



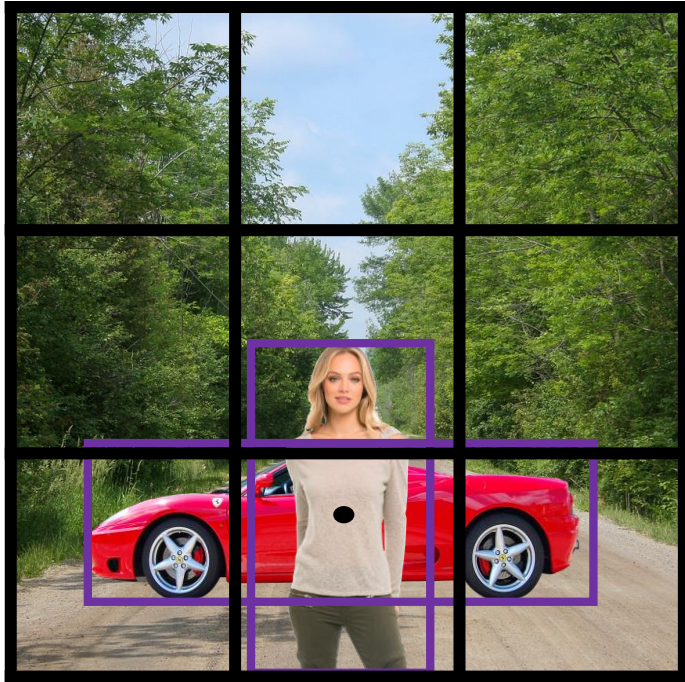
deeplearning.ai

# Object Detection

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## Anchor boxes

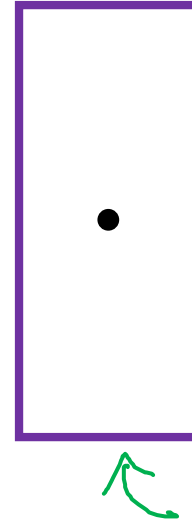
# Overlapping objects:



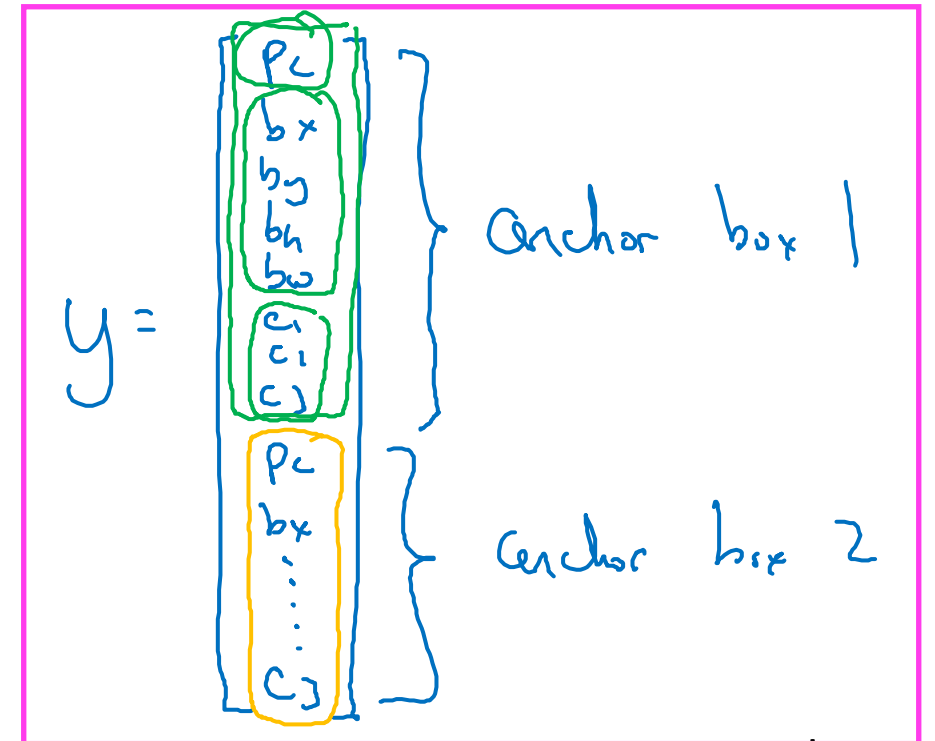
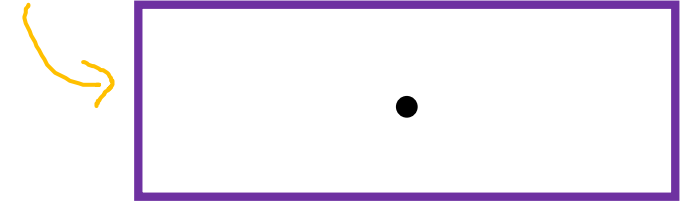
$$y = \begin{bmatrix} p_c \\ b_x \\ b_y \\ b_h \\ b_w \\ c_1 \\ c_2 \\ c_3 \end{bmatrix}$$

