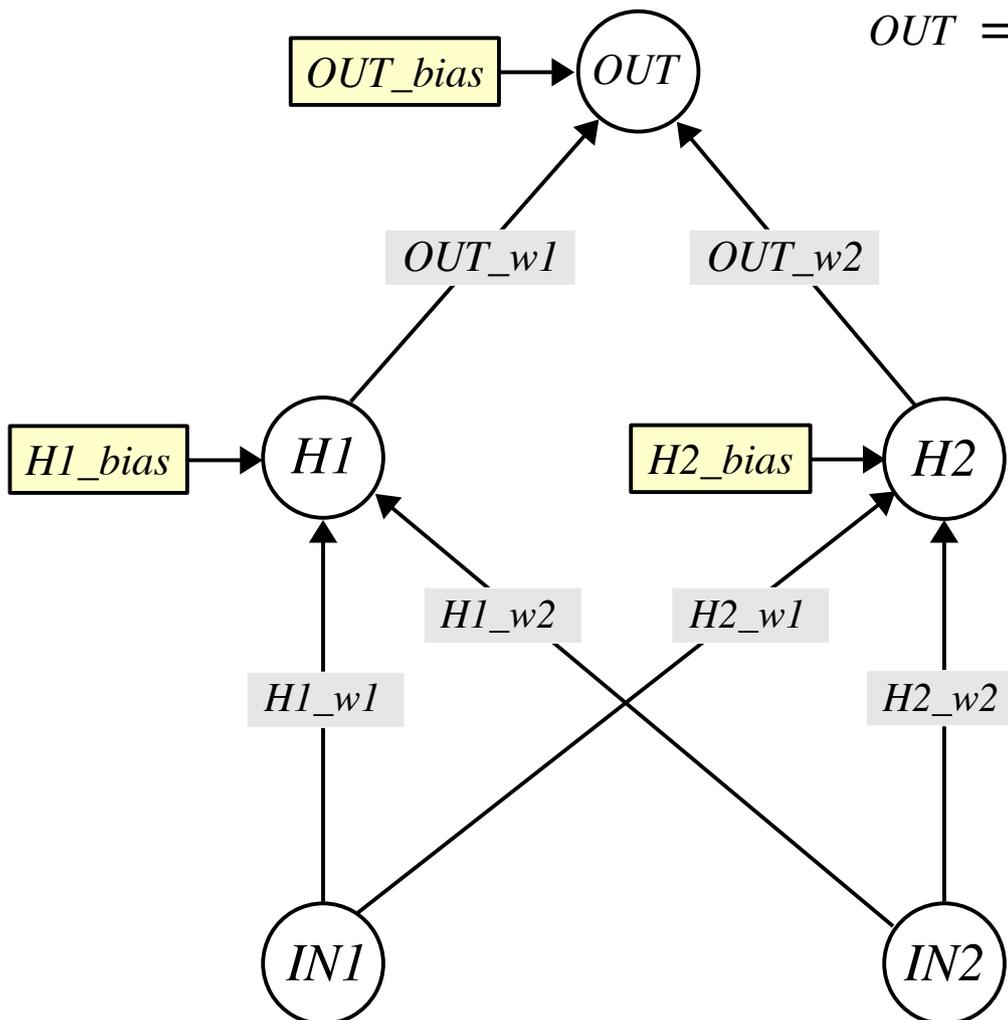# Summary: 2-2-1 Network – Forward Pass

$$\sigma(z) = \frac{1}{1 + e^{-z}}$$

$H1 \ = \ \sigma(IN1 \times H1\_w1 \ + \ IN2 \times H1\_w2 \ + \ H1\_bias)$

$H2 \ = \ \sigma(IN1 \times H2\_w1 \ + \ IN2 \times H2\_w2 \ + \ H2\_bias)$

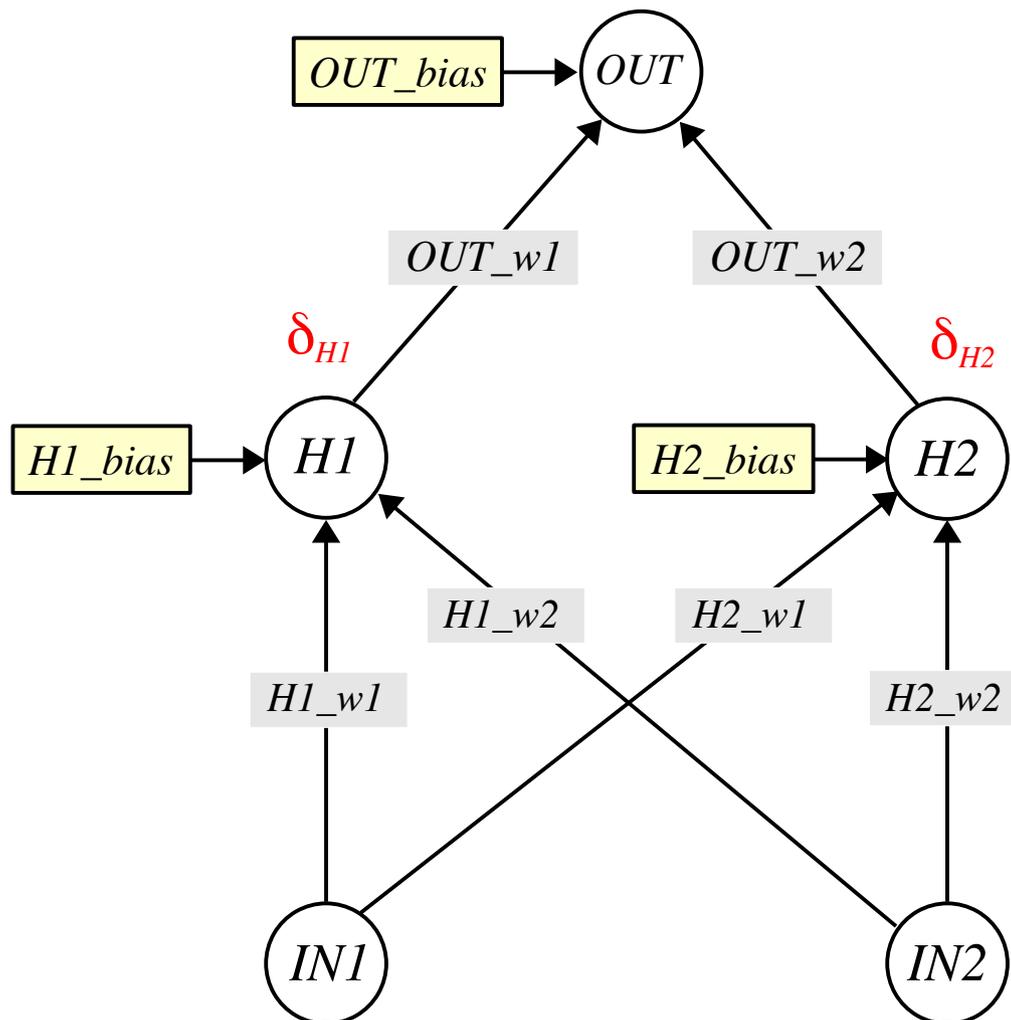$OUT \ = \ \sigma(H1 \times OUT\_w1 \ + \ H2 \times OUT\_w2 \ + \ OUT\_bias)$

Summary: 2-2-1 Network – Backward Pass

Learning rate
$0 < \eta < 1$

TARGET

δ_{OUT}

OUT_bias → OUT

δ_{H1}

OUT_w1   OUT_w2

δ_{H2}

H1_bias → H1   H2_bias → H2

H1_w2   H2_w1

H1_w1   H2_w2

IN1   IN2

$$\delta_{OUT} = (OUT - TARGET) \times OUT \times (1 - OUT)$$

$$\delta_{H1} = (\delta_{OUT} \times OUT\_w1) \times H1 \times (1 - H1)$$

$$\delta_{H2} = (\delta_{OUT} \times OUT\_w2) \times H2 \times (1 - H2)$$

$$\Delta OUT\_w1 = -\eta \times \delta_{OUT} \times H1$$

$$\Delta OUT\_w2 = -\eta \times \delta_{OUT} \times H2$$

$$\Delta OUT\_bias = -\eta \times \delta_{OUT}$$

$$\Delta H1\_w1 = -\eta \times \delta_{H1} \times IN1$$

$$\Delta H1\_w2 = -\eta \times \delta_{H1} \times IN2$$

$$\Delta H1\_bias = -\eta \times \delta_{H1}$$

$$\Delta H2\_w1 = -\eta \times \delta_{H2} \times IN1$$

$$\Delta H2\_w2 = -\eta \times \delta_{H2} \times IN2$$

$$\Delta H2\_bias = -\eta \times \delta_{H2}$$