Semantic Segmentation

PIRL, POSTECH

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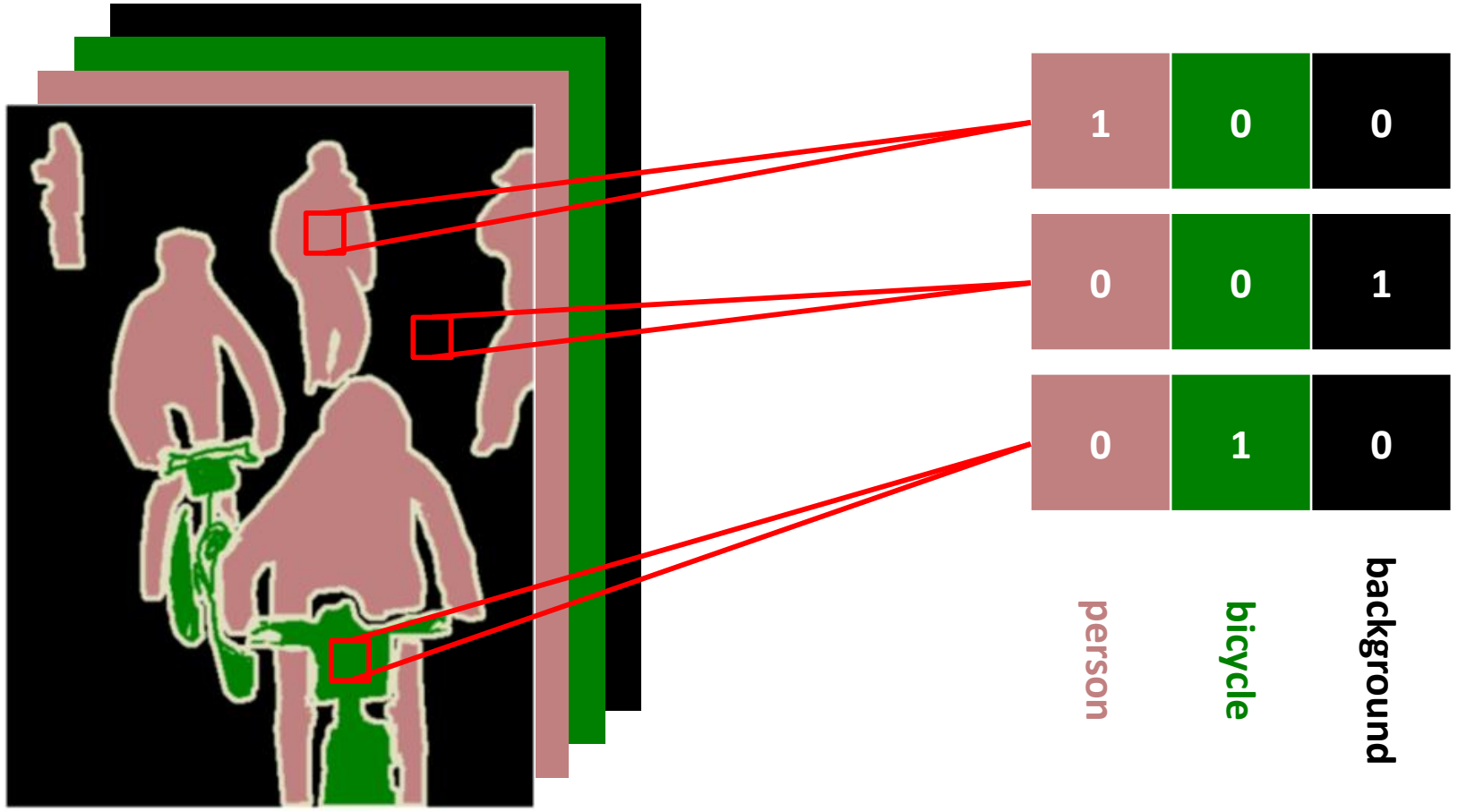
- Semantic Segmentation using FCN
  - ~~Load pre-trained vgg-16 model~~
  - Implement bilinear filter with a given filter size
  - Implement vgg-16 model with fully convolutional layers
  - Implement FCN-16s and FCN-8s

