Deep Learning

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Tính toán cổng XOR với $\theta = 0.5$, $\eta = 1$

$$f(y) = \begin{cases} 1, & \text{Nếu } y \geq \theta \\ 0, & \text{Nếu } y < \theta \end{cases}$$

Từ định nghĩa cổng XOR ta có:

$$y = x_1\overline{x_2} + \overline{x_1}x_2;$$

$$z_1 = x_1\overline{x_2}; z_2 = \overline{x_1}x_2;$$

$$y = z_1 + z_2$$

x_1	x_2	$x_1\overline{x_2}$	$\overline{x_1}x_2$	y
0	0	0	0	0
0	1	0	1	1
1	0	1	0	1
1	1	0	0	0

- $z_1 = x_1\overline{x_2}$
- $w_{11} = w_{12} = 1$, khởi tạo ngẫu nhiên
- $\theta = 0.5$, $\eta = 1$

$$\begin{aligned}
&(0,0) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 1 \times 0 + 1 \times 0 = 0, f(z_1) = 0(True)\\
&(0,1) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 1 \times 0 + 1 \times 1 = 1, f(z_1) = 1(False)\\
&(0,1) : w_{11} = 1 + (0-1)0 = 1, w_{21} = 1 + (0-1)1 = 0\\
&(1,0) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 1 \times 1 + 0 \times 0 = 1, f(z_1) = 1(True)\\
&(1,1) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 1 \times 1 + 0 \times 1 = 1, f(z_1) = 1(False)\\
&(1,1) : w_{11} = 1 + (0-1)1 = 0, w_{21} = 0 + (0-1)1 = -1\\
&(0,0) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 0 \times 0 + (-1) \times 0 = 0, f(z2) = 0(True)\\
&(0,1) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 0 \times 0 + (-1) \times 1 = -1, f(z_1) = 0(True)\\
&(1,0) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 0 \times 1 + (-1) \times 0 = 0, f(z_1) = 0(False)\\
&(1,0) : w_{11} = 0 + (1-0)1 = 1, w_{12} = -1 + (1-0)0 = -1\\
&(1,1) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 1 \times 1 + (-1) \times 1 = 0, f(z_1) = 0(True)\\
&(0,0) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 1 \times 0 + (-1) \times 0 = 0, f(z_1) = 0(True)\\
&(0,1) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 1 \times 0 + (-1) \times 1 = -1, f(z_1) = 0(True)\\
&(1,0) \leftarrow z_1 = w_{11}x_1 + w_{21}x_2 = 1 \times 1 + (-1) \times 0 = 1, f(z_1) = 1(True)
\end{aligned} \tag{1}$$

- $z_2 = \overline{x1}x_2$
- $w_{21} = w_{22} = 1$, khởi tạo ngẫu nhiên
- $\theta = 0.5$, $\eta = 1$

$$
\begin{aligned}
&(0,0) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = 1 \times 0 + 1 \times 0 = 0, f(z_2) = 0(True)\\
&(0,1) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = 1 \times 0 + 1 \times 1 = 0, f(z_2) = 1(True)\\
&(1,0) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = 1 \times 1 + 1 \times 0 = 1, f(z_2) = 1(False)\\
&(1,0) : w_{21} = 1 + 1(0-1)1 = 0, w_{12} = 1 + 1(0-1)0 = 1\\
&(1,1) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = 0 \times 1 + 1 \times 1 = 1, f(z_2) = 1(False)\\
&(1,1) : w_{21} = 0 + 1(0-1)1 = -1, w_{12} = 1 + 1(0-1)1 = 0\\
&(0,0) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = -1 \times 0 + 0 \times 0 = 0, f(z_2) = 0(True)\\
&(0,1) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = -1 \times 0 + 0 \times 1 = 0, f(z_2) = 0(False)\\
&(0,1) : w_{21} = -1 + 1(1-0)1 = -1, w_{12} = 0 + 1(1-0)1 = 1\\
&(1,0) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = -1 \times 1 + 1 \times 0 = -1, f(z_2) = 0(True)\\
&(1,1) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = -1 \times 1 + 1 \times 1 = 0, f(z_2) = 0(True)\\
&(0,0) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = -1 \times 0 + 1 \times 0 = 0, f(z_2) = 0(True)\\
&(0,1) \leftarrow z_2 = w_{21}x_1 + w_{22}x_2 = -1 \times 0 + 1 \times 1 = 1, f(z_2) = 1(True)
\end{aligned}
\tag{2}
$$

- $y = w_{31}z_1 + w_{32}z_2$
- $w_{31} = w_{32} = 1$, khởi tạo ngẫu nhiên
- $\theta = 0.5$, $\eta = 1$

$$
\begin{aligned}
&(0,0) \leftarrow y_{in} = w_{31}z_1 + w_{32}z_2 = 1 \times 0 + 1 \times 0 = 0, f(y_{in}) = 0(True)\\
&(0,1) \leftarrow y_{in} = w_{31}z_1 + w_{32}z_2 = 1 \times 0 + 1 \times 1 = 0, f(y_{in}) = 1(True)\\
&(1,0) \leftarrow y_{in} = w_{31}z_1 + w_{32}z_2 = 1 \times 1 + 1 \times 0 = 1, f(y_{in}) = 1(True)\\
&(1,1) \leftarrow y_{in} = w_{31}z_1 + w_{32}z_2 = 1 \times 0 + 1 \times 0 = 0, f(y_{in}) = 0(True)
\end{aligned}
\tag{3}
$$

Link code: **Click here**