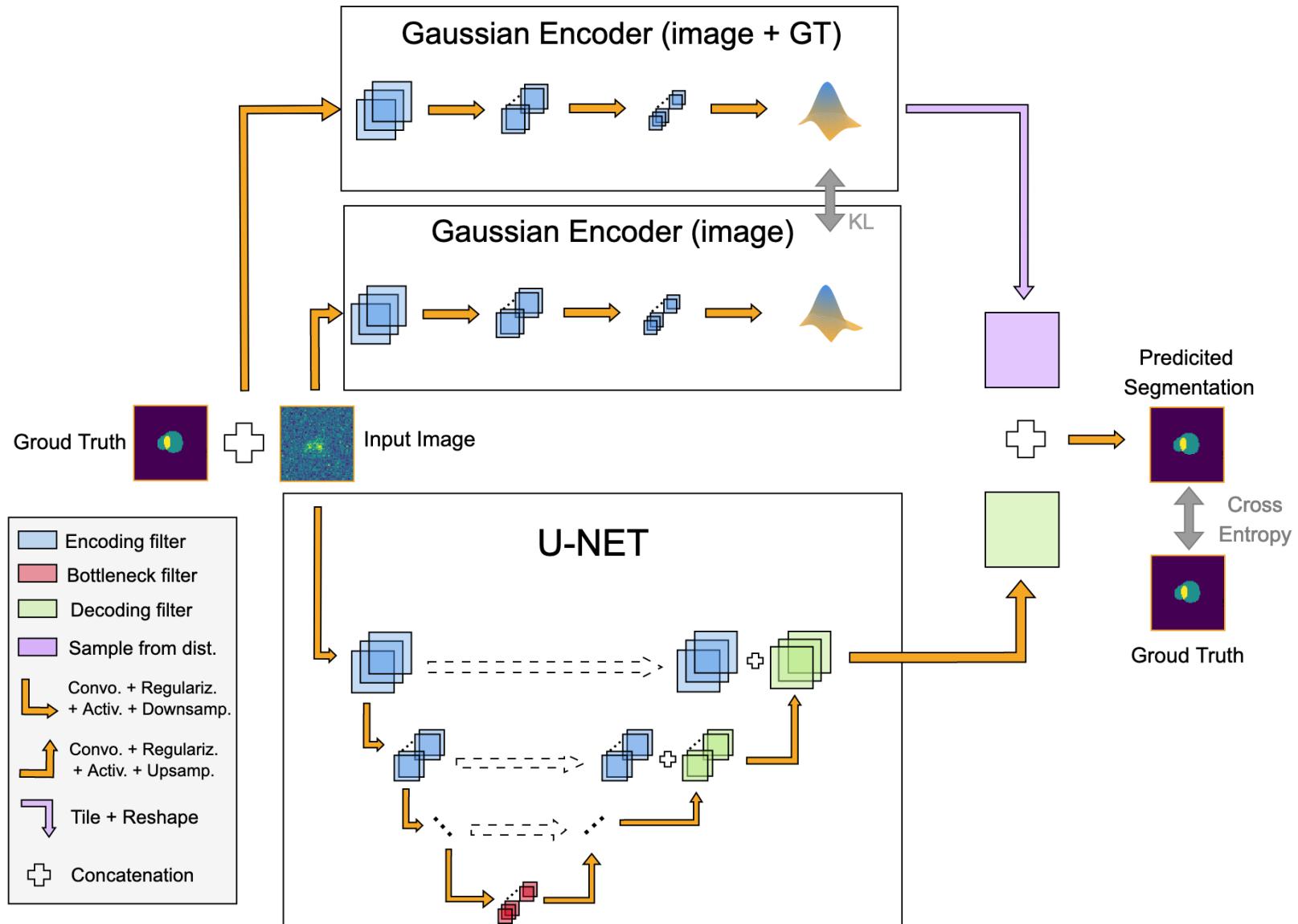
Rodriguez+19, Modi+18, Berger+18, He+18, Zhang+19, Troster+19, Zamudio-Fernandez+19, Perraudin+19, Charnock+19, List+19, Giusarma+19, Bernardini+19, Chardin+19, Mustafa+19, Ramanah+20, Tamasiunas+20, Feder+20, Moster+20, Thiele+20, Wadekar+20, Dai+20, Li+20, Lucie-Smith+20, Kasmanoff+20, Ni+21, Rouhaiainen+21, Harrington+21, Horowitz+21, Horowitz+21, Bernardini+21, Schaurecker+21, Etezad-Razavi+21, Curtis+21



