The Popular LSTM Cell – Forward

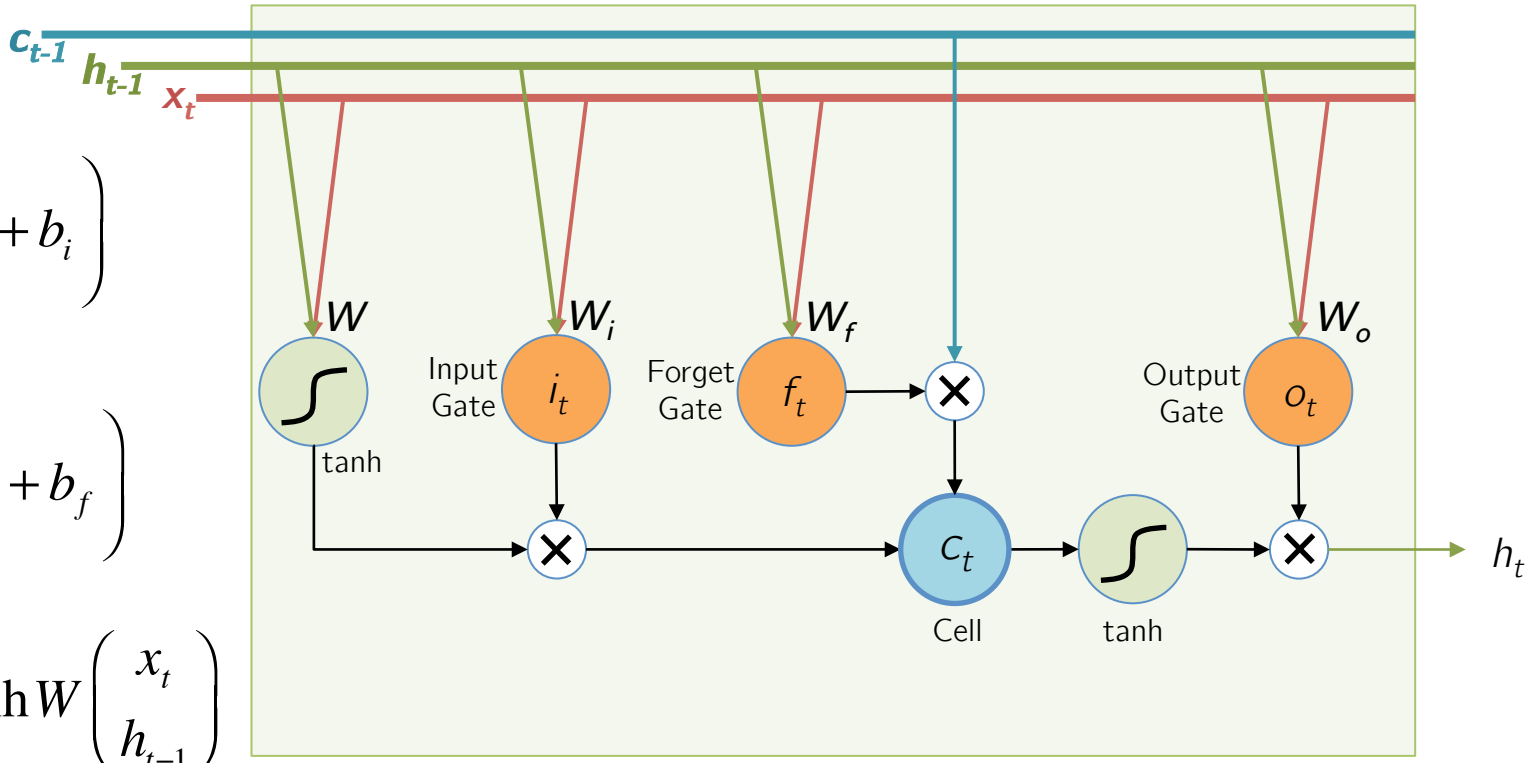
$$i_t = \sigma\left(W_i\begin{pmatrix}x_t\\h_{t-1}\end{pmatrix}+b_i\right)$$

