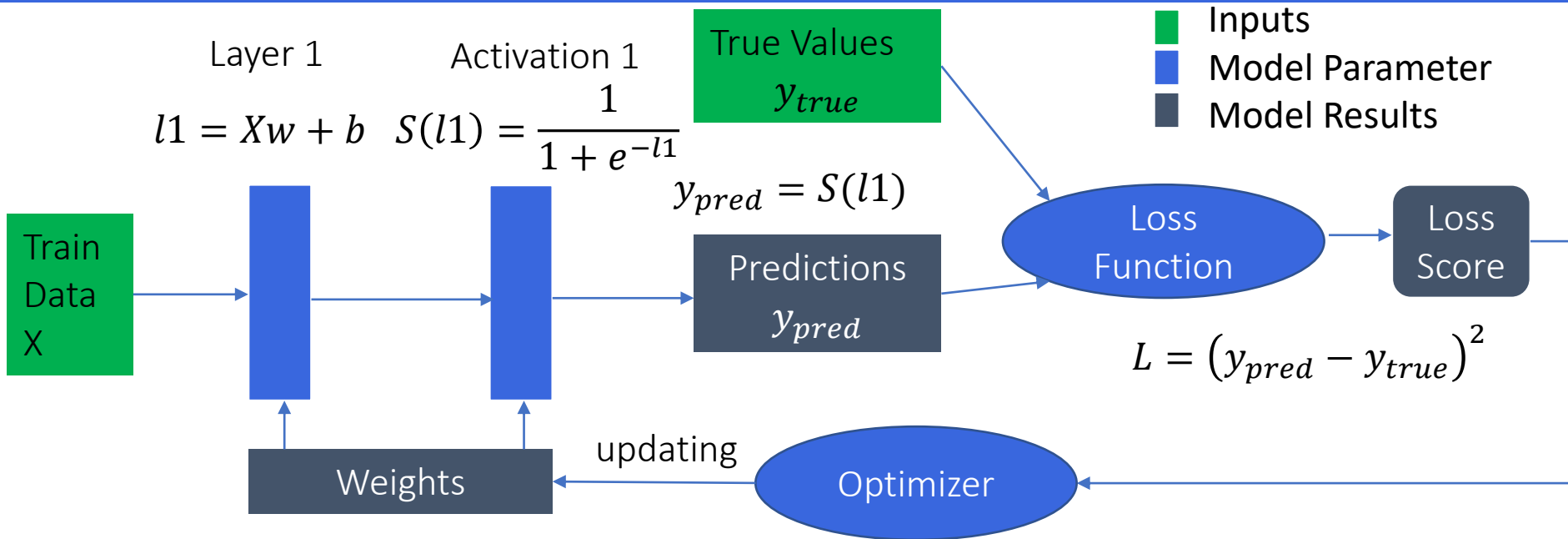


# Neural Network from Scratch

# Neural Network from Scratch

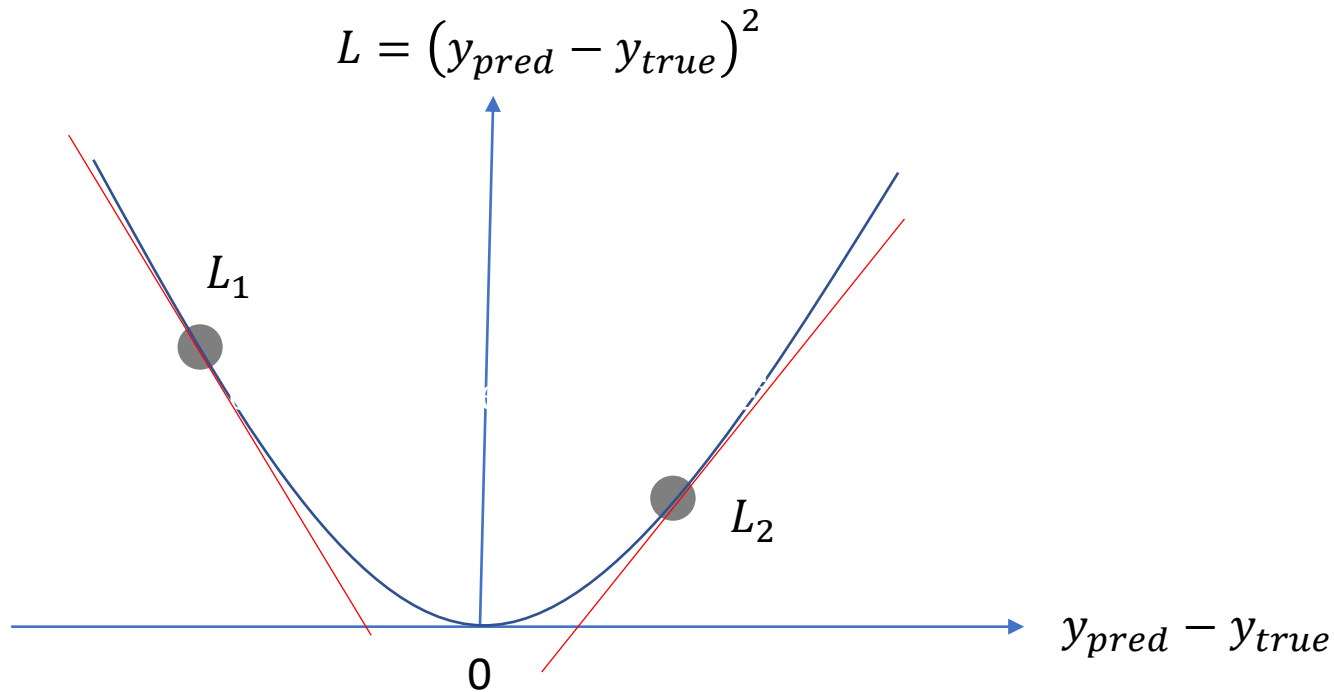
## Forward Pass



How to update the weights?