>50% of objects will be affected by blending in future deep surveys such as LSST



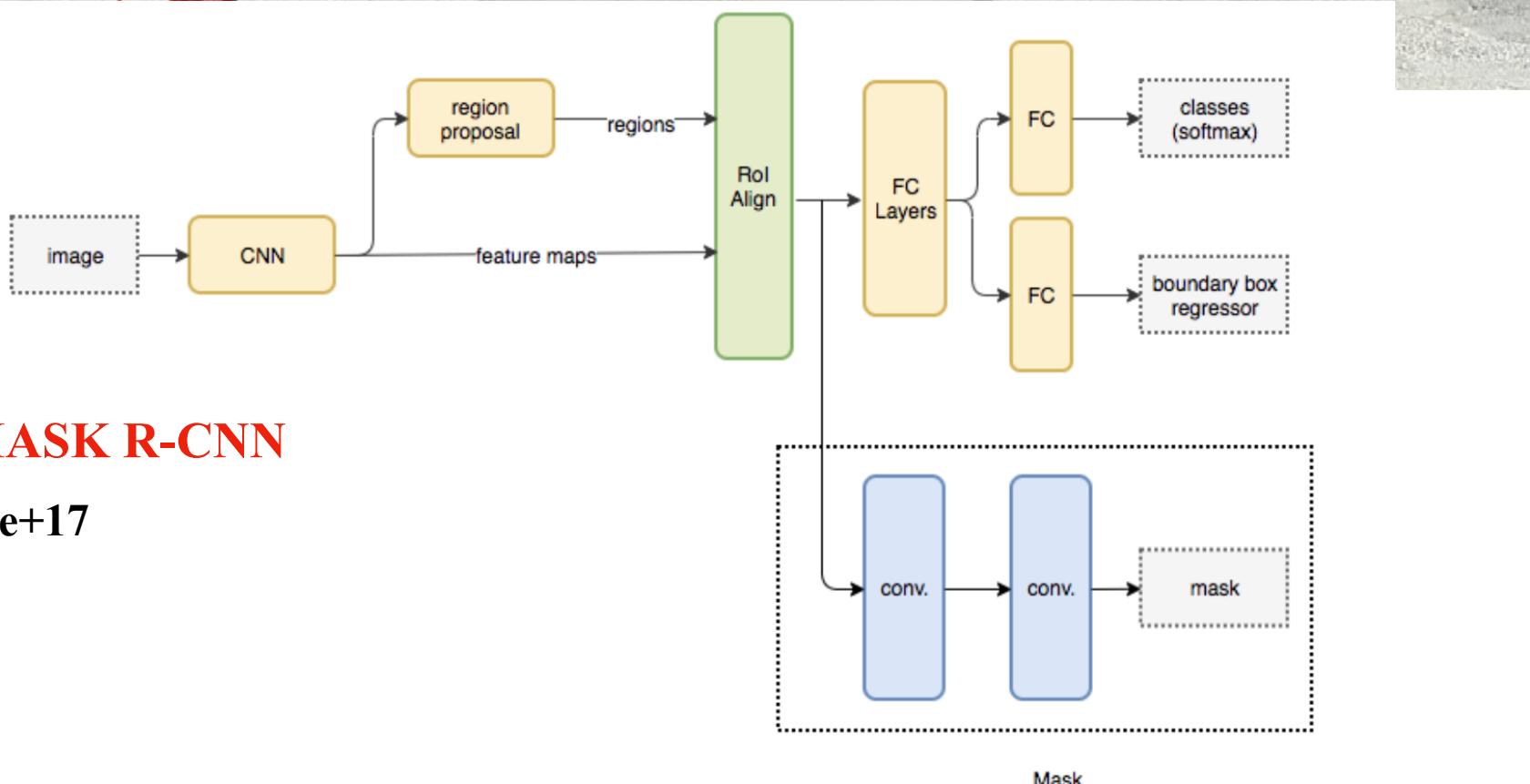
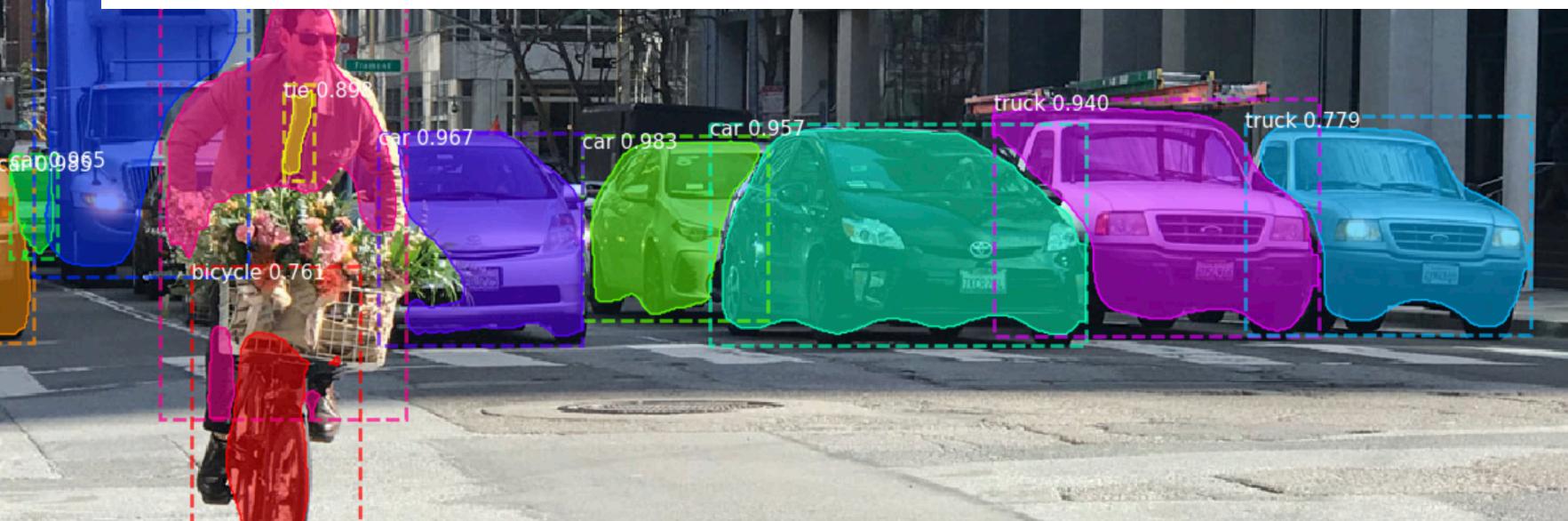
PROBABILISTIC U-NET



instance segmentation



SIMULTANEOUS DETECTION + SEGMENTATION + CLASSIFICATION



MASK R-CNN

He+17