$$f_t = \sigma\left(W_f\begin{pmatrix}x_t\\h_{t-1}\end{pmatrix}+b_f\right)$$

$$c_t = c_{t-1} + i_t \otimes \tanh W\begin{pmatrix}x_t\\h_{t-1}\end{pmatrix}$$

$$o_t = \sigma\left(W_o\begin{pmatrix}x_t\\h_{t-1}\end{pmatrix}+b_o\right)$$

$$h_t = o_t \otimes \tanh c_t$$



The Popular LSTM Cell – Backward

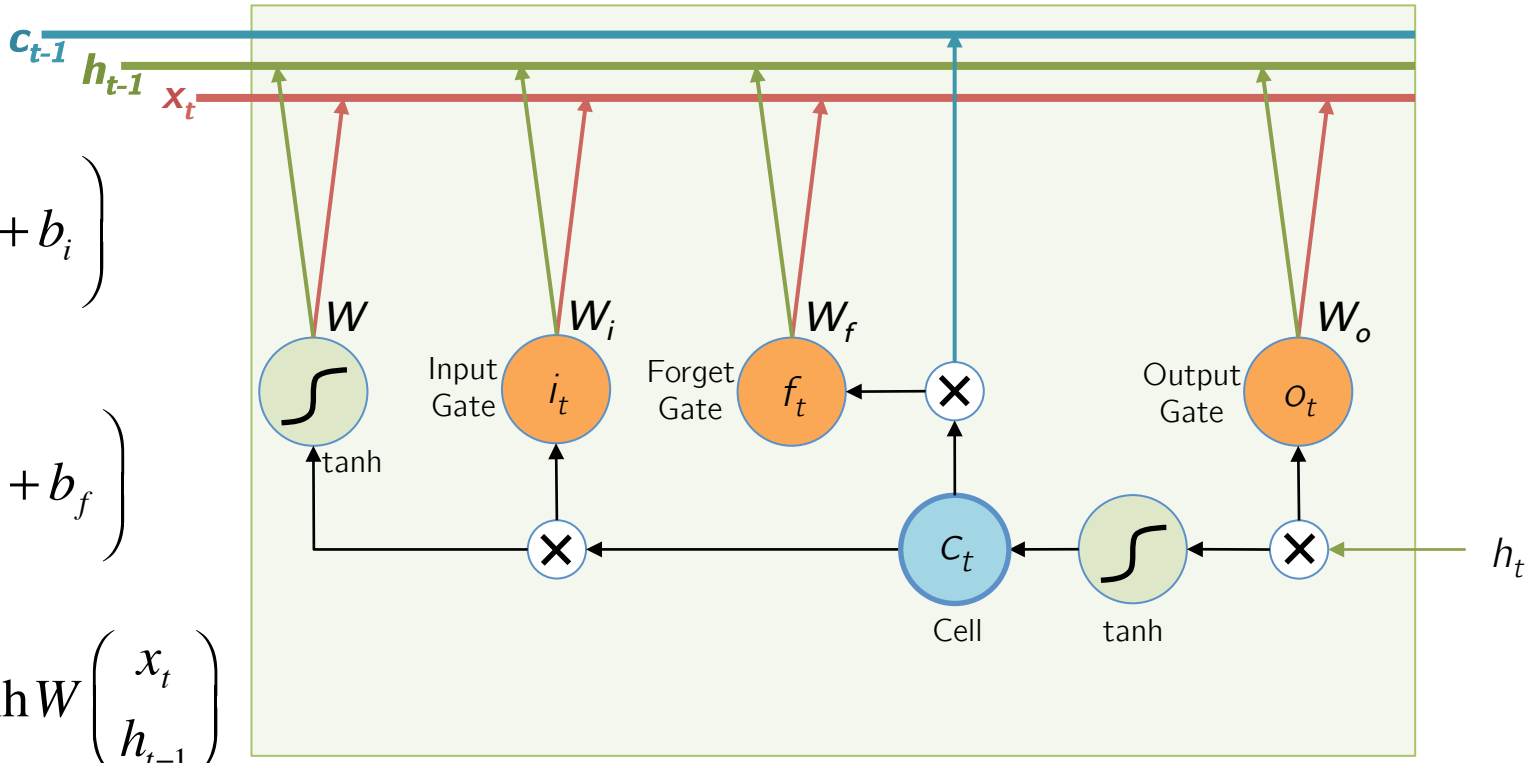
$$i_t = \sigma\left(W_i\begin{pmatrix}x_t\\h_{t-1}\end{pmatrix}+b_i\right)$$