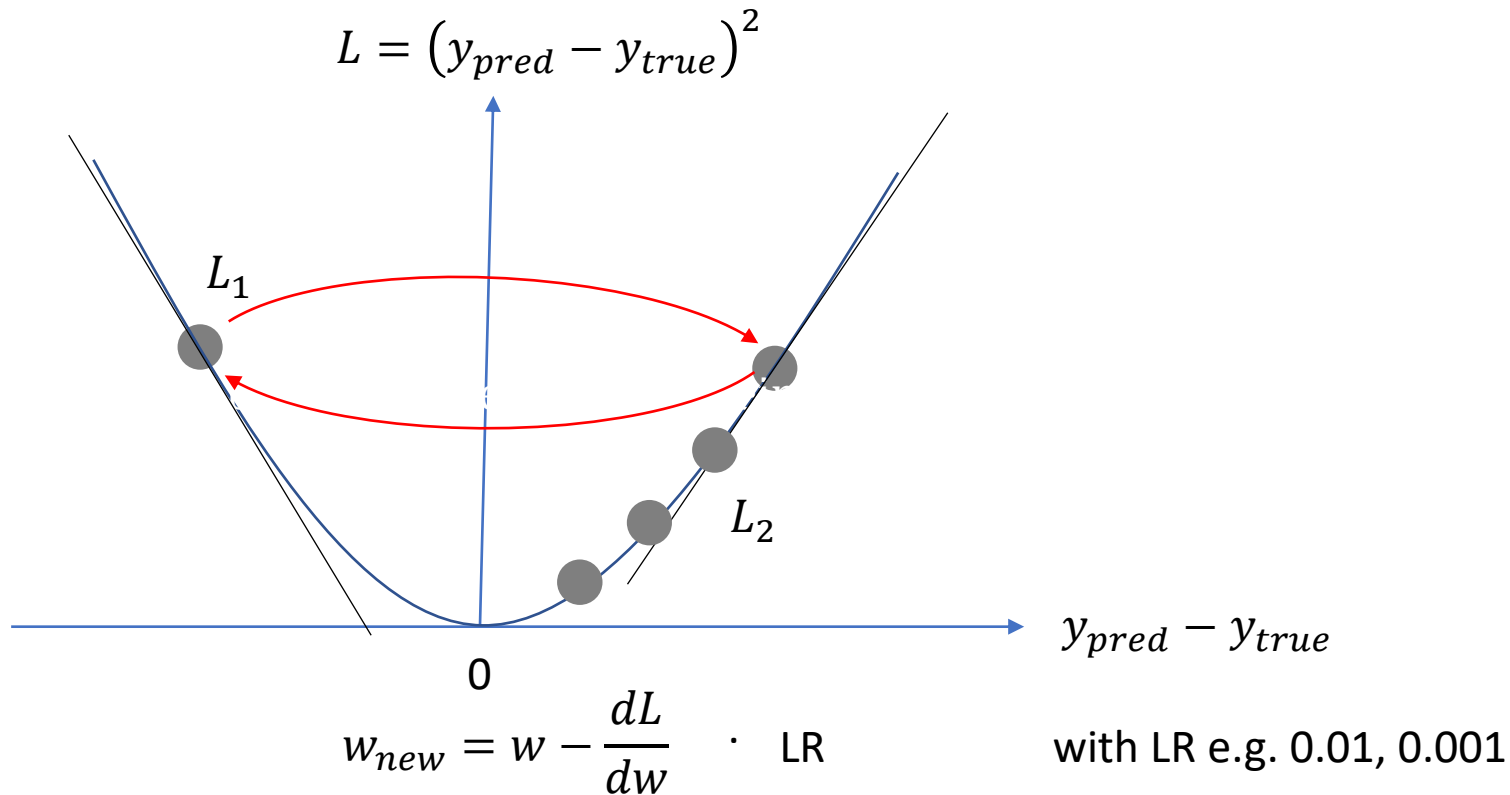
# Neural Network from Scratch

Weight Update



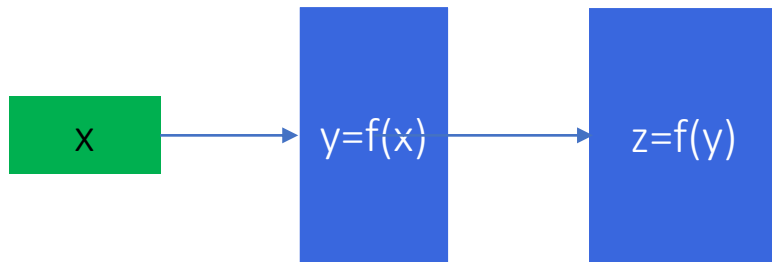
# Neural Network from Scratch

Learning Rate



