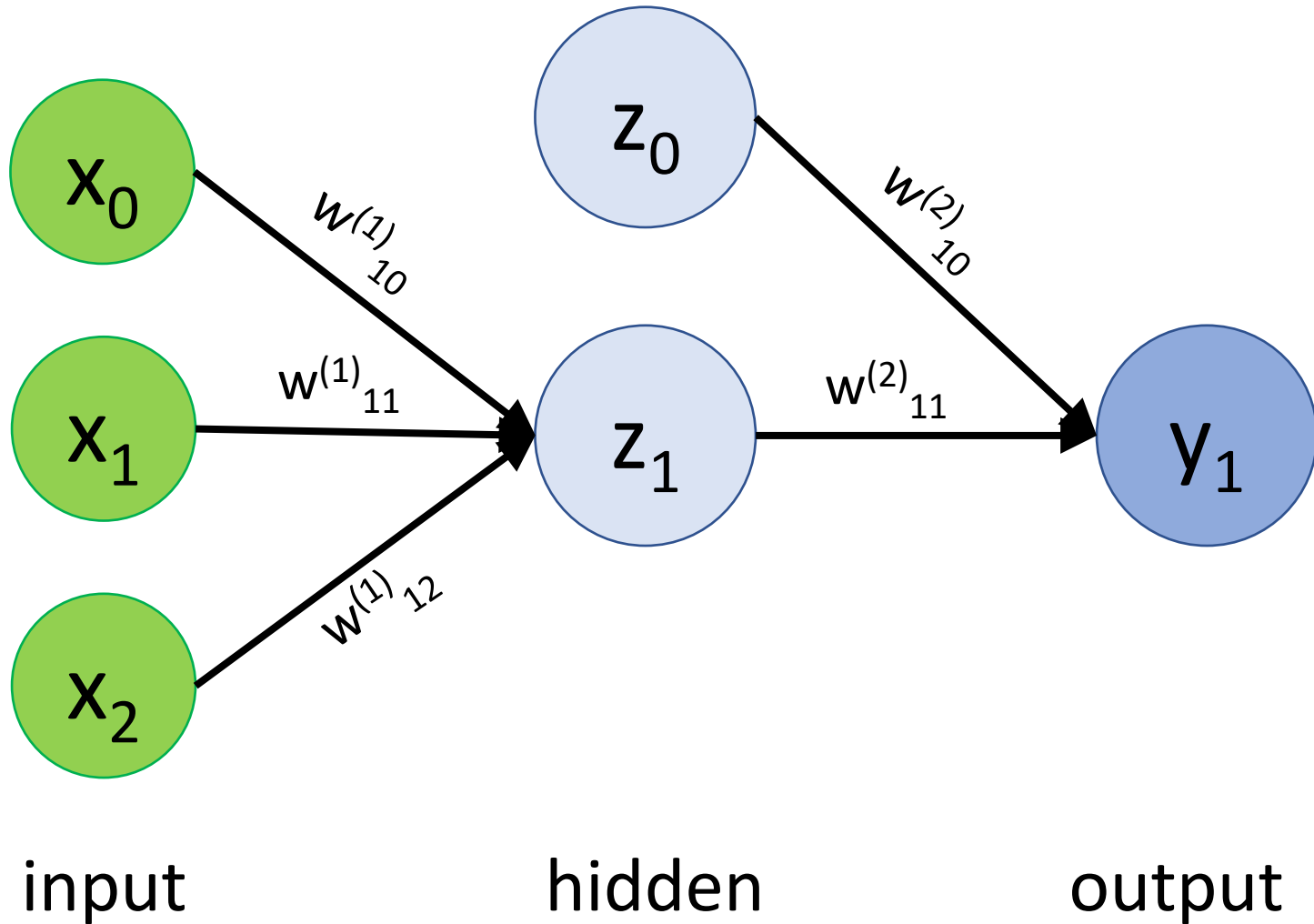


# Neural Net Examples

CS 1678 Intro to Deep Learning

Feb. 4, 2021

# First architecture



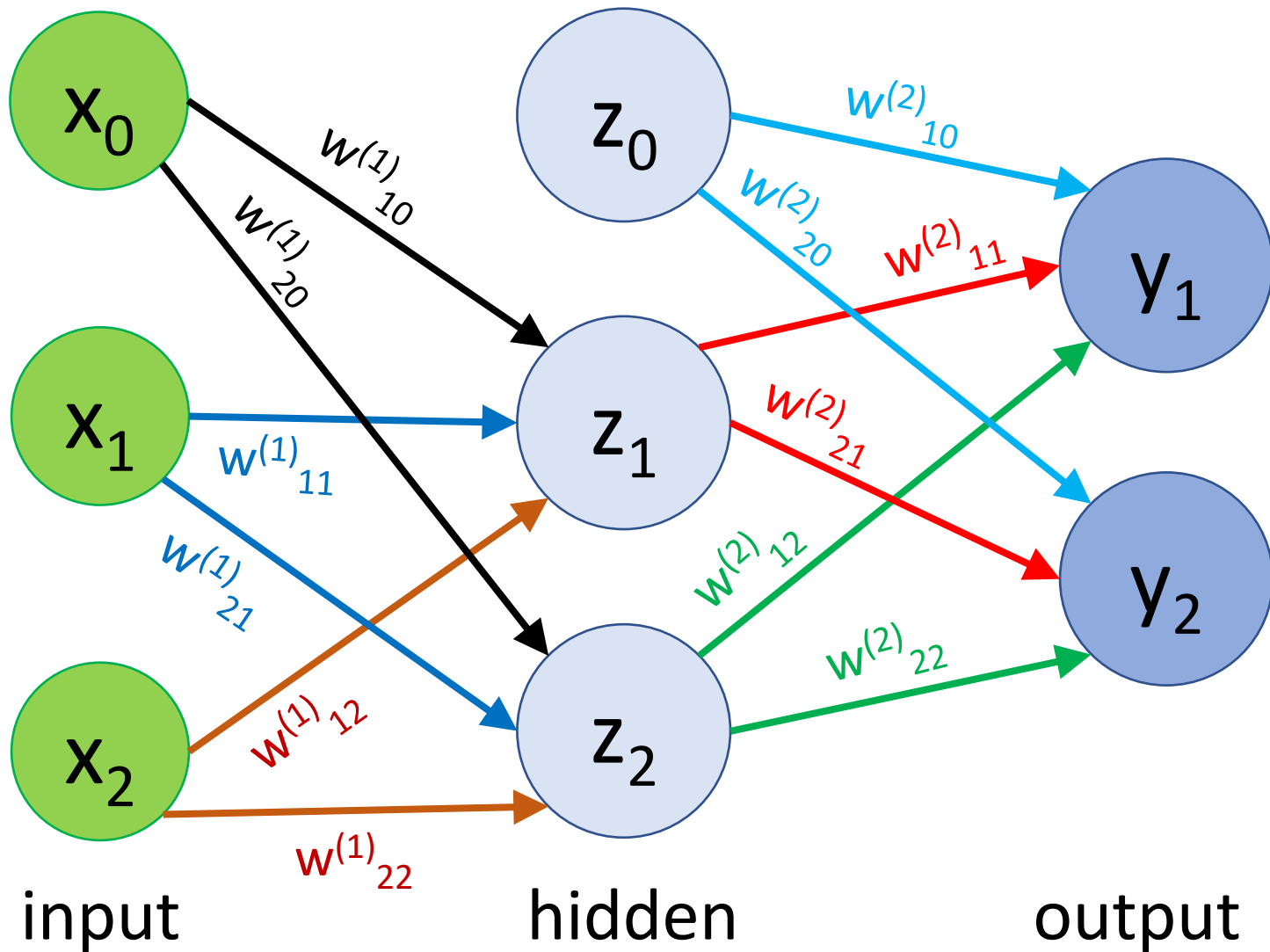
# Computing activations

- In all examples,  $x = [x_0 \ x_1 \ x_2]$ , where  $x_0 = 1$
- Assume sigmoid activation function
- Initialize all weights to 0.1
- First example:  $x = [1 \ 1 \ 0]$
- Second example:  $x = [1 \ 0 \ 1]$
- Third example:  $x = [1 \ 1 \ 1]$

# Computing activations

- First example:
  - At hidden:  $z_1 = ?$
  - At output:  $y_1 = ?$   $y_{\text{pred}} = ?$
- Second example:
  - At hidden:  $z_1 = ?$
  - At output:  $y_1 = ?$   $y_{\text{pred}} = ?$
- Third example:
  - At hidden:  $z_1 = ?$
  - At output:  $y_1 = ?$   $y_{\text{pred}} = ?$

# Second architecture



# Computing activations

- In all examples,  $x = [x_0 \ x_1 \ x_2]$ , where  $x_0 = 1$
- Assume sigmoid activation function
- Initialize all weights to 0.05
- First example:  $x = [1 \ 1 \ 0]$
- Second example:  $x = [1 \ 0 \ 1]$
- Third example:  $x = [1 \ 1 \ 1]$

# Computing activations

- First, second, third example:
  - At hidden:
    - $z_1 = ?$
    - $z_2 = ?$
