Loss Function Definition

A loss function L(ŷ, y) measures the discrepancy between the predicted output ŷ and the true target y, guiding the network to minimize prediction errors during training.

Regression Tasks

Mean Squared Error (MSE)

$$L = (1/n) \Sigma (\hat{y}_i - y_i)^2$$

- **Penalizes large errors** quadratically
- **Differentiable** everywhere
- **Sensitive to outliers**

Example Calculation

Prediction		Target		Loss
5.2	−	4.0	→	1.44

Classification Tasks

Cross-Entropy Loss

$$L = -\Sigma y_i \log(\hat{y}_i)$$

- **Measures probability distribution** difference
- **Works with softmax** output
- **Penalizes confident mistakes** heavily

Example Calculation

Prediction		Target		Loss
0.7	log	1	→	0.36

Common Loss Functions

MSE

Task: Regression

Formula: $\Sigma(\hat{y} - y)^2$

Use Case: Continuous values

Cross-Entropy

Task: Classification

Formula: $-\Sigma\ y\ \log(\hat{y})$

Use Case: Class probabilities

MAE

Task: Regression

Formula: $\Sigma|\hat{y} - y|$

Use Case: Robust to outliers

🎯 Training Objective

The goal is to find parameters θ that minimize the average loss: $\boldsymbol{\theta^* = \text{argmin}\ (1/n)\ \Sigma\ L(f(x_i; \theta), y_i)}$