Neural Network from Scratch

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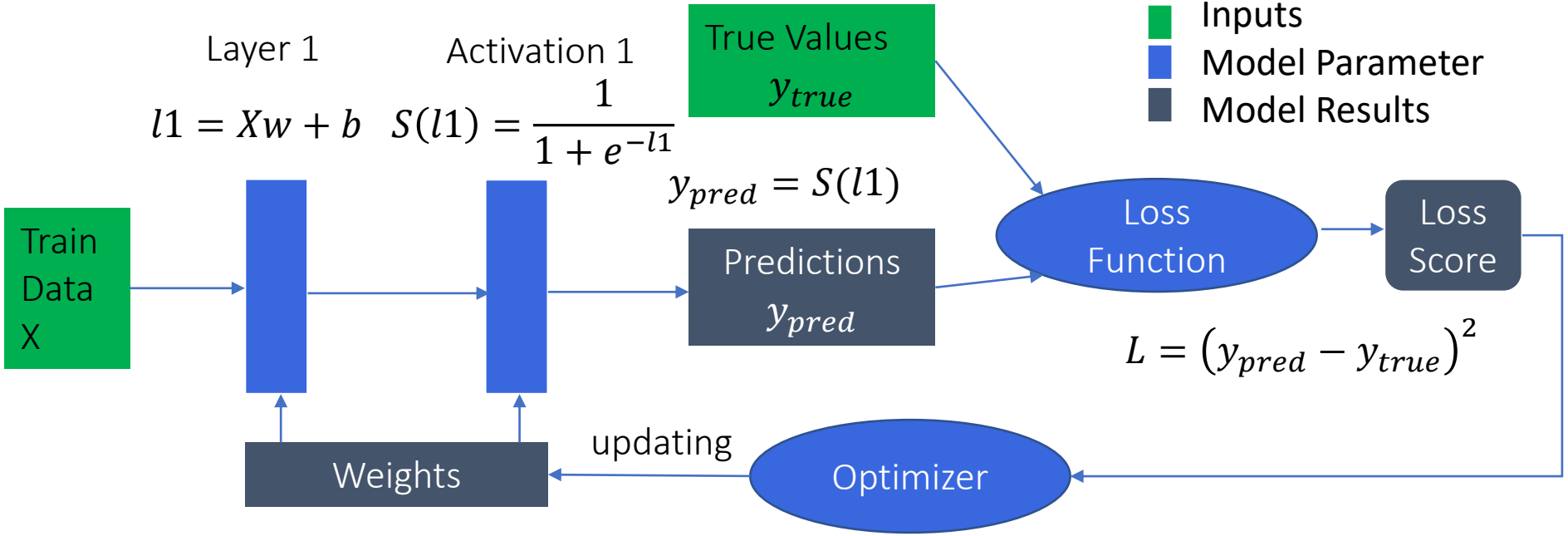
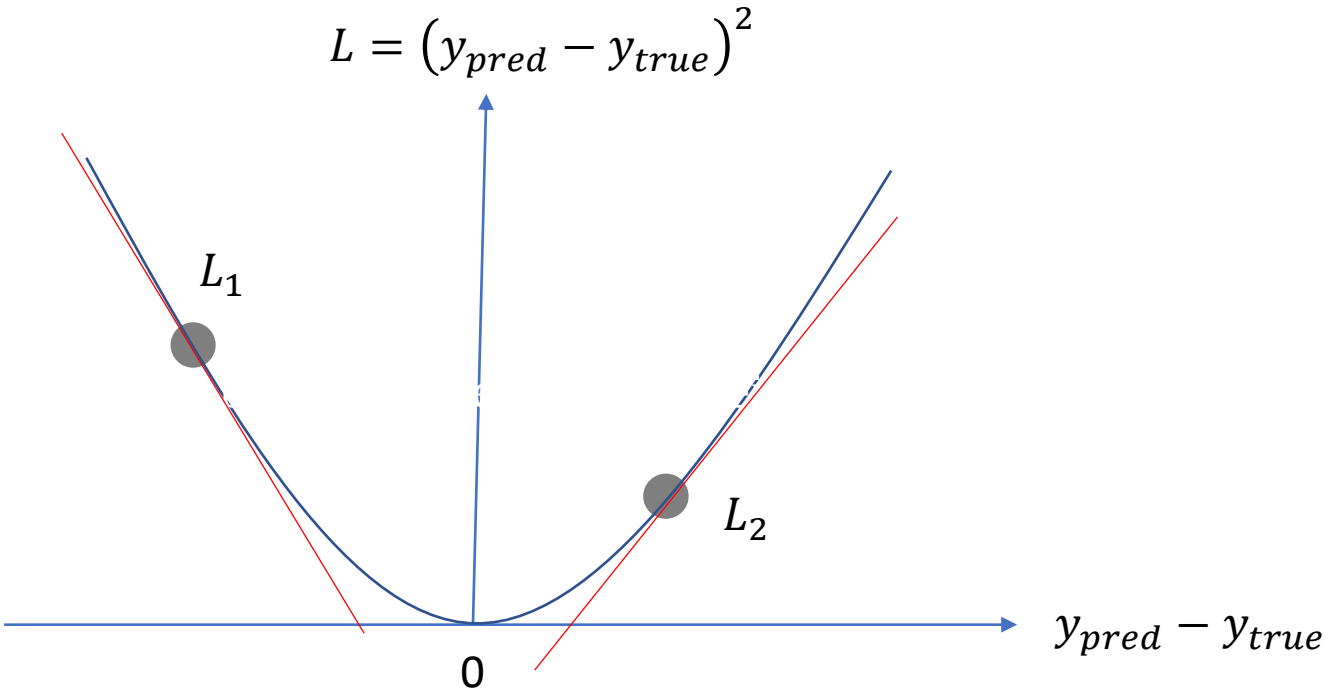
Forward Pass