  - At output:
    - $y_1 = ?$
    - $y_2 = ?$
    - $y_{\text{pred}} = [1 \ 1]$

# Training the first network

- Perform backpropagation using stochastic gradient descent (one sample at a time)
- Weights are initially all 0.1
- Learning rate is 0.3
- Sigmoid activation function at hidden and output
- $d s(x) / dx = s(x) (1 - s(x)) dx$
- Samples have the following labels:
  - First example:  $x = [1 \ 1 \ 0]$ ,  $y = 1$
  - Second example:  $x = [1 \ 0 \ 1]$ ,  $y = 0$
  - Third example:  $x = [1 \ 1 \ 1]$ ,  $y = 1$
- Preview: What do you expect final weights to be?



# Learning from first example

- First example:  $x = [1 \ 1 \ 0]$ ,  $y = 1$
- Weights are  $w_{10}^{(1)} = w_{11}^{(1)} = w_{12}^{(1)} = w_{10}^{(2)} = w_{11}^{(2)} = 0.1$
- Activations are  $z_1 = 0.5498$ ,  $y_1 = 0.5387$
- Compute errors:
  - $\delta_{y1} = ?$
  - $\delta_{z1} = ?$
- Update weights:
  - $w_{10}^{(2)} = w_{10}^{(2)} - ?$
  - $w_{11}^{(2)} = w_{11}^{(2)} - ?$
  - $w_{10}^{(1)} = w_{10}^{(1)} - ?$
  - $w_{11}^{(1)} = w_{11}^{(1)} - ?$
  - $w_{12}^{(1)} = w_{12}^{(1)} - ?$

# Recap

- Do the  $w^{(1)}$  weights we obtained make sense?