Semantic Segmentation

- Segmenting images based on its semantic notion

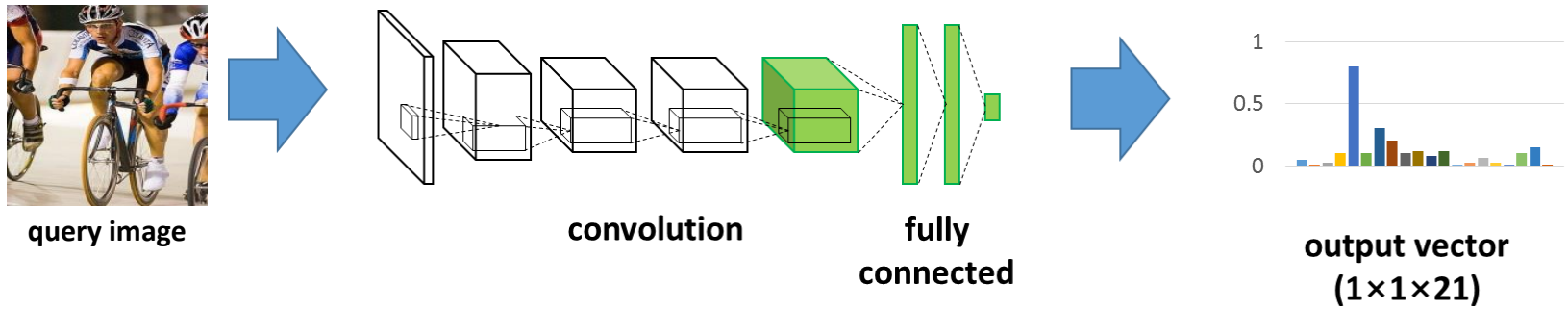
Semantic Segmentation

- It would be considered as a pixel-level classification

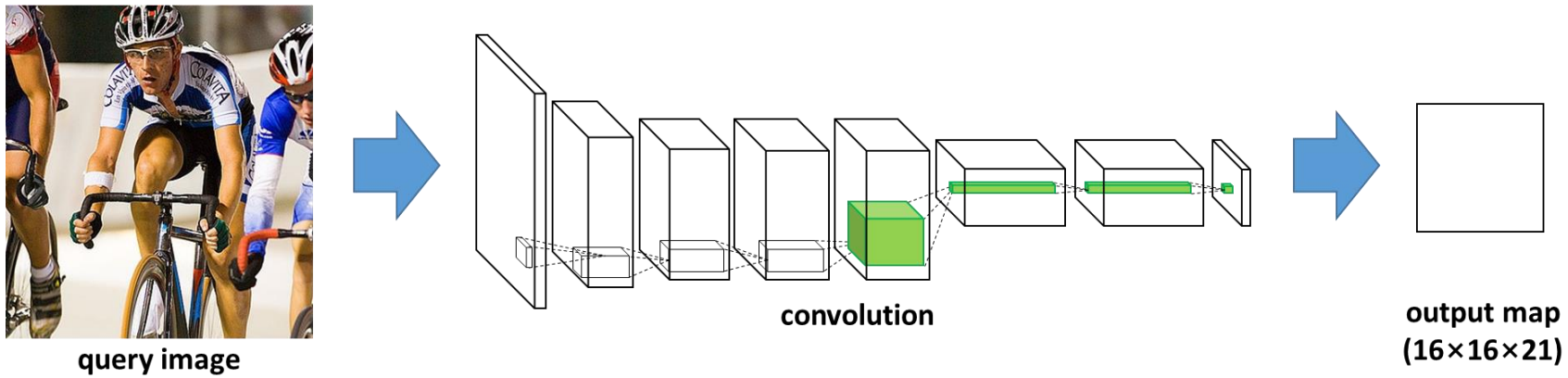


Classification vs Segmentation

- Image classification



- Semantic segmentation

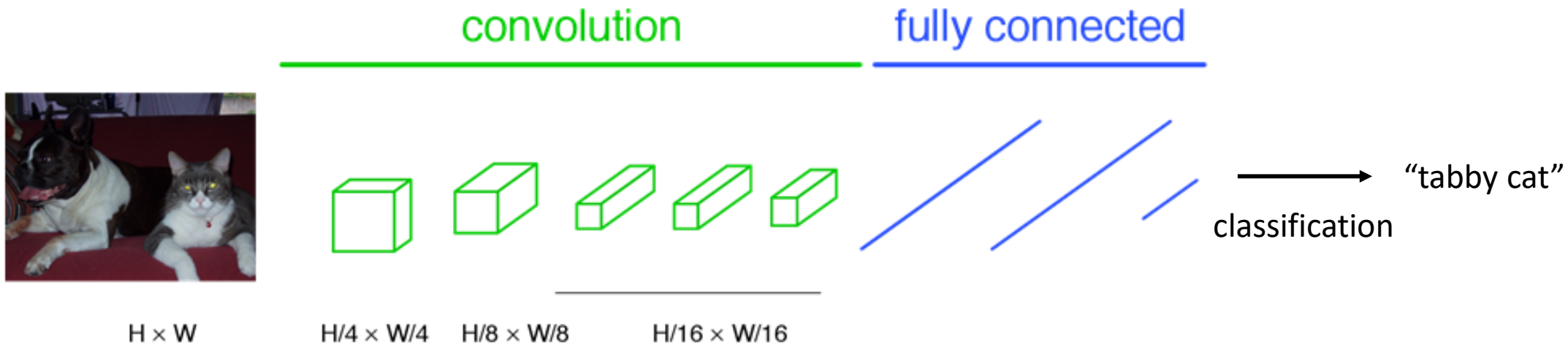


Classifier to FCN

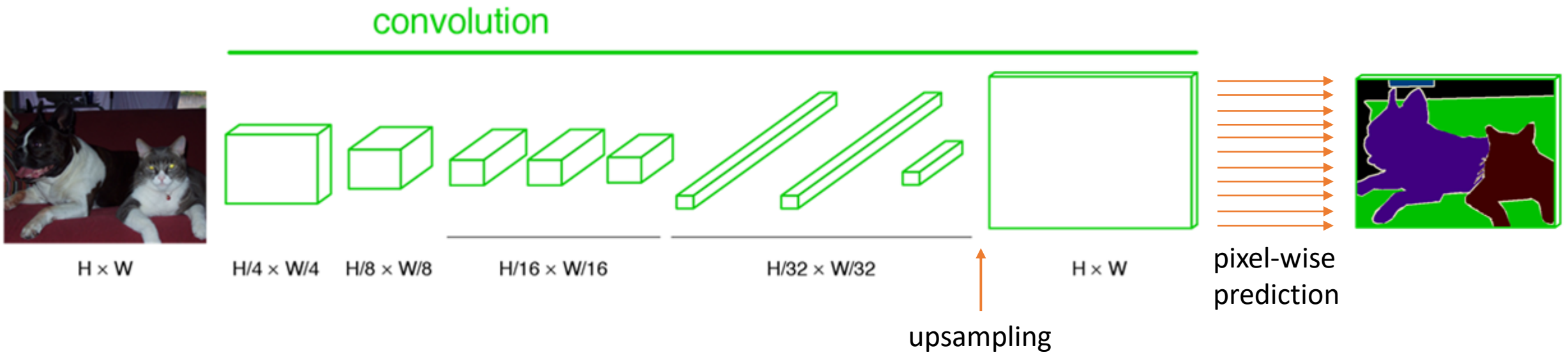
