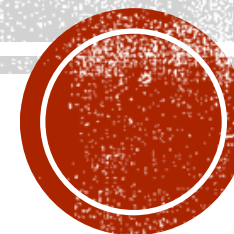


- Batch Gradient
- Mini-batch Gradient
- Stochastic Gradient



بسم الله الرحمن الرحيم

GRADIENT DESCENT

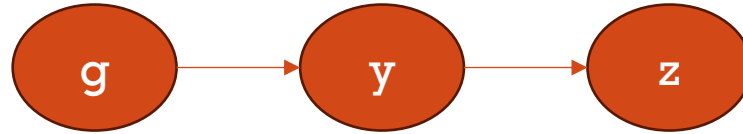


$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$

$$z = (w2 + -2 * w1) * w3$$



Target = 10

Predicted = -10

Loss = 20

$w1 = 3$

$w2 = 4$

$w3 = 5$

$$dz / dw1 = dz/dy * dy/dg * dg/dw1 = -10$$

$$dz / dw2 = dz/dy * dy/dw2 = w3 * 1 = w3 = 5$$

$$dz / dw3 = y = w2 + g = w2 - 2 * w1 = 4 - 2 * 3 = -2$$

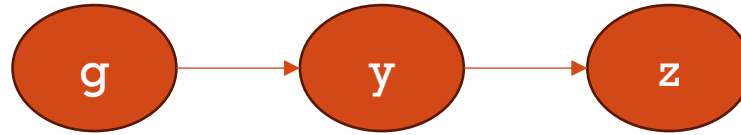
Gradient Descent STARTS...



$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$



Target = 10

$$dz / dw1 = -10$$

affect of w1 on z

$$dz / dw2 = 5$$

affect of w2 on z

$$dz / dw3 = -2$$

affect of w3 on z

w1 ↑

z ↓

w2 ↑

z ↑

w3 ↓

z ↑

GOAL!!!

Loss = 20



Predicted = -10



$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$

Predicted = -10



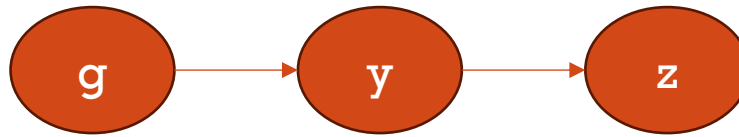
w1



w2



w3



Target = 10

$$w1 = 3$$

$$w2 = 4$$

$$w3 = 5$$

$$dz / dw1 = -10$$

$$dz / dw2 = 5$$

$$dz / dw3 = -2$$

Learning rate

$$w1 = 3 + 0.01 * (-10) = 2.9$$

$$w2 = 4 + 0.01 * 5 = 4.1$$

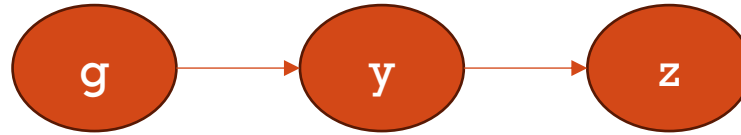
$$w3 = 5 + 0.01 * (-2) = 4.9$$



$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$



Target = 10

$$w1 = 3$$

$$w2 = 4$$

$$w3 = 5$$

$$z = (w2 + -2 * w1) * w3$$

$$\text{Predicted} = z = (4.1 - 2 * 2.9) * 4.9 = -8.33$$

This is one step!!

