

Supplemental Material

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This is the supplemental material for paper "Tracing Diagnosis Paths on Histopathology WSIs for Diagnostically Relevant Case Recommendation, MIC-CAI 2020". It includes the algorithm of the ROI feature extraction network.

Algorithm 1: The computation flowchart of the ROI feature extraction network $\mathbf{g} = \mathcal{F}_{graph}(\mathbf{A}, \mathbf{X})$, where $\mathcal{G}_{embed}^{(l)}$ and $\mathcal{G}_{pool}^{(l)}$ are GCN modules formulated in Algorithm2.

Input:
 $\mathbf{A} \in \mathbb{R}^{n_p \times n_p} \leftarrow$ The adjacency matrix of the n_p patches in the given ROI.
 $\mathbf{X} \in \mathbb{R}^{d \times n_p} \leftarrow$ The patch features for the ROI.
 $L \leftarrow$ The number of Diffpool modules.
 $n_l \leftarrow$ The number of graph vetexes after the l -th pooling. Specifically, $n_0 = n_p$ and $n_{l+1} < n_l$.
1 $\mathbf{X}^{(0)} \leftarrow \mathbf{X}_i^T$;
2 $\mathbf{A}^{(0)} \leftarrow \mathbf{A}_i$;
3 $\mathbf{Z}^{(0)} \leftarrow \mathcal{G}_{embed}^{(0)}(\mathbf{A}^{(0)}, \mathbf{X}^{(0)}) \in \mathbb{R}^{n_0