

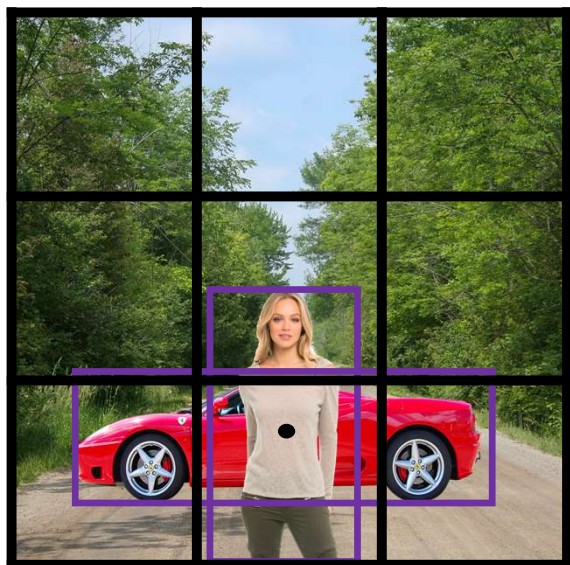


deeplearning.ai

Object Detection

Anchor boxes

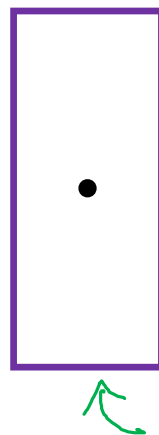
Overlapping objects:



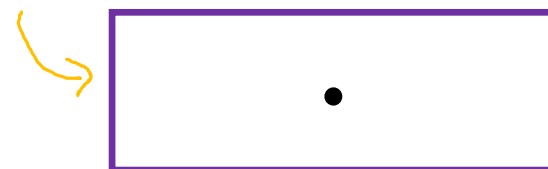
$$y = \begin{bmatrix} p_c \\ b_x \\ b_y \\ b_h \\ b_w \\ c_1 \\ c_2 \\ c_3 \end{bmatrix}$$

Handwritten annotations: A green arrow points from the p_c element to the center dot in the image patch. A blue arrow points from the b_x, b_y, b_h, b_w elements to the purple bounding box. A blue bracket groups the c_1, c_2, c_3 elements.

Anchor box 1:



Anchor box 2:



$y =$

p_c	Anchor box 1
b_x	
b_y	
b_h	
b_w	
c_1	Anchor box 2
c_2	
\vdots	
c_3	

Handwritten annotations: A green box highlights the first four elements (p_c, b_x, b_y, b_h) and is labeled 'Anchor box 1'. An orange box highlights the last four elements (b_w, c_1, c_2, c_3) and is labeled 'Anchor box 2'. A blue bracket groups the c_1, c_2, c_3 elements.

[Redmon et al., 2015, You Only Look Once: Unified real-time object detection]

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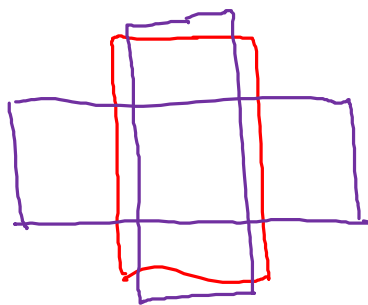
Anchor box algorithm

Previously:

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

Output y :

$$\underline{3 \times 3 \times 8}$$



With two anchor boxes:

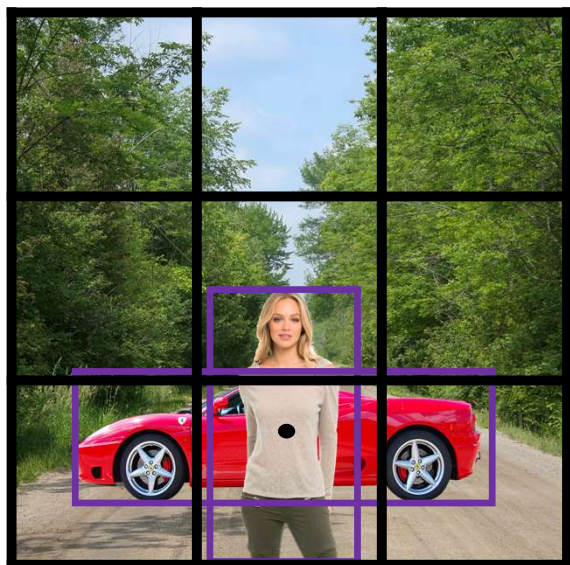
Each object in training image is assigned to grid cell that contains object's midpoint and anchor box for the grid cell with highest IoU.

(grid cell, anchor box)

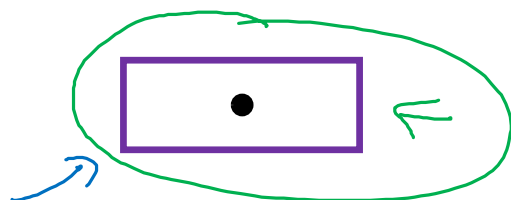
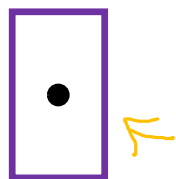
Output y :

$$\begin{aligned} &3 \times 3 \times \underline{16} \\ &3 \times 3 \times \underline{2 \times 8} \end{aligned}$$

Anchor box example



Anchor box 1: Anchor box 2:



$y =$

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

Handwritten values for the first vector (orange and green):

$$\begin{bmatrix} 1 \\ b_x \\ b_y \\ b_h \\ b_w \\ 1 \\ 0 \\ 0 \\ 1 \\ b_x \\ b_y \\ b_h \\ b_w \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

Handwritten values for the second vector (green and blue):

car only?

$$\begin{bmatrix} ? \\ ? \\ ? \\ ? \\ ? \\ ? \\ ? \\ ? \\ 1 \\ b_x \\ b_y \\ b_h \\ b_w \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

anchor box 1

anchor box 2