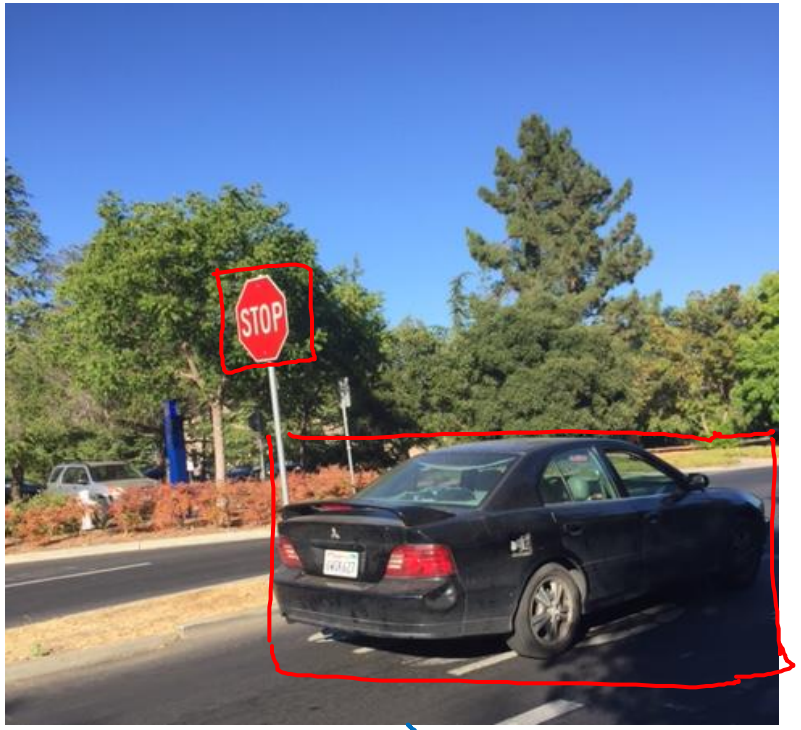
deeplearning.ai

Learning from multiple tasks

Multi-task learning

Simplified autonomous driving example



$x^{(i)}$

$y^{(i)}$ $(4,1)$

Pedestrians

Cars

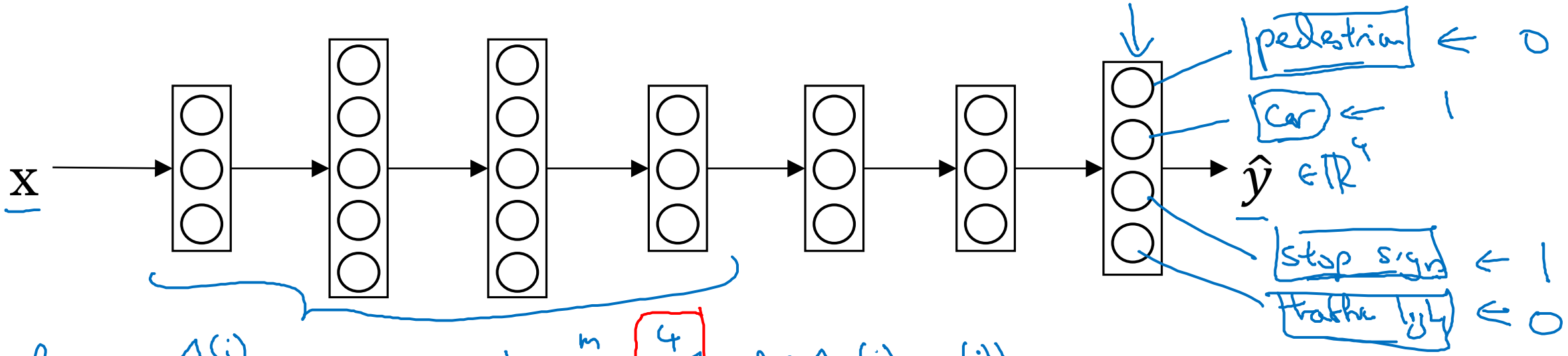
Stop signs

Traffic lights

$$y = \begin{bmatrix} | & | & | & & | \\ y^{(1)} & y^{(2)} & y^{(3)} & \cdots & y^{(m)} \\ | & | & | & & | \end{bmatrix}$$

$(4, m)$

Neural network architecture



Loss: $y^{(i)}$ $(4,1)$

$\Rightarrow \frac{1}{m} \sum_{i=1}^{m} \sum_{j=1}^{4} \mathcal{L}(\hat{y}_j^{(i)}, y_j^{(i)})$

Sum only over values of j with 0/1 label.

$\mathcal{L}(\hat{y}_j^{(i)}, y_j^{(i)})$

→ Usual logistic loss

$-y_j^{(i)} \log \hat{y}_j^{(i)} - (1-y_j^{(i)}) \log (1-\hat{y}_j^{(i)})$

Unlike softmax regression:

One image can have multiple labels

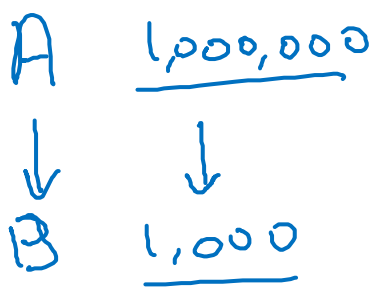
Multi-task learning ←

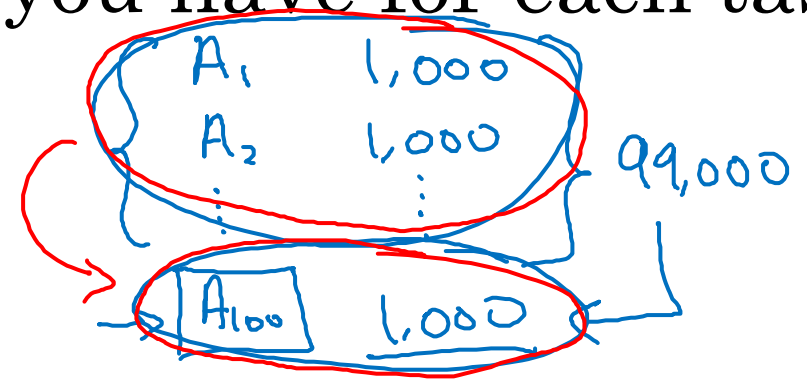
$Y = \begin{bmatrix} 1 & 1 & \cdots & 0 & \cdots & ? & \cdots \\ 0 & 1 & & 1 & & 1 & \\ ? & ? & & ? & & ? & \\ ? & ? & & 0 & & ? & \end{bmatrix}$ ←

Andrew Ng

When multi-task learning makes sense

- Training on a set of tasks that could benefit from having shared lower-level features.
- Usually: Amount of data you have for each task is quite similar.





- Can train a big enough neural network to do well on all the tasks.