- Remove classification layer and covert all fully connected layers to convolution layers

- Append 1x1 convolution layer with channel dimensions and predict scores at each of the coarse output locations (20 categories + background for PASCAL VOC)

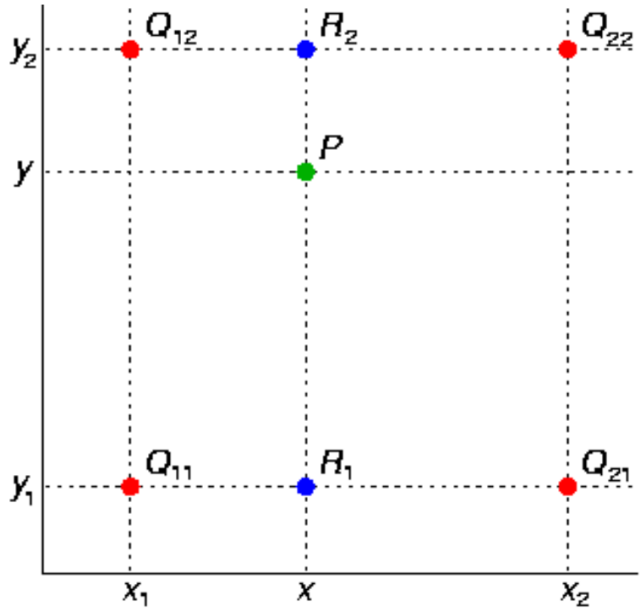
Classification Network



Fully Convolutional Network



Upsampling: bilinear interpolation



$$f(R_1) \approx \frac{x_2 - x}{x_2 - x_1} f(Q_{11}) + \frac{x - x_1}{x_2 - x_1} f(Q_{21})$$