$$w1 = 3 + 0.01 * (-10) = 2.9$$

$$w2 = 4 + 0.01 * 5 = 4.1$$

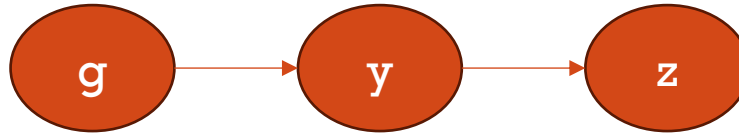
$$w3 = 5 + 0.01 * (-2) = 4.9$$



$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$



Target = 10

Predicted = -8.33

$w1 = 3$

$w2 = 4$

$w3 = 5$

$$z = (w2 + -2 * w1) * w3$$

$$dz / dw1 = -10$$

$$dz / dw2 = 5$$

$$dz / dw3 = -2$$

1 → Calculate the prediction

$$w1 = 3 + 0.01 * (-10) = 2.9$$

$$w2 = 4 + 0.01 * 5 = 4.1$$

$$w3 = 5 + 0.01 * (-2) = 4.9$$

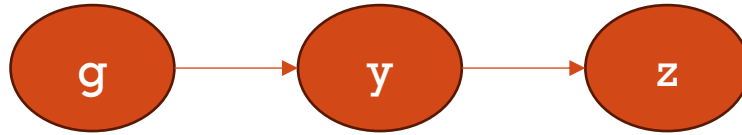


$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$

$$z = (w2 + -2 * w1) * w3$$



Target = 10

Predicted = -8.33

$w1 = 3$

$w2 = 4$

$w3 = 5$

$$dz / dw1 = -10$$

$$dz / dw2 = 5$$

$$dz / dw3 = -2$$

1 ➡ Calculate the prediction

2 ➡ Calculate the loss ➡ $\text{Loss} = \text{target} - \text{predicted}$

$$w1 = 3 + 0.01 * (-10) = 2.9$$

$$w2 = 4 + 0.01 * 5 = 4.1$$

$$w3 = 5 + 0.01 * (-2) = 4.9$$

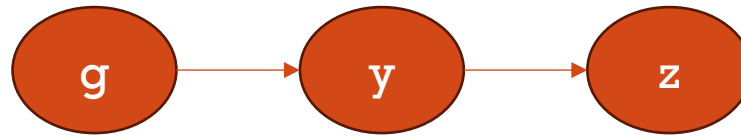


$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$

$$z = (w2 + -2 * w1) * w3$$



Target = 10

Predicted = -8.33

$w1 = 3$

$w2 = 4$

$w3 = 5$

$dz / dw1$

$dz / dw2$

$dz / dw3$

1 → Calculate the prediction

2 → Calculate the loss

3 → backpropagation

$$w1 = 3 + 0.01 * (-10) = 2.9$$

$$w2 = 4 + 0.01 * 5 = 4.1$$

$$w3 = 5 + 0.01 * (-2) = 4.9$$

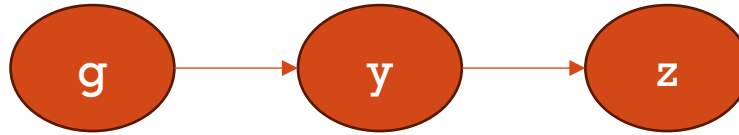


$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$

$$z = (w2 + -2 * w1) * w3$$



Target = 10

Predicted = -8.33

$w1 = 3$

$w2 = 4$

$w3 = 5$

$dz / dw1$

$dz / dw2$

$dz / dw3$

1 ➡ Calculate the prediction

2 ➡ Calculate the loss

3 ➡ backpropagation

4 ➡ Gradient Descent

$$w1 = 3 + 0.01 * (-10) = 2.9$$

$$w2 = 4 + 0.01 * 5 = 4.1$$

$$w3 = 5 + 0.01 * (-2) = 4.9$$

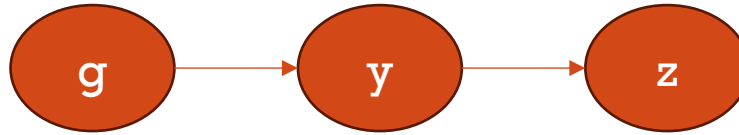


$$g = -2 * w1$$

$$y = w2 + g$$

$$z = y * w3$$

$$z = (w2 + -2 * w1) * w3$$



Target = 10

Predicted = -8.33

$w1 = 3$

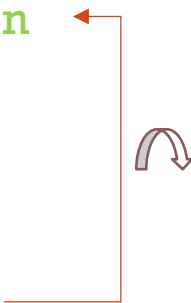
$w2 = 4$

$w3 = 5$

$dz / dw1$

$dz / dw2$

$dz / dw3$

- 1 ➡ Calculate the prediction
 - 2 ➡ Calculate the loss
 - 3 ➡ backpropagation
 - 4 ➡ Gradient Descent
- 

$$w1 = 3 + 0.01 * (-10) = 2.9$$

$$w2 = 4 + 0.01 * 5 = 4.1$$

$$w3 = 5 + 0.01 * (-2) = 4.9$$



NEXT... Neural Networks...

Practically

