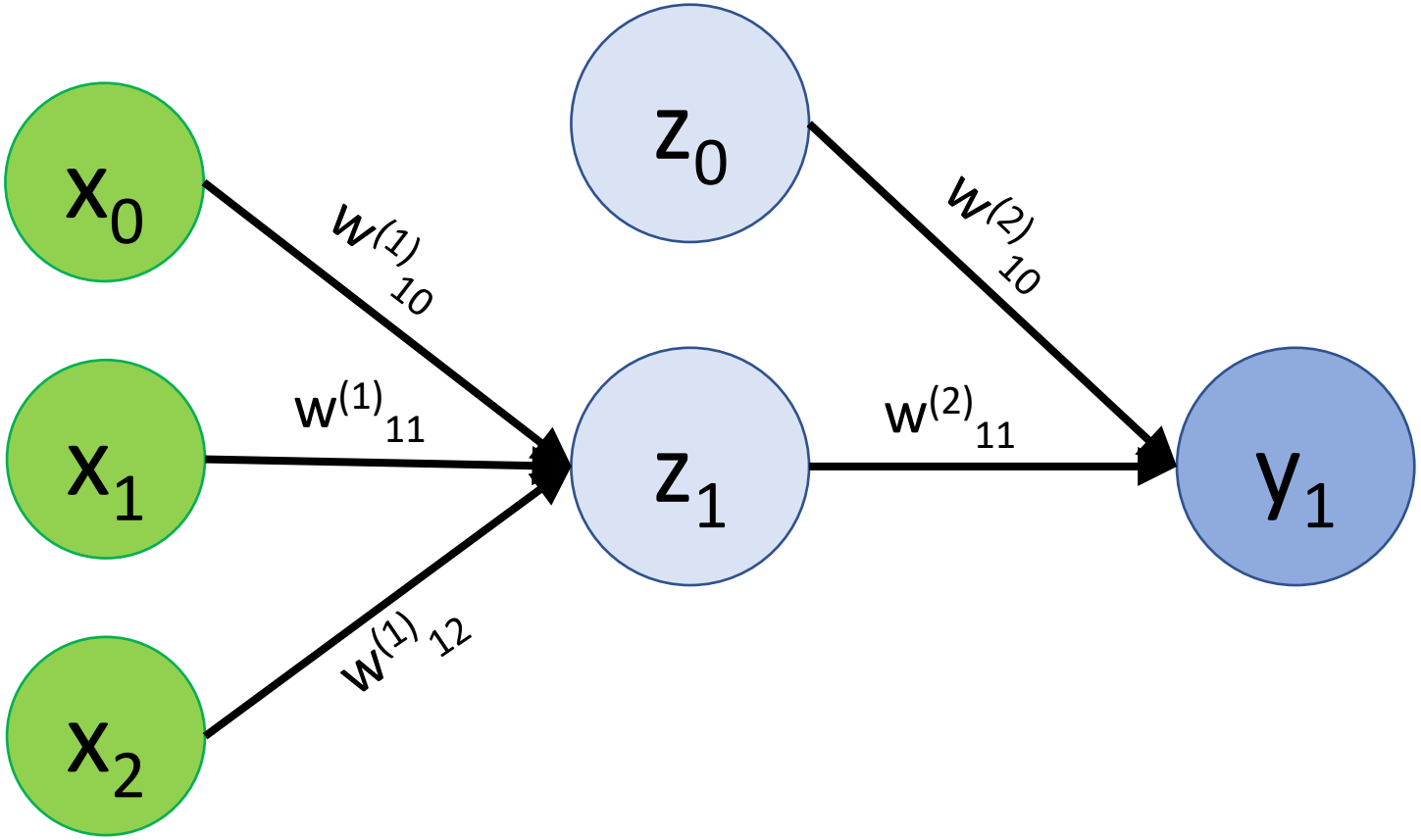
Neural Net Examples

CS 1678/2078 Intro to Deep Learning

January 24, 2024

Slides by Adriana Kovashka, examples credit: Rebecca Hwa / Nick Dryslewski

First architecture



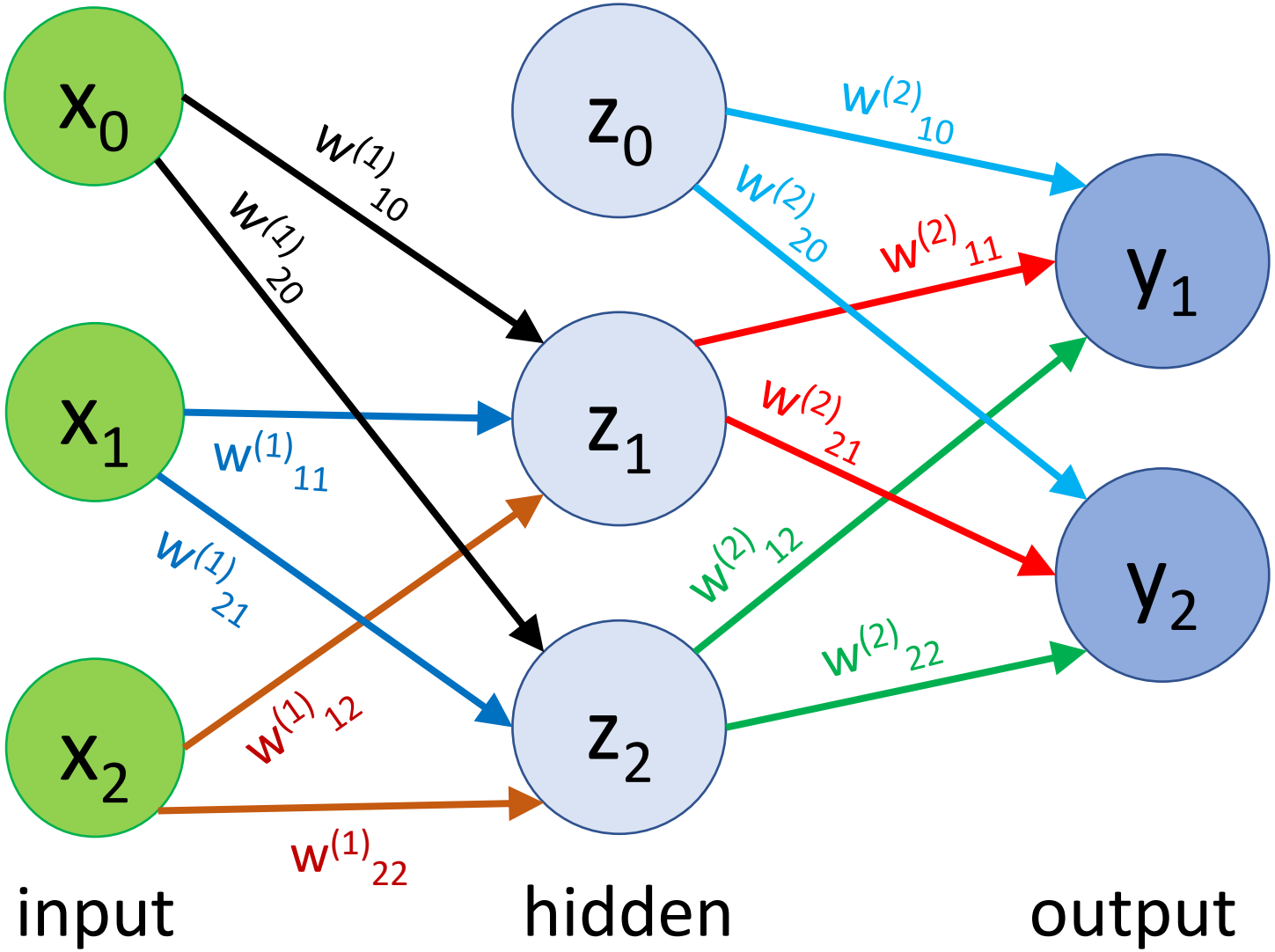
Computing activations

- In all examples, x = [x0 x1 x2], where x0 = 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_{pred} = ?
- Second example:
  - At hidden: z_1 = ?
  - At output: y_1 = ? y_{pred} = ?
- Third example:
  - At hidden: z_1 = ?
  - At output: y_1 = ? y_{pred} = ?

Second architecture



Computing activations

- In all examples, x = [x0 x1 x2], where x0 = 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_{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 $w^{(1)}_{10} = w^{(1)}_{11} = w^{(1)}_{12} = w^{(2)}_{10} = w^{(2)}_{11} = 0.1$
- Activations are $z_1 = 0.5498$, $y_1 = 0.5387$
- Compute errors:
  - $\delta_{y1} = ?$
  - $\delta_{z1} = ?$
- Update weights:
  - $w^{(2)}_{10} = w^{(2)}_{10} - ?$
  - $w^{(2)}_{11} = w^{(2)}_{11} - ?$
  - $w^{(1)}_{10} = w^{(1)}_{10} - ?$
  - $w^{(1)}_{11} = w^{(1)}_{11} - ?$
  - $w^{(1)}_{12} = w^{(1)}_{12} - ?$

Recap

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