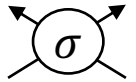
# Activity: MLP Structure

ML for Health, Week 3

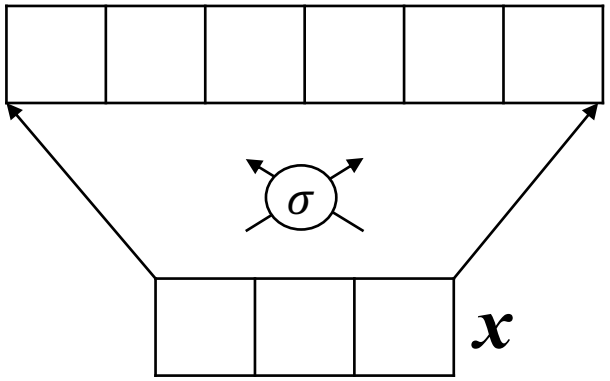
# For each of the models on the pages to follow:

- Specify the number and size(s) of hidden layers.
- Determine how many parameters the model contains, in total.
- Write the output as a function of the input. In other words, write the equation defined by this model.

**Note**: I am using the symbol at right to denote fully connected layers with activation function $\sigma$:

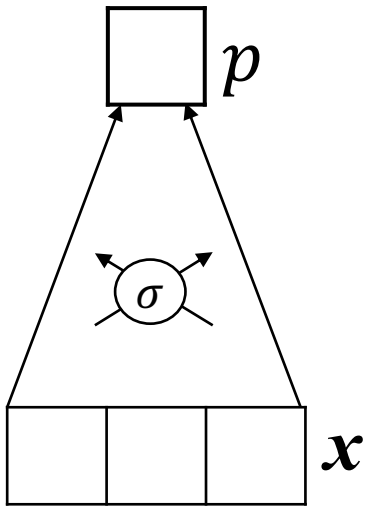



An **example** of this notation:



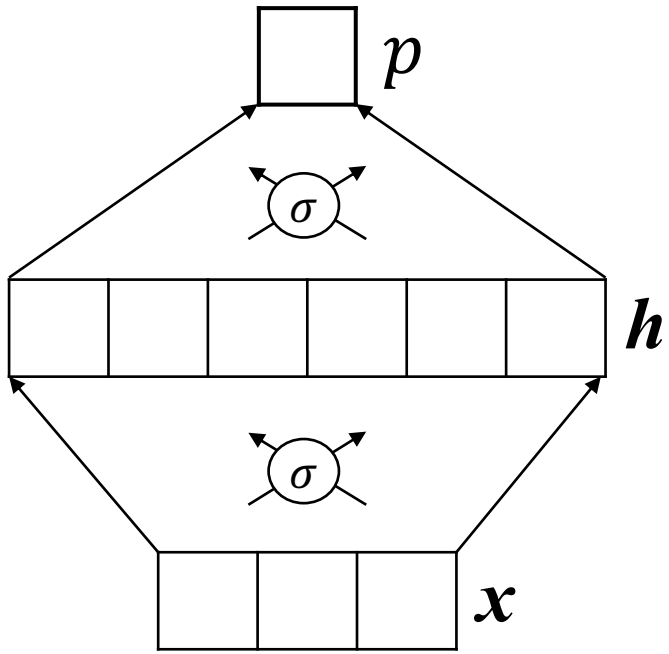

$$\boldsymbol{h} = \sigma(W\boldsymbol{x} + \boldsymbol{b})$$

# Logistic Regression



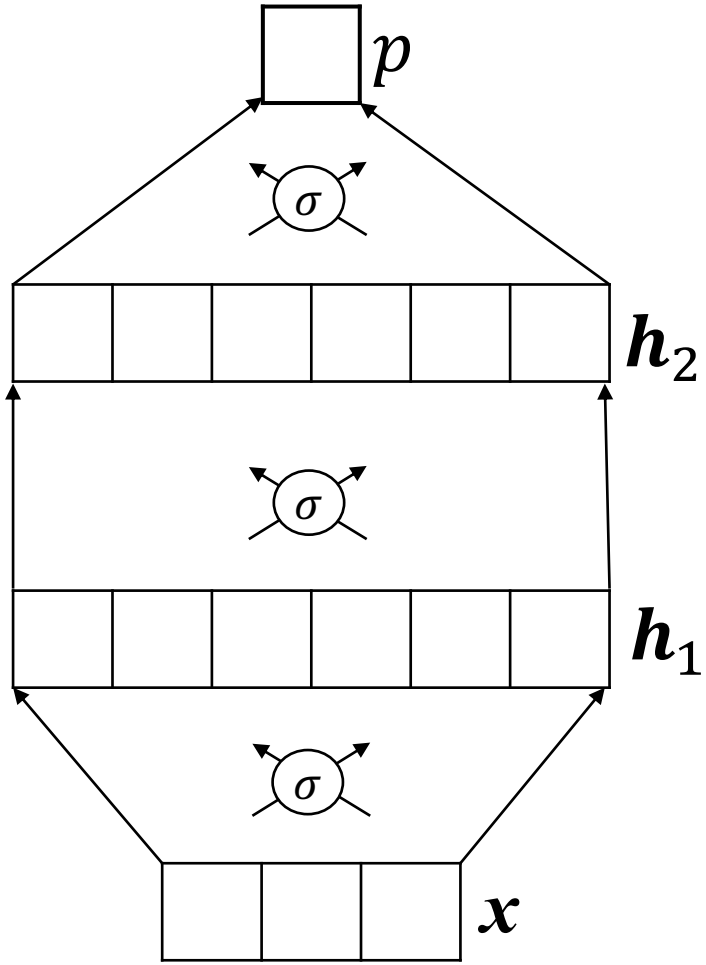

- Specify the number and size(s) of hidden layers.
- Determine how many parameters the model contains, in total.
- Write the output as a function of the input. In other words, write the equation defined by this graph/model.