How to update the weights?

Neural Network from Scratch

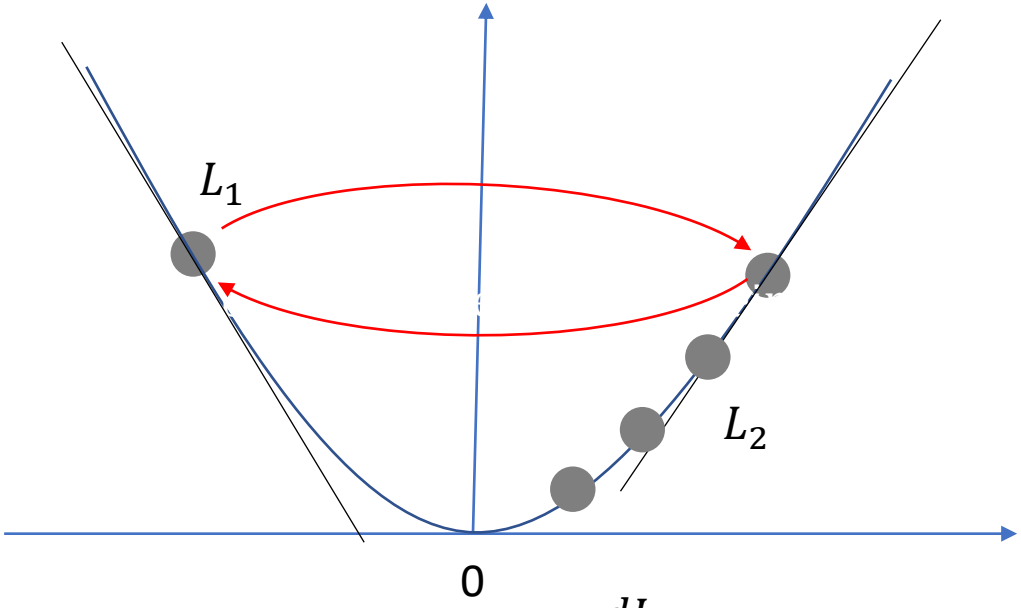
Weight Update



Neural Network from Scratch

Learning Rate

$$L = (y_{pred} - y_{true})^2$$

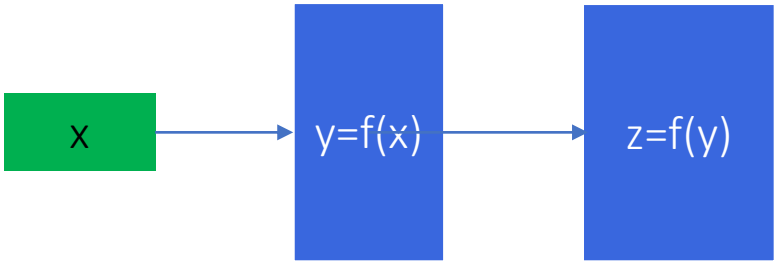


