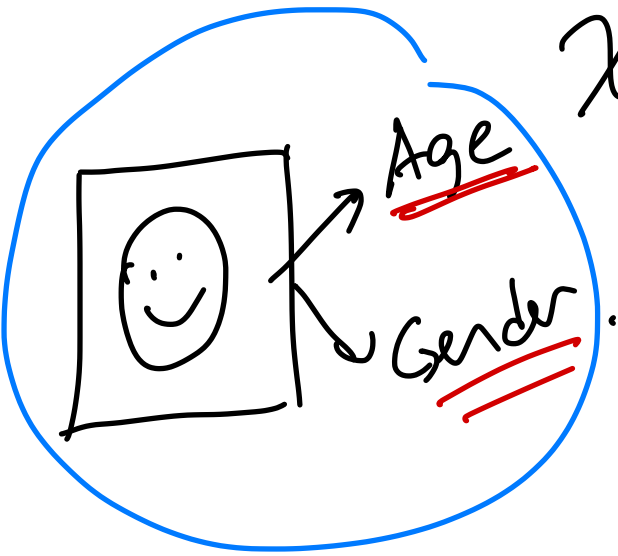


# (Multi)Input / (Multi)Output Models.

Until this point, all models we have discussed were single-input and single-output models.



$$\mathcal{X} = \{(x_i, y_i)\}_{i=1}^N$$

$$(x_{1i}, x_{2i}, y_{1i}, y_{2i})$$

$\Downarrow$   
multi input / multi output

$$(x_{1i}, x_{2i}, y_i)$$

$\Rightarrow$  multi input

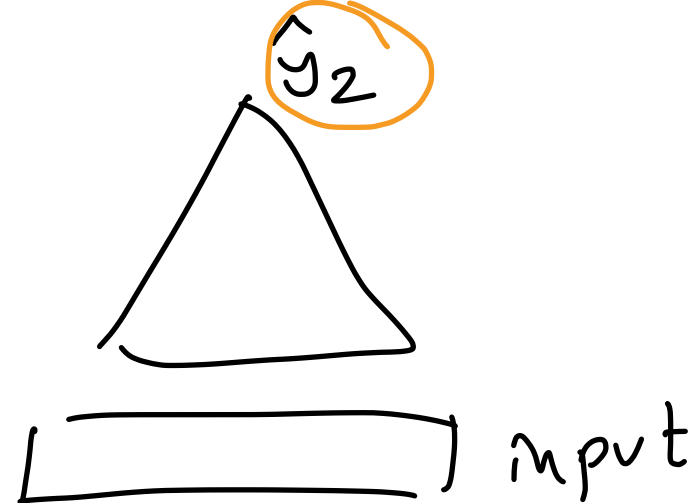
$$(x_i, y_{1i}, y_{2i})$$

$\Rightarrow$  multi output

$\Downarrow$   $\Downarrow$   
(Age) Regression (Gender) Binary Classification.

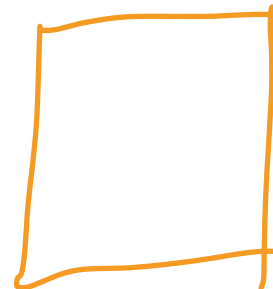
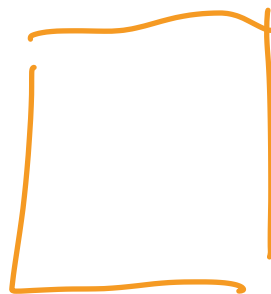


NN 1 (Age)

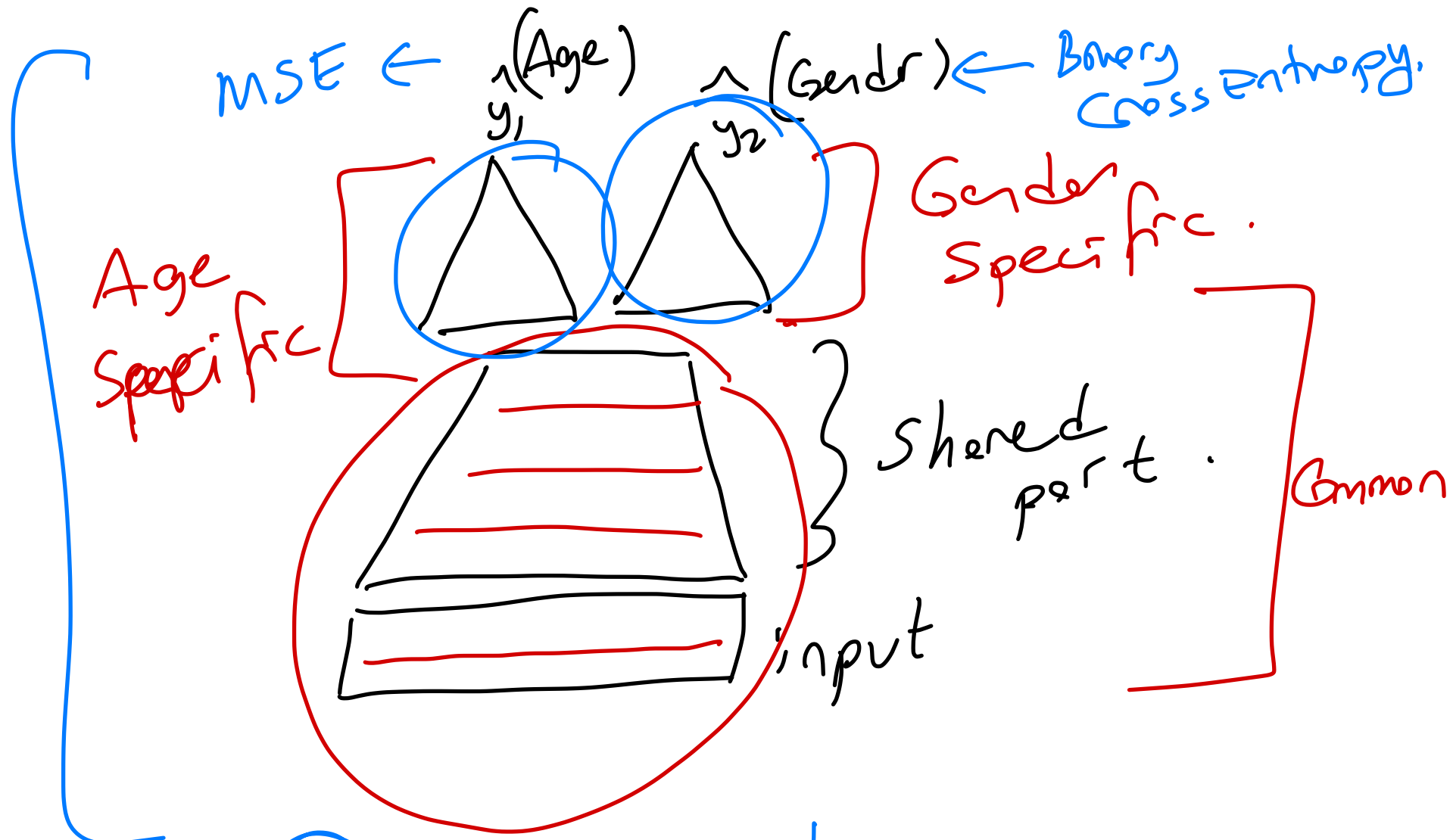


NN 2 (Gender)

# of parameters of NN1 + # of parameters of NN2



Single Input  
Multi-Output



$$\textcircled{21} \underline{loss 1} + \underline{loss 2}$$

Multi-Input  
Single Output.