# Shallow MLP
(with $\sigma$ activations)



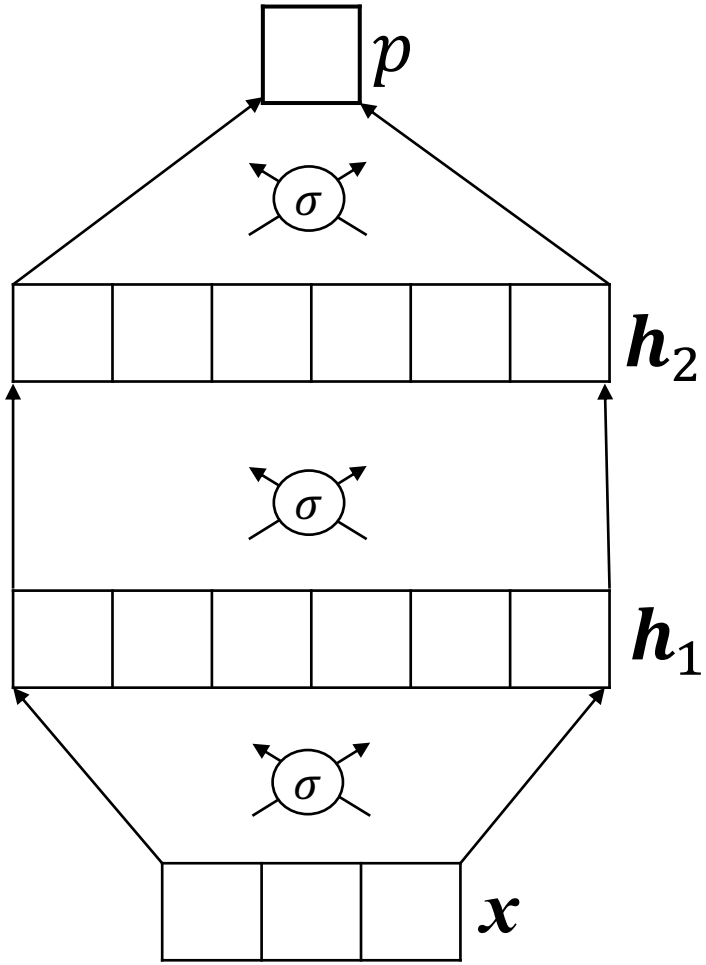

- Specify the number and size(s) of hidden layers.
- Determine how many parameters the model contains, in total.
- Write the output as a function of the input. In other words, write the equation defined by this model.

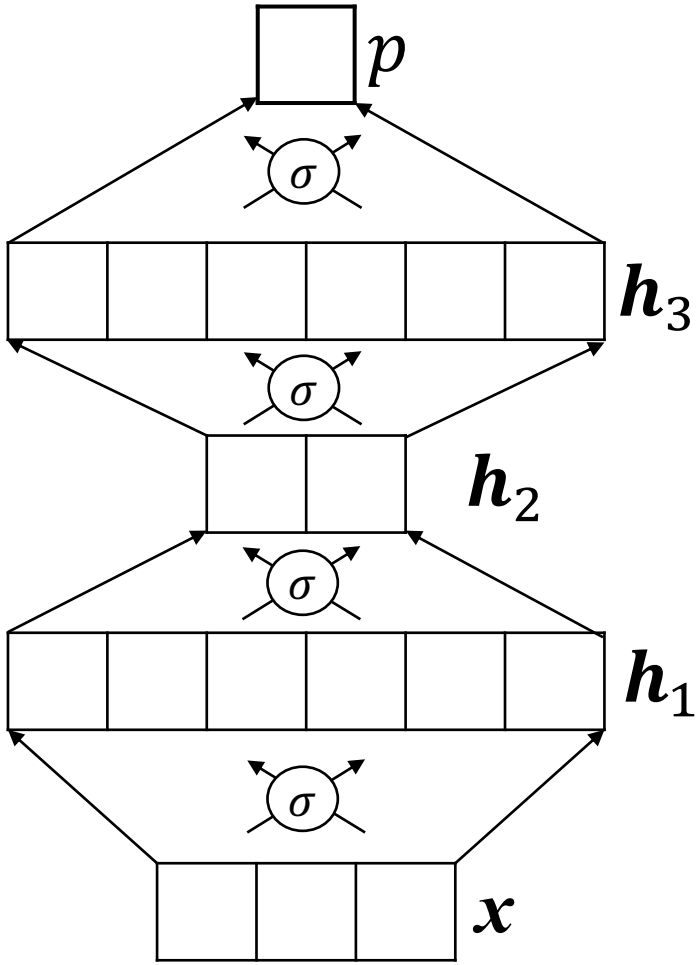
# Slightly Deeper MLP
(with $\sigma$ activations)




- Specify the number and size(s) of hidden layers.
- Determine how many parameters the model contains, in total.
- Write the output as a function of the input. In other words, write the equation defined by this model.

# Which model contains more parameters?



# Challenge

- In the logistic regression model (left), consider how to quantify the effect of increasing the first feature ($x_1$) on $p$. Other than the structure of the model, what information do you need?
- Similarly, in the MLP (right), consider how to quantify the effect of increasing $h_{2,1}$ on $p$
- Finally, in the MLP (right), consider how to quantify the effect of increasing $x_1$ on $p$