

$$\begin{array}{l} ? \\ ? \\ ns.drawioTODO \\ ? \\ ???? \\ W\times \\ HI_0 \\ \{I_1,I_2,I_3,\cdots,I_{12}\} \\ W\times \\ \frac{H}{2^j} \\ \frac{H}{2^j} \\ \left\{F_i^j,j=1,2,3,4,5\right\} \\ F_i^jI_iji= \\ 0 \\ F_i^ji= \\ 1,2,\cdots,12F_i^j \\ F_i^j,j= \\ 2,3,4,5 \\ ???? \end{array}$$

$$(1) \quad X_l = softmax(Q_lK_l^T)V_l+X_{l-1}$$

$$\begin{array}{l} lX_l \in \\ R^{N \times C} \\ NC l^{th} \\ Q_l = \\ f_Q(X_{l-1}) \in \\ R^{N \times C} \\ X_0 \\ K_l, V_l \in \\ R^{H_l W_l \times C} \\ f_K(\cdot) f_V(\cdot) \\ H_l W_l \\ f_Q, f_K f_V \end{array}$$

$$(2) \quad \begin{array}{l} X_l = softmax(M_{l-1}+Q_lK_l^T)V_l+X_{l-1} \\ (x,y)M_{l-1} \end{array}$$

$$(3) \quad M_{l-1}(x,y)=\left\{ \begin{array}{l} 0 \; if \; M_{l-1}(x,y)=1-\infty \\ otherwise \end{array} \right.$$

$$\begin{array}{l} M_{l-1} \in \\ \{0,1\}^{N \times H_l W_l} \\ l_- \\ 1 \\ M_0 \\ 1/32,1/161/8 \\ e_{pos} \in \\ R^{H_l W_l \times C} \\ L^3 L \\ H_1 = \\ H/32, H_2 = \\ H/16, H_3 = \\ H/8 \\ W_1 = \\ W/32, W_2 = \\ W/16, W_3 = \\ W/8 H W \\ f_{CNN} v = \\ f_{CNN}(I) \in \\ R^D \\ \psi^I \\ I \end{array}$$

$$(4) \quad \mathcal{L}_I^{NCE} = -log \frac{exp(v \cdot v^+/\tau)}{exp(v \cdot v^+/\tau) + \sum_{v^- \in N_I} exp(v \cdot v^-/\tau)}$$

$$\begin{array}{l} v^+IN_I. \\ \tau > \\ 0 \ell_2 \\ N_I \\ ? \\ ? \\ ? \\ ? \\ ? \\ ? \\ ? \\ ? \\ f_{CNN} \\ I^h \\ f_{FCN} ? I \\ I \in \\ D^H \times W \times D \end{array}$$