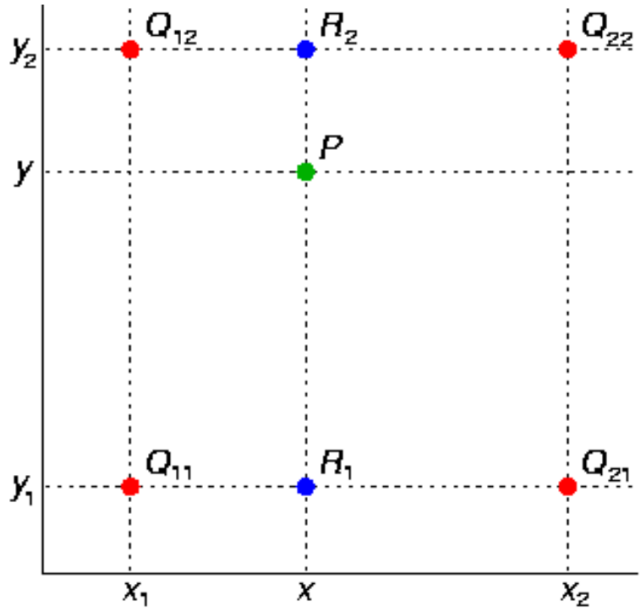
$$f(R_2) \approx \frac{x_2 - x}{x_2 - x_1} f(Q_{12}) + \frac{x - x_1}{x_2 - x_1} f(Q_{22})$$

$$f(P) \approx \frac{y_2 - y}{y_2 - y_1} f(R_1) + \frac{y - y_1}{y_2 - y_1} f(R_2).$$

1	2
3	4

1		2
3		4

Upsampling: bilinear interpolation



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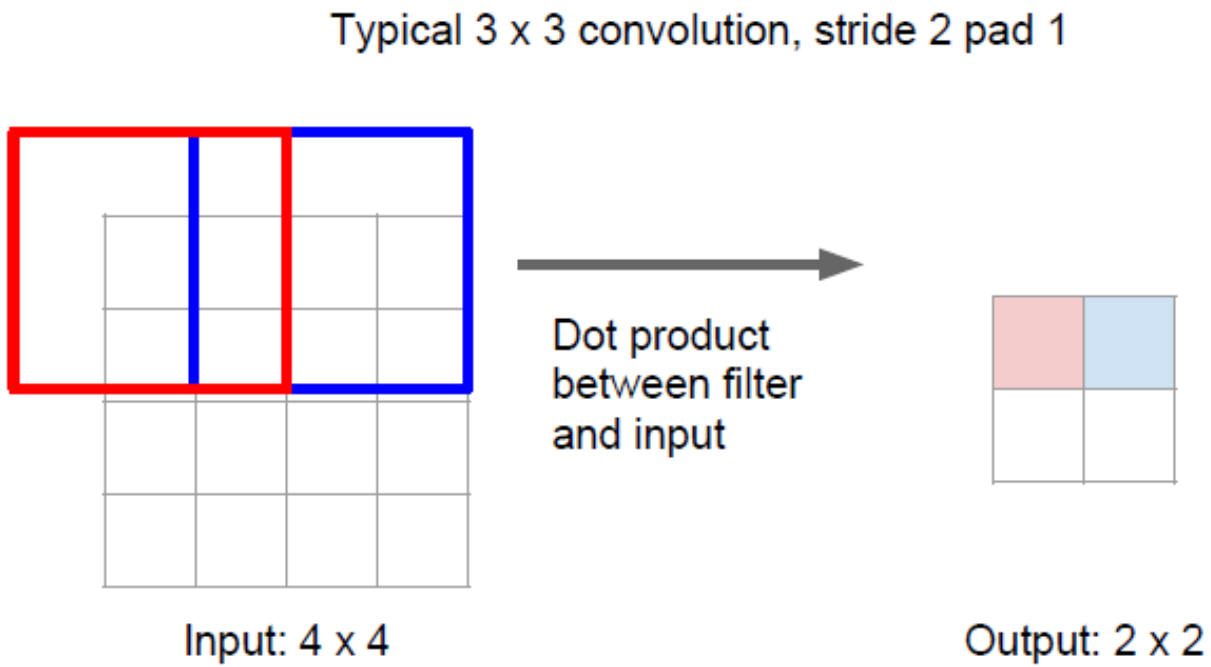
1	2
3	4

