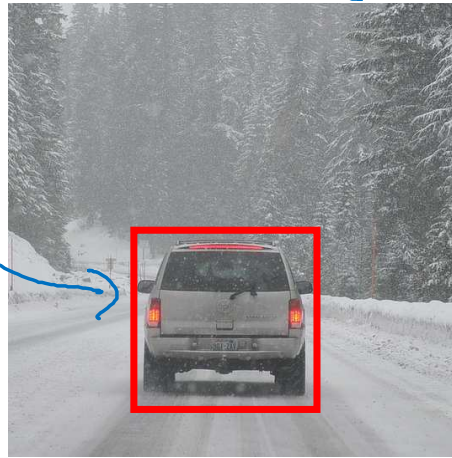# Object Detection

deeplearning.ai

Object localization

What are localization and detection?

Image classification

"Car"

Classification with localization
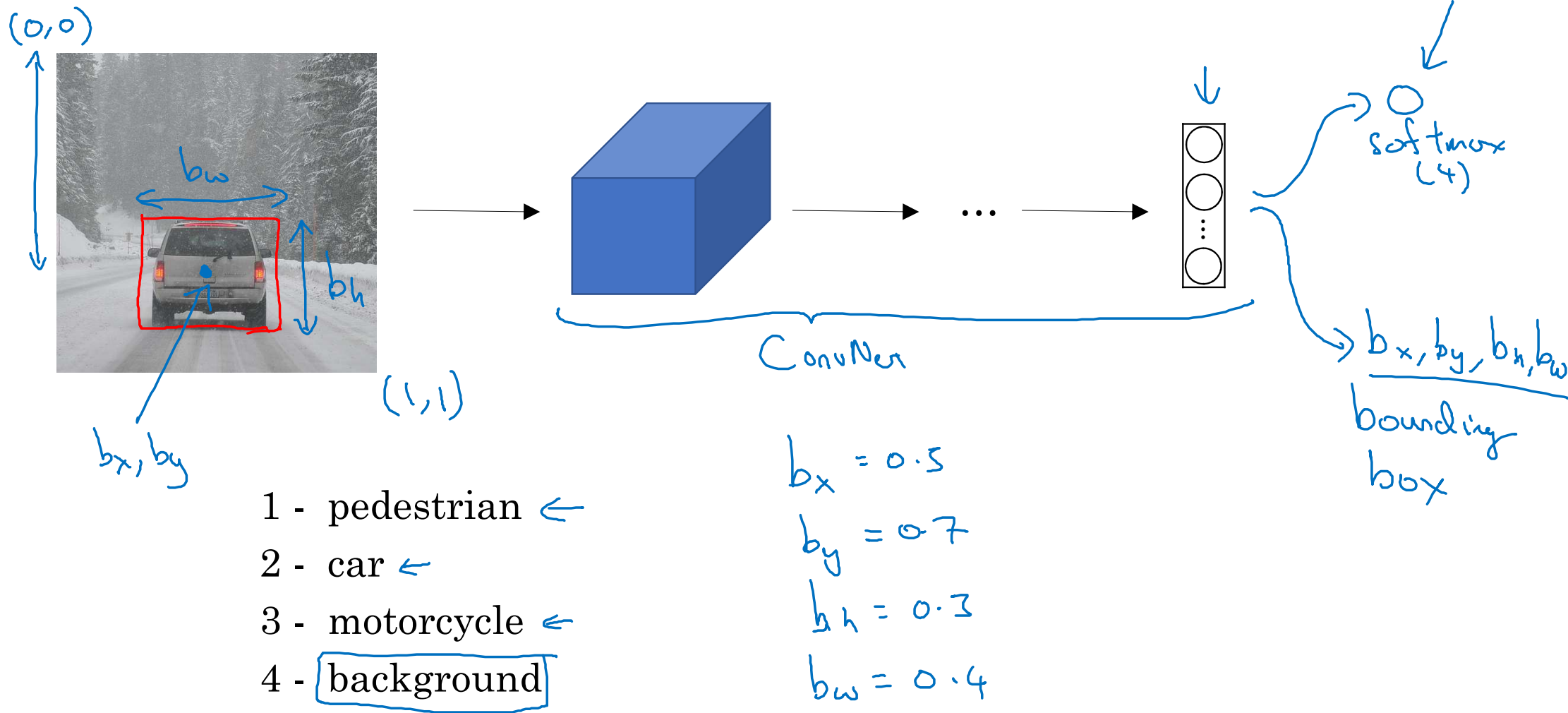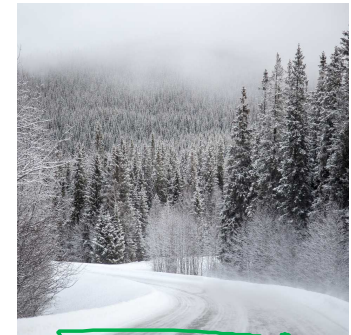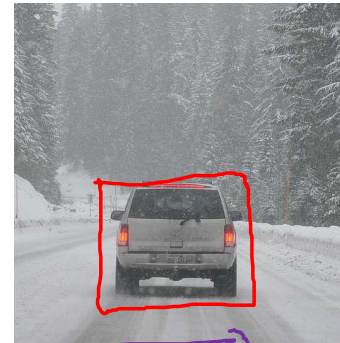