# Neural Network from Scratch

## Chain Rule



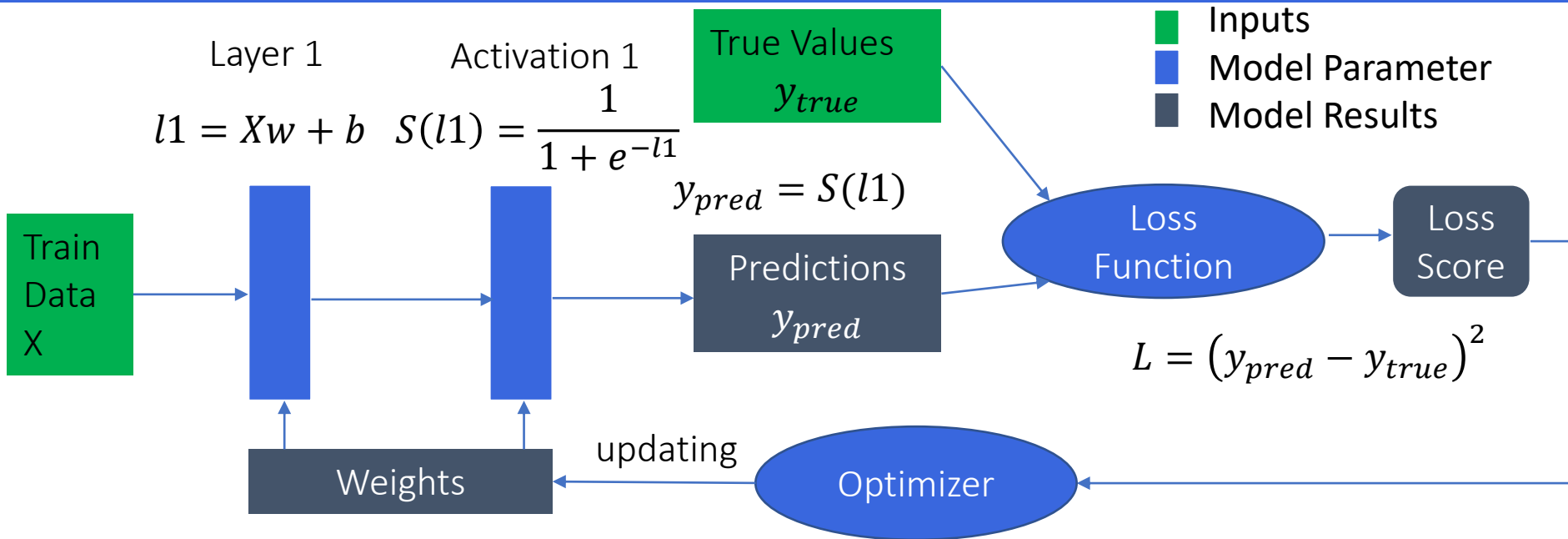
Target: get derivative of  $z$  to  $x$ !

