Algorithm 1 CNSL Inference Framework

Require: $p_\theta(x_s|z_s, z_{fs})$; $p_{\psi_1}(y_s|x_s, G_s)$; $p_{\psi_2}(y_t|y_s, x_t, G_t)$; the number of iteration η; learning rate α.

Ensure: $\hat{x}_s$

1: $\bar{z}_s = \frac{1}{k}\sum_i^k q_{\phi_1}(z_s|\hat{x}_s^{(i)}, \mathcal{G})$ ▷ $\hat{x}_s^{(i)}$ sampled from training set.

2: $\bar{z}_{fs} = \frac{1}{k}\sum_i^k q_{\phi_2}(z_s|\hat{x}_s^{(i)}, \mathcal{G})$ ▷ $\hat{x}_s^{(i)}$ sampled from training set.

3: **for** $i = 0, ..., \eta$ **do**

4:     $\hat{x}_s = p_\theta(\bar{z}_s, \bar{z}_{fs})$ ▷ Decoder

5:     $\hat{y}_s = p_{\psi_1}(\hat{x}_s, G_s)$ ▷ Source Network Diffusion

6:     $\hat{x}_t \leftarrow \hat{x}_s$ ▷ $L = \{(v_s, v_t)|v_s \in V_s, v_t \in V_t\}$

7:     $\hat{y}_t = p_{\psi_2}(\hat{x}_t, G_t)$ ▷ Target Network Diffusion

8:     $\bar{z}_s \leftarrow \bar{z}_s - \alpha \cdot \nabla \mathcal{L}_{\text{pred}}(\hat{y}_t, \bar{z}_s, \bar{z}_{fs})$

9: **end for**

10: $\hat{x}_s = p_\theta(\bar{z}_s, \bar{z}_{fs})$

For the seed set inference, we first sample k different $\hat{x}_s^{(i)}$ from the training set, and we marginalize them to obtain two latent variables $\bar{z}_s$ and $\bar{z}_{fs}$ (Line 1-2). For η iterations, we decode the predicted $\hat{x}_s$ based on $(\bar{z}_s, \bar{z}_{fs})$ (Line 4) and conduct cross-network information diffusion prediction (Line 5-7). The error between predicted $\hat{y}_t$ and the observed y_t is leveraged to update $\bar{z}_s$ based on Eq. (6).