1	1.5	2
2	2.5	3
3	3.5	4

Learnable Upsampling: Deconvolution

- Convolution works,



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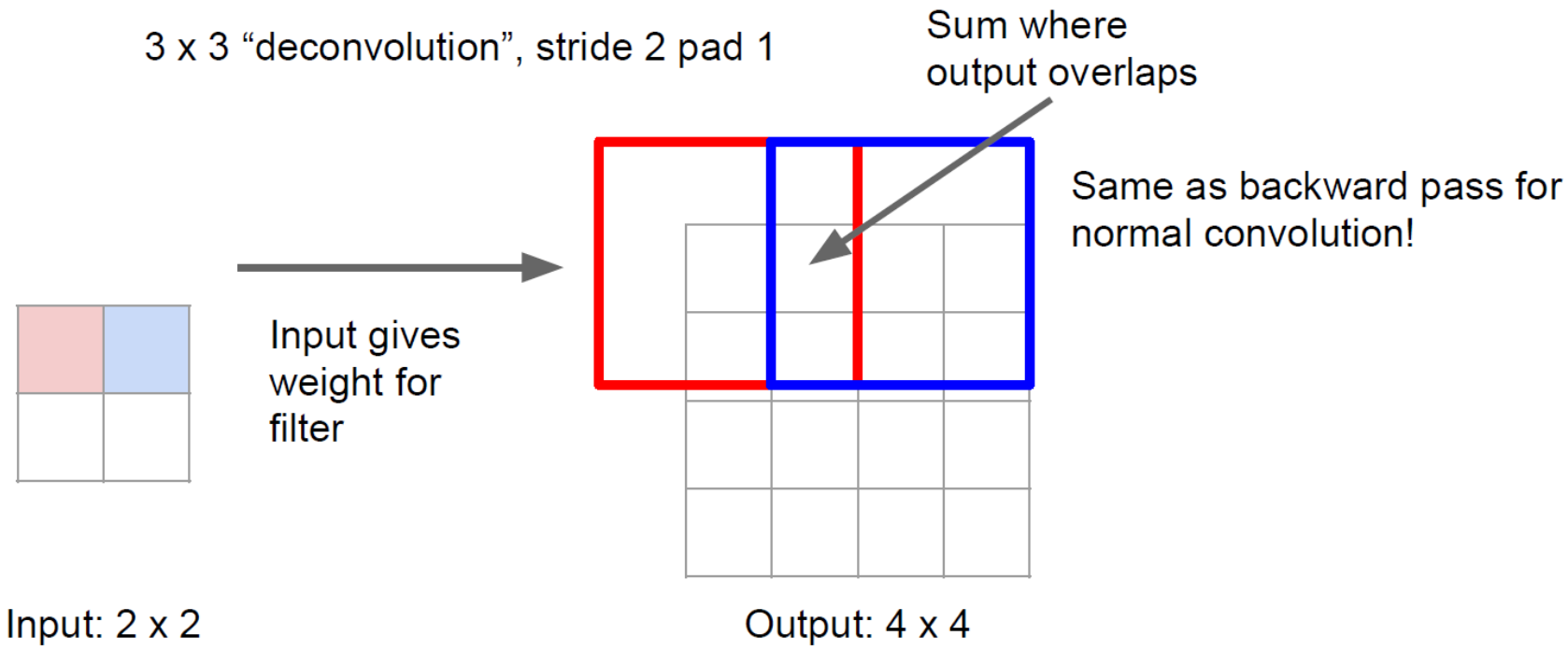
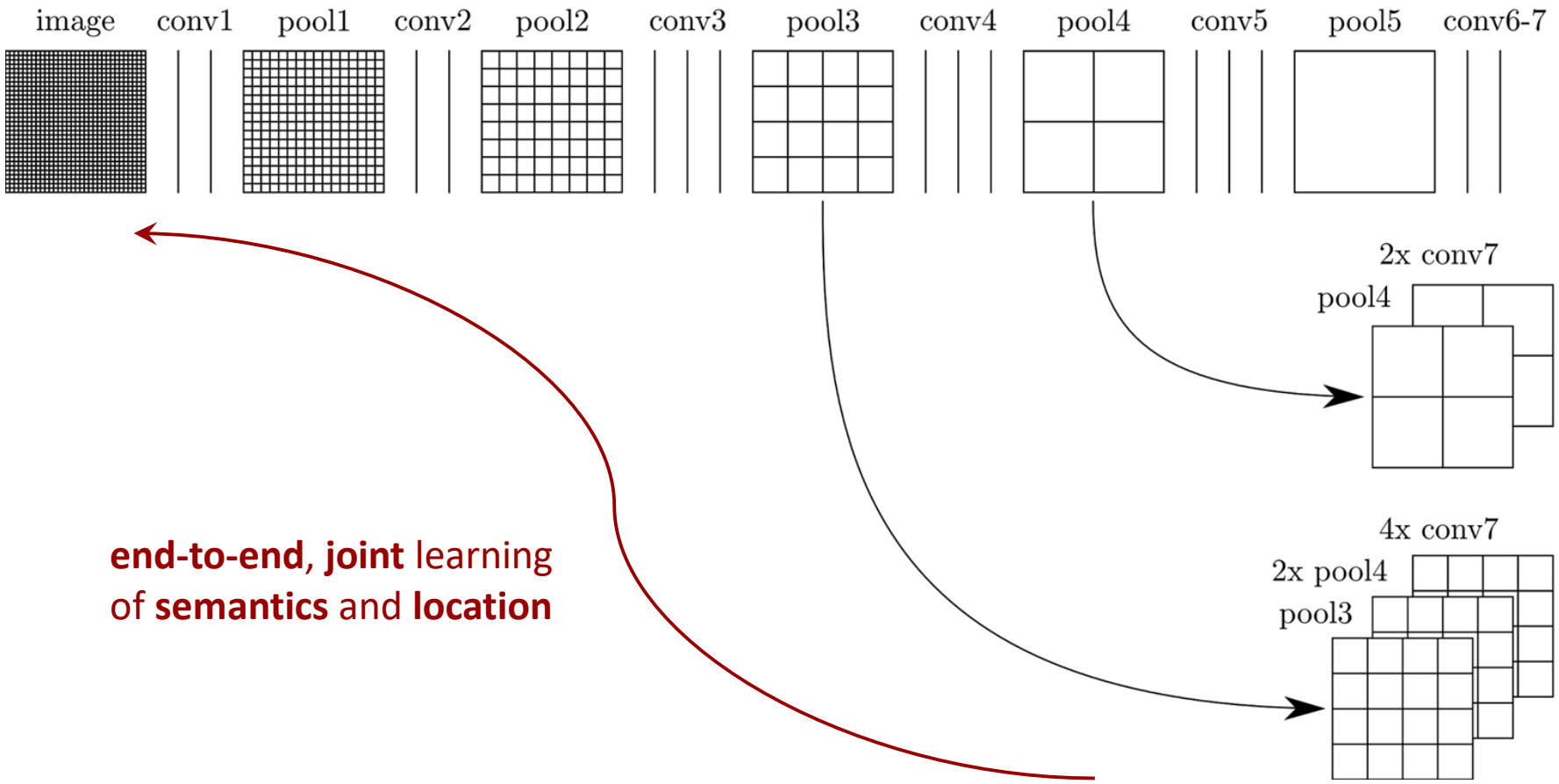