"Car"

Detection

1 object

multiple objects

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Classification with localization

$(0,0)$

b_w

b_h

b_x, b_y

$(1,1)$

ConvNet

softmax (4)

b_x, b_y, b_h, b_w
bounding box

1 - pedestrian
2 - car
3 - motorcycle
4 - background

$b_x = 0.5$
$b_y = 0.7$
$b_h = 0.3$
$b_w = 0.4$

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Defining the target label y

1 - pedestrian

2 - car ←

3 - motorcycle

4 - background ←

Need to output b_x, b_y, b_h, b_w, class label (1-4)
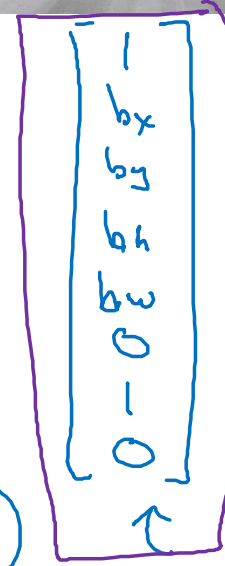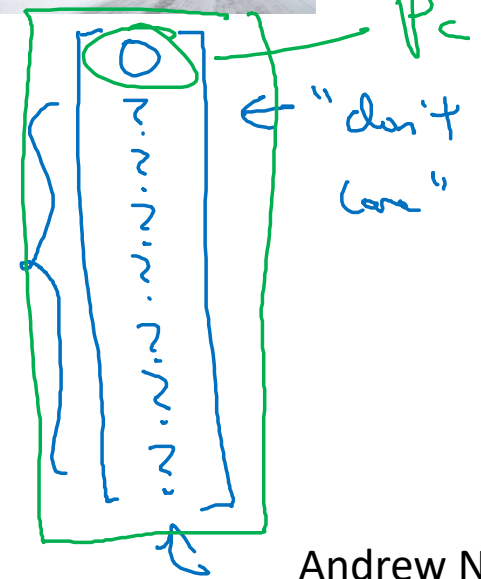
$$\mathcal{L}(\hat{y}, y) =$$

$$\begin{cases} (\hat{y_1} - y_1)^2 + (\hat{y_2} - y_2)^2 \\ + \dots + (\hat{y_8} - y_8)^2 \quad \text{if } y_1 = 1 \\ \\ (\hat{y_1} - y_1)^2 \quad \text{if } y_1 = 0 \end{cases}$$

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

is there any object?

$x =$

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

(x, y)

$$\begin{bmatrix} 0 \\ ? \\ ? \\ ? \\ ? \\ ? \\ ? \\ ? \end{bmatrix}$$

P_c

← "don't care"

Andrew Ng