$$\frac{1}{1+e^{-\theta^T x}} \rightarrow \boxed{\frac{1}{\alpha} \times \frac{1}{1+e^{-\theta^T x}}} \geq 0.5$$

new pred

if new pred $\geq 0.5 \rightarrow 1$

else $\rightarrow 0$

$$\frac{1}{\alpha} \times \frac{1}{1+e^{-\theta^T x}} \geq 0.5$$

$$\frac{1}{\alpha} \times \frac{1}{1+e^{-\theta^T x}} \geq \frac{1}{2}$$

$$\frac{1}{1+e^{-\theta^T x}} \geq \frac{\alpha}{2}$$

$$2 \geq (1+e^{-\theta^T x})\alpha$$

$$\frac{2}{\alpha} \geq (1+e^{-\theta^T x})$$

$$\frac{2}{\alpha} - 1 \geq e^{-\theta^T x}$$

$$e^{-\theta^T x} \leq \frac{2}{\alpha} - 1$$

$$-\theta^T x \leq \log\left(\frac{2-\alpha}{\alpha}\right)$$

$$\log\left(\frac{2}{\alpha} - 1\right) + \theta^T x \geq 0$$

$$\therefore \theta^0 := \theta^0 + \log\left(\frac{2}{\alpha} - 1\right)$$