

$$\begin{aligned} \ell = \sum_u \sum_v \#Sampled_u(v) \cdot (\log \sigma(\vec{s}_u \cdot \vec{t}_v) \\ + k \cdot E_{t_n \sim P_D} [\log \sigma(-\vec{s}_u \cdot \vec{t}_n)]) \end{aligned}$$