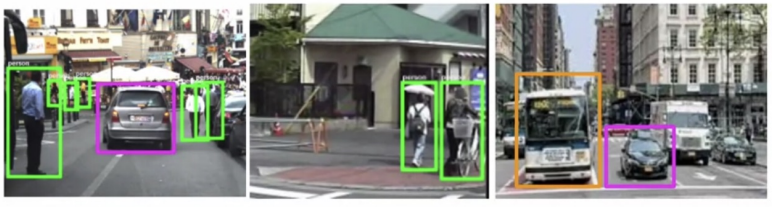
For a particular input $\vec{x}$, there can be multiple labels.



Is there a car?	Yes	No	Yes
Is there a bus?	No	No	Yes
Is there a pedestrian	Yes	Yes	No

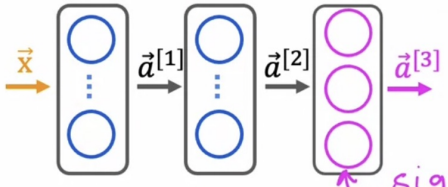
$$\vec{y} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} \qquad \vec{y} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \qquad \vec{y} = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

Difference in the handwriting digit classification and this is that a particular input is having more than 1 label (3 in this case) whereas in the handwriting digit an input was only classified as one label.

Two ways to do this

- Creating different neural network for each label
- Handling all of them in a single neural network.

Handling all of them in a single neural network means that the output layer will have a neuron for each category.



$$\vec{a}^{[3]} = \begin{bmatrix} a_1^{[3]} \\ a_2^{[3]} \\ a_3^{[3]} \end{bmatrix}$$

car
bus
pedestrian