$$f_t = \sigma\left(W_f\begin{pmatrix}x_t\\h_{t-1}\end{pmatrix}+b_f\right)$$

$$c_t = c_{t-1} + i_t \otimes \tanh W\begin{pmatrix}x_t\\h_{t-1}\end{pmatrix}$$

$$o_t = \sigma\left(W_o\begin{pmatrix}x_t\\h_{t-1}\end{pmatrix}+b_o\right)$$

$$h_t = o_t \otimes \tanh c_t$$



The Peephole LSTM Cell – Forward

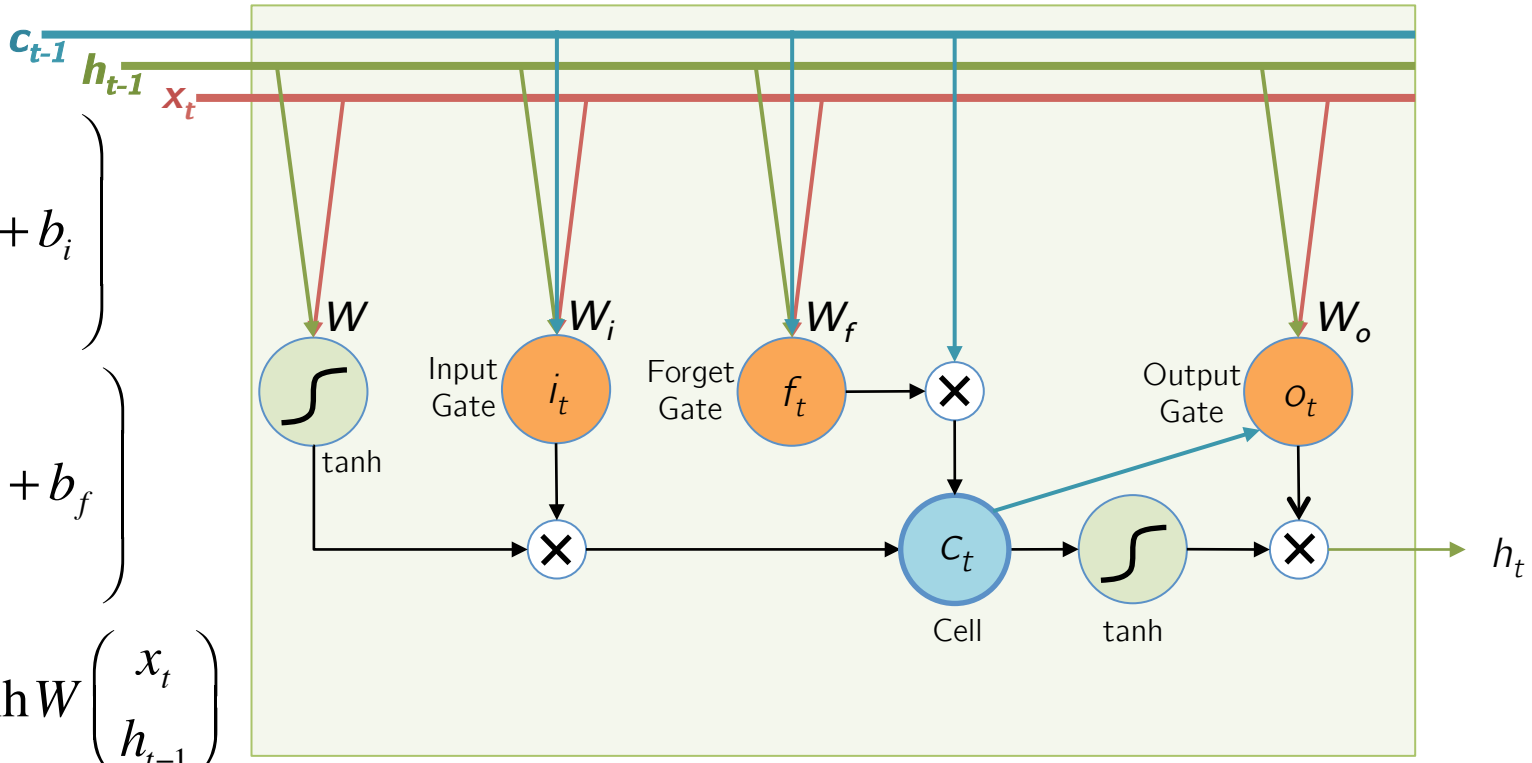
$$i_t = \sigma\left(W_i \begin{pmatrix} x_t \\ h_{t-1} \\ c_{t-1} \end{pmatrix} + b_i\right)$$

$$f_t = \sigma\left(W_f \begin{pmatrix} x_t \\ h_{t-1} \\ c_{t-1} \end{pmatrix} + b_f\right)$$

$$c_t = c_{t-1} + i_t \otimes \tanh W \begin{pmatrix} x_t \\ h_{t-1} \end{pmatrix}$$

$$o_t = \sigma\left(W_o \begin{pmatrix} x_t \\ h_{t-1} \\ c_t \end{pmatrix} + b_o\right)$$

$$h_t = o_t \otimes \tanh c_t$$



The Peephole LSTM Cell – Backward

$$i_t = \sigma\left(W_i \begin{pmatrix} x_t \\ h_{t-1} \\ c_{t-1} \end{pmatrix} + b_i \right)$$

$$f_t = \sigma\left(W_f \begin{pmatrix} x_t \\ h_{t-1} \\ c_{t-1} \end{pmatrix} + b_f \right)$$

$$c_t = c_{t-1} + i_t \otimes \tanh W \begin{pmatrix} x_t \\ h_{t-1} \end{pmatrix}$$

$$o_t = \sigma\left(W_o \begin{pmatrix} x_t \\ h_{t-1} \\ c_t \end{pmatrix} + b_o \right)$$

$$h_t = o_t \otimes \tanh c_t$$