Arrows point from the labels to the corresponding elements in the vector  $y$ :  $p_c$  points to the first element,  $b_x$  points to the second,  $b_y$  points to the third,  $b_h$  points to the fourth,  $b_w$  points to the fifth, and  $c_1, c_2, c_3$  are grouped by a bracket pointing to the last three elements.

Anchor box 1:



Anchor box 2:

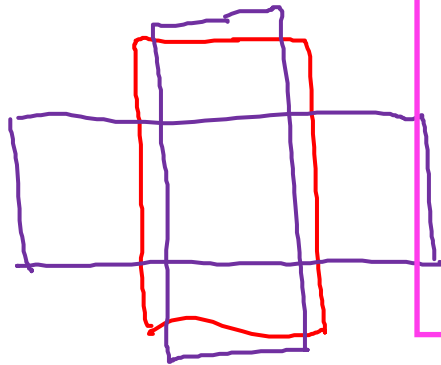


# Anchor box algorithm

## Previously:

Each object in training image is assigned to grid cell that contains that object's midpoint.

Output  $y$ :  
 $3 \times 3 \times 8$



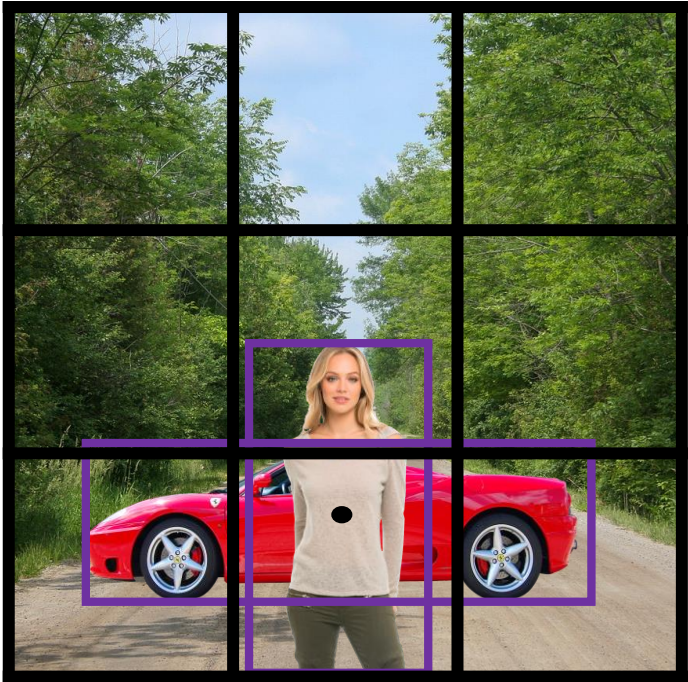
## With two anchor boxes:

Each object in training image is assigned to grid cell that contains object's midpoint and anchor box for the grid cell with highest IoU.

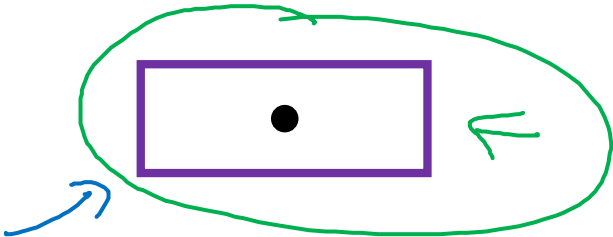
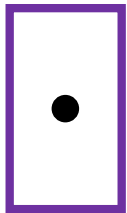
(grid cell, anchor box)

Output  $y$ :  
 $3 \times 3 \times 16$   
 $3 \times 3 \times 2 \times 8$

# Anchor box example



Anchor box 1:      Anchor box 2:



y =

$$\begin{bmatrix} p_c \\ b_x \\ b_y \\ b_h \\ b_w \\ c_1 \\ c_2 \\ c_3 \\ p_c \\ b_x \\ b_y \\ b_h \\ b_w \\ c_1 \\ c_2 \\ c_3 \end{bmatrix}$$

1  
bx  
by  
bh  
bw  
1  
0  
0

1  
bx  
by  
bh  
bw  
0  
1  
0

Car only?

0  
0  
0  
0  
0  
0  
0  
0

1  
bx  
by  
bh  
bw  
0  
1  
0

anchor box 1

anchor box 2