$$w_{new} = w - \frac{dL}{dw} \cdot \text{LR}$$

with LR e.g. 0.01, 0.001

Neural Network from Scratch

Chain Rule



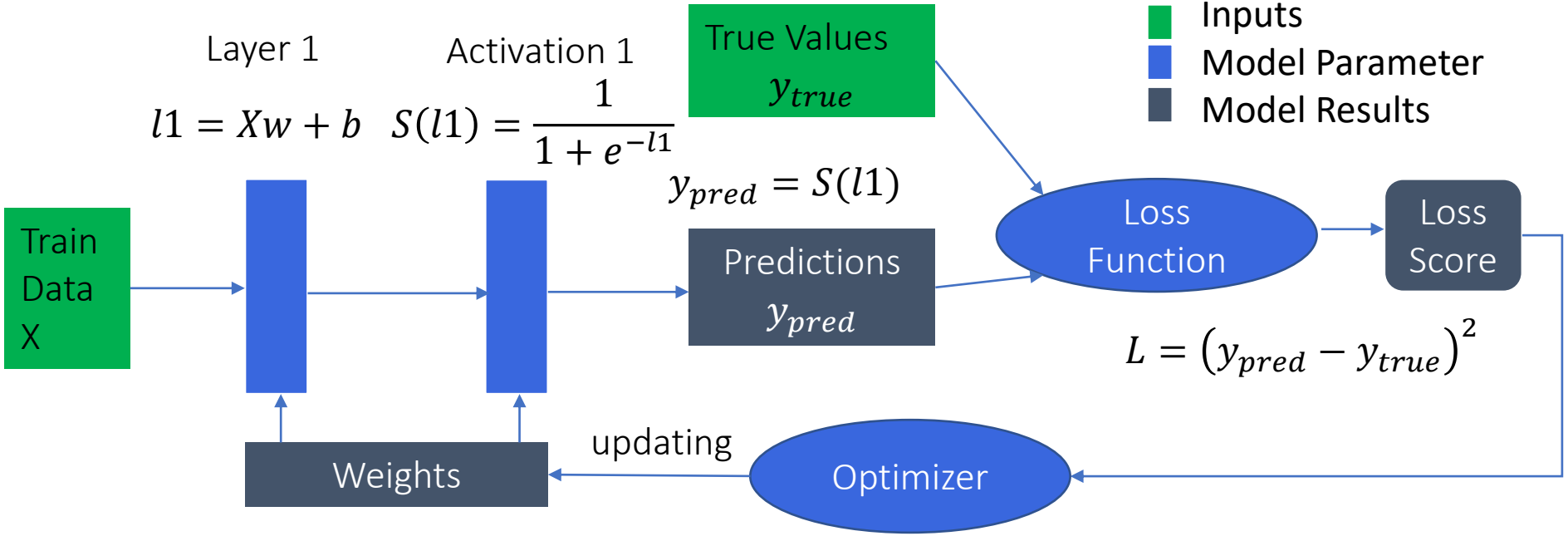
Target: get derivative of z to x!