FCN: Skip Layers



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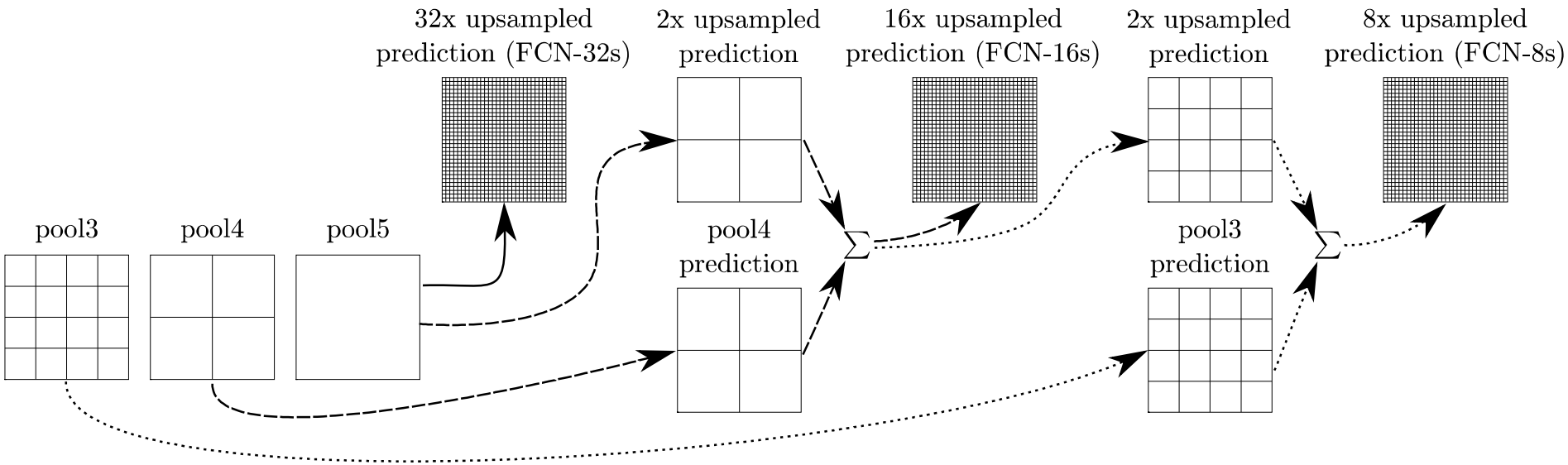
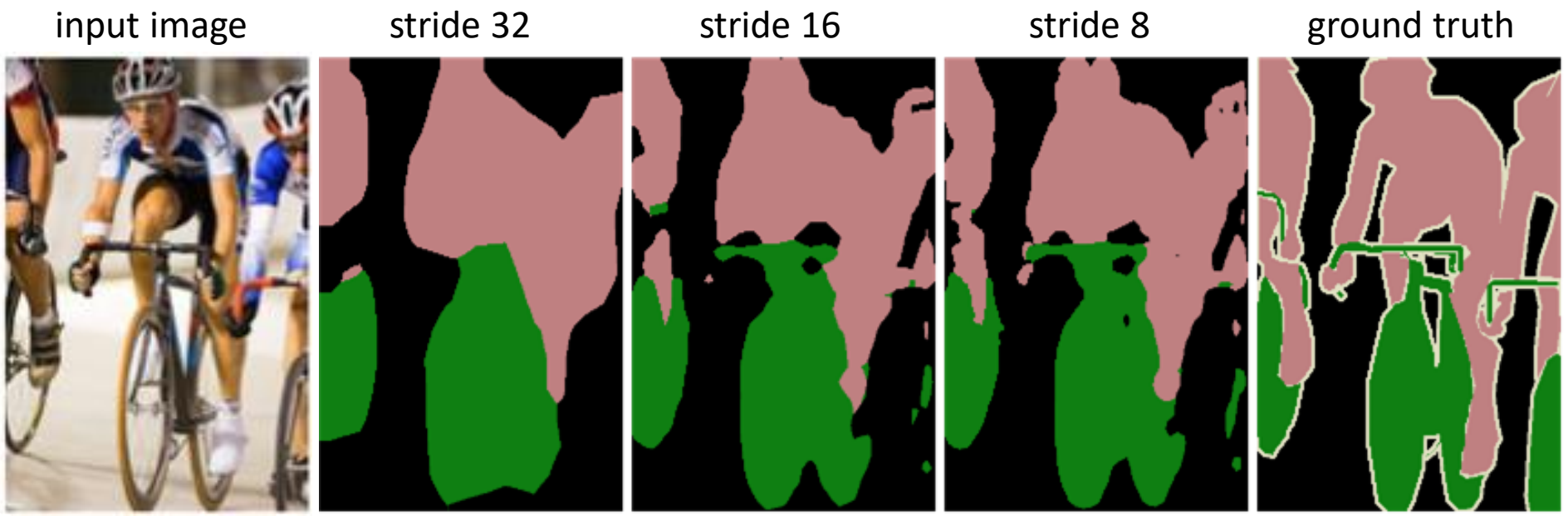


FCN: Skip Layers



Exercise

- Download git from
  - https://github.com/mixcheck/cnntutorial

- Implement bilinear filter with a given filter size
- Implement vgg-16 model with fully convolutional layers
- Implement FCN-16s and FCN-8s