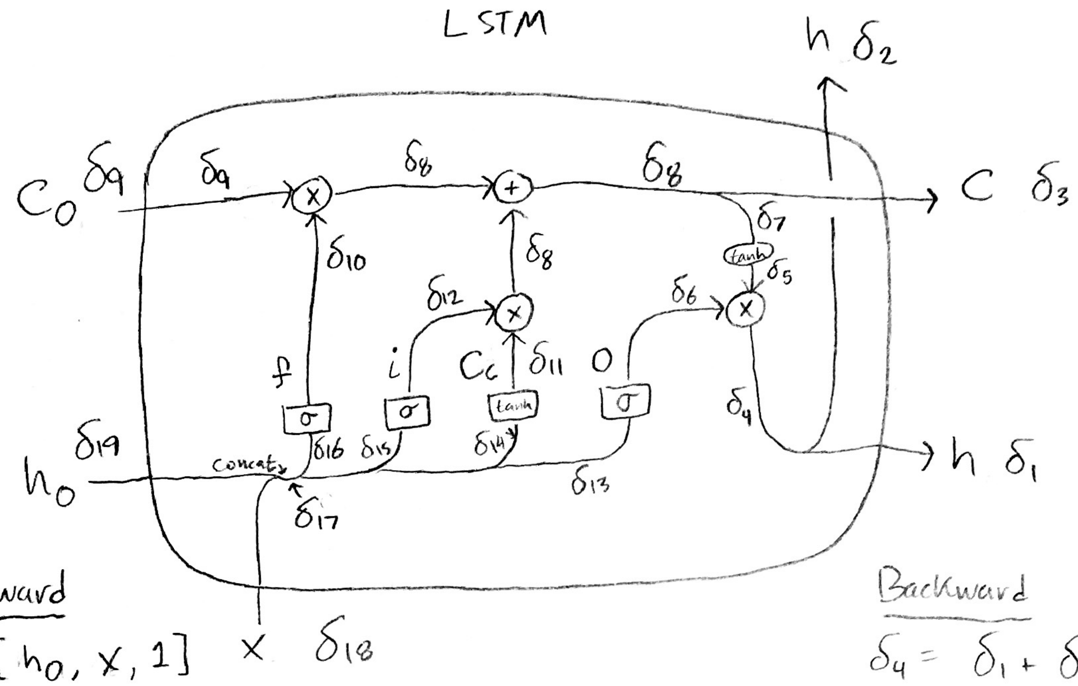

forward

$hxb = [h_0, x, 1]$

$f = \sigma(hxb \cdot W_f)$

$i = \sigma(hxb \cdot W_i)$

$C_c = \tanh(hxb \cdot W_c)$

$o = \sigma(hxb \cdot W_o)$

$C = f \otimes C_{t-1} + i \otimes C_c$

$h = O \otimes \tanh(C)$

Backward

$\delta_4 = \delta_1 + \delta_2$

$\delta_5 = \delta_4 \otimes O$

$\delta_6 = \delta_4 \otimes \tanh(C)$

$\delta_7 = \delta_5 \otimes \tanh'(C)$

$\delta_8 = \delta_3 + \delta_7$

$\delta_9 = \delta_8 \otimes f$

$\delta_{10} = \delta_8 \otimes C_0$

$\delta_{11} = \delta_8 \otimes i$

$\delta_{12} = \delta_8 \otimes C_c$

$$\left.\begin{aligned}
\delta_{13} &= O'(\delta_6) \\
\delta_{14} &= C_c'(\delta_{11}) \\
\delta_{15} &= i'(\delta_{12}) \\
\delta_{16} &= f'(\delta_{10})
\end{aligned}\right\} \text{remove last 1 from bias add}$$

$\delta_{17} = \delta_{13} + \delta_{14} + \delta_{15} + \delta_{16}$

$\delta_{18} = \delta_{17}[x \text{ region}]$

$\delta_{19} = \delta_{17}[h \text{ region}]$