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

Chain Rule

Neural Network from Scratch

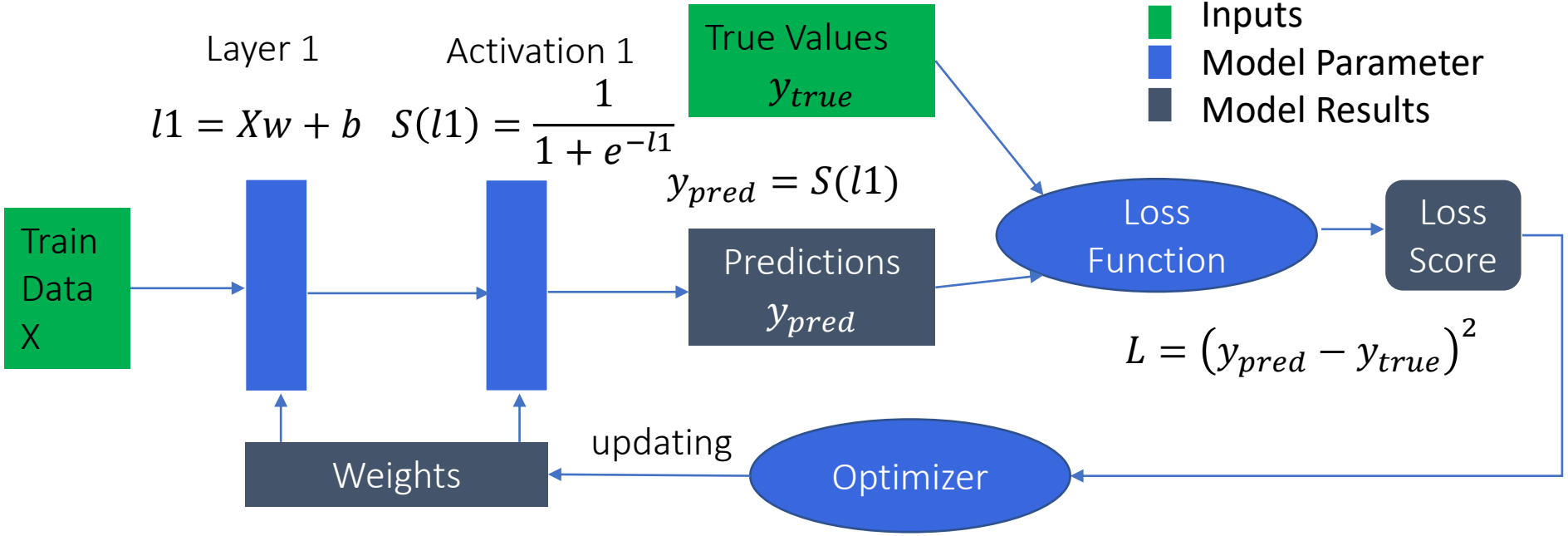
Weights Update



$$\frac{dL}{dw} = \frac{dlayer_1}{dw} = X \cdot \frac{dy_{pred}}{dl_1} = \frac{dS(l1)}{dl1} \cdot \frac{dL}{dy_{pred}} = 2(y_{pred} - y_{true})$$

Neural Network from Scratch

Bias Update

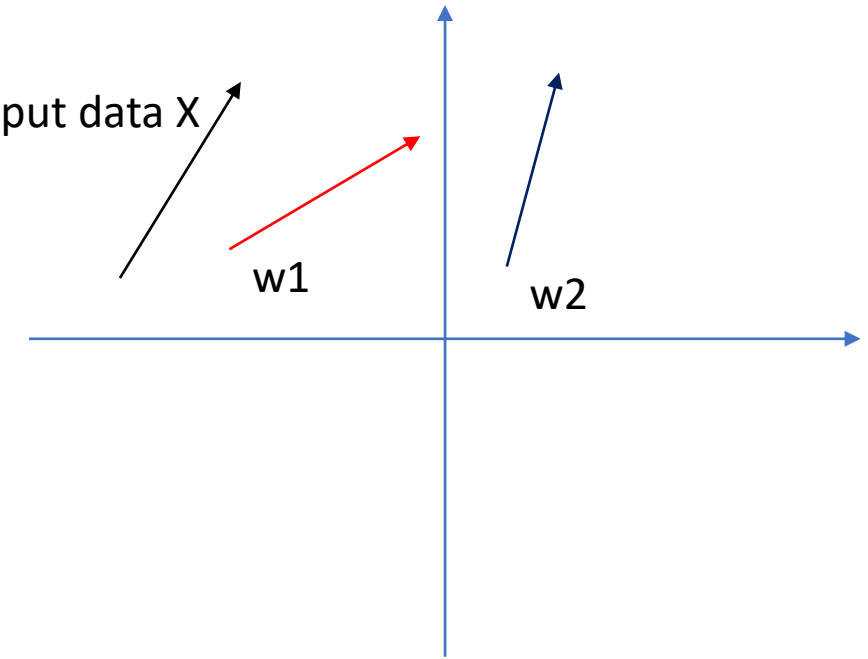


$$\frac{dL}{db} = \frac{dlayer_1}{db} = 1 \cdot \frac{dy_{pred}}{dl_1} = \frac{dS(l1)}{dl1} \cdot \frac{dL}{dy_{pred}} = 2(y_{pred} - y_{true})$$

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