

# Dead ReLU Problem

## DEFINITION

Neurons that always output zero for all inputs (permanently inactive)

### CAUSE

Large negative gradients push weights into negative region

### CONSEQUENCE

Neuron stops learning,  
effectively removed

### IMPACT

Reduced capacity, wasted  
parameters

### ⚠ Symptoms & Detection

Significant portion of neurons inactive (**sometimes >40%**) · Monitor percentage of always-zero activations during training

## ✓ Solutions



Leaky ReLU / PReLU



Lower Learning Rate



Better Initialization



Gradient Clipping