$$\frac{dz}{dx} = \frac{dy}{dx} \cdot \frac{dz}{dy}$$

Chain Rule

# Neural Network from Scratch

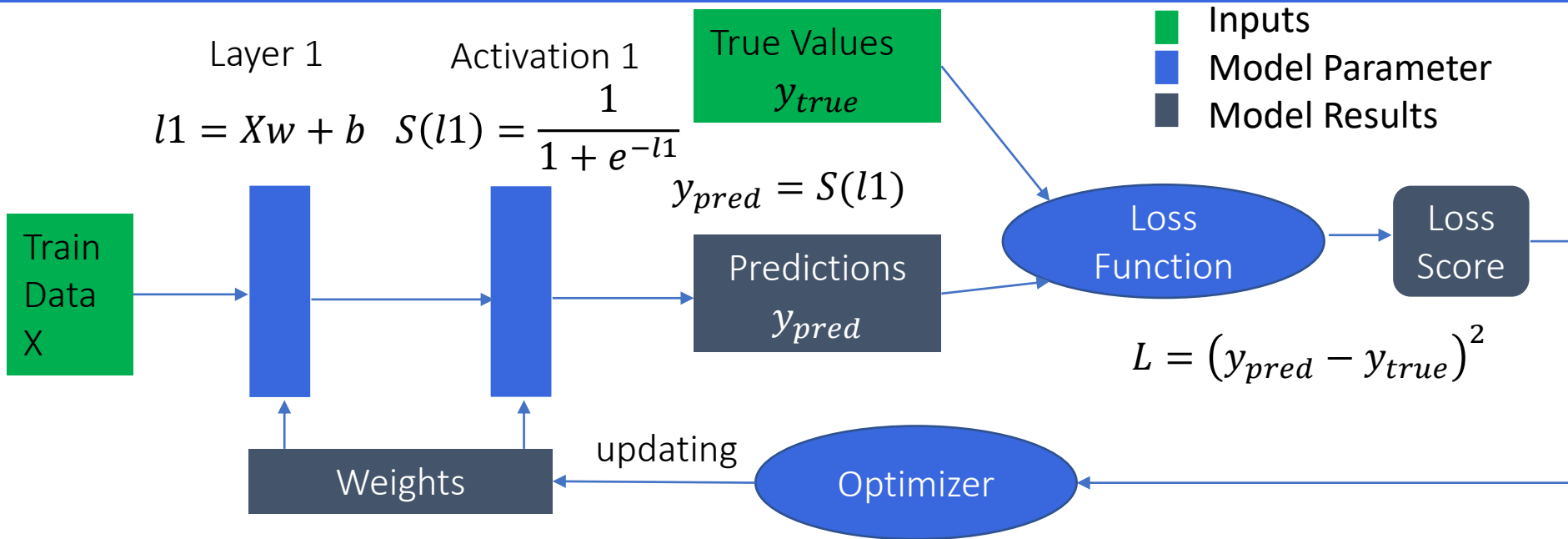
## Weights Update



$$\frac{dL}{dw} = \frac{d_{layer_1}}{dw} = X \cdot \frac{dy_{pred}}{dl_1} = \frac{dS(l1)}{dl_1} \cdot \frac{dL}{dy_{pred}} = 2(y_{pred} - y_{true})$$

# Neural Network from Scratch

Bias Update



$$\frac{dL}{db} = \frac{d_{layer_1}}{db} = 1 \cdot \frac{dy_{pred}}{dl_1} = \frac{dS(l1)}{dl_1} \cdot \frac{dL}{dy_{pred}} = 2(y_{pred} - y_{true})$$

# Neural Network from Scratch

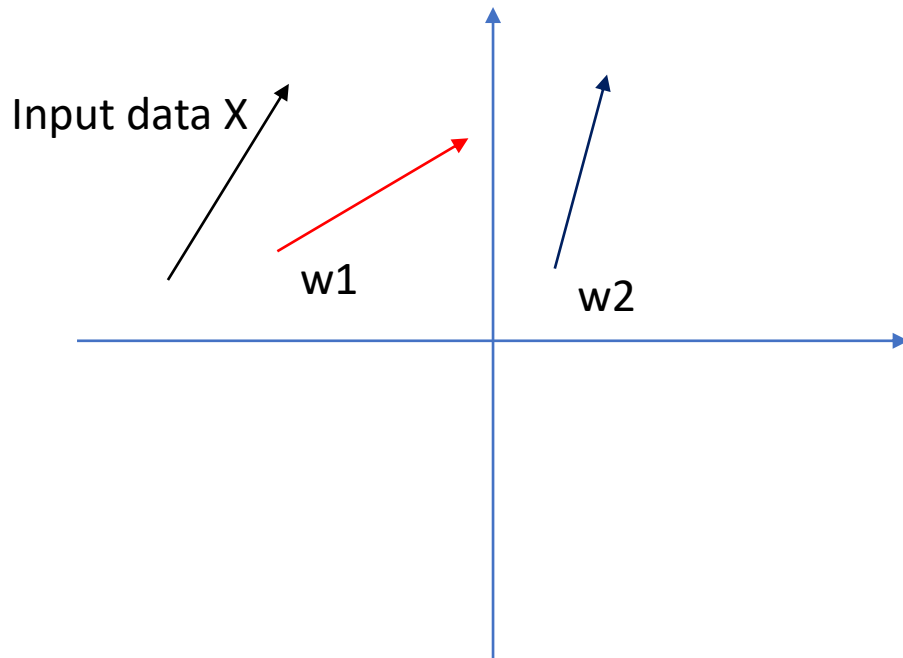
## Dot Product

- Finally, weights shall be adapted to map input data to outputs.
- Which weight is more similar to X?
- Dot product applied
- Weight is more similar, if
  - Magnitude is similar
  - Angle is similar

Angle between vectors

$$\vec{a} \cdot \vec{b} = \|\vec{a}\| \|\vec{b}\| \cos(\theta)$$

Magnitude (length) of vector





# Neural Network from Scratch

## Dot Product

- Finally, weights shall be adapted to map input data to outputs.
- Which weight is more similar to X?
- Dot product applied

X		w1
0	*	2
1	*	3

Dot product

$$X \cdot w1 = 0 * 2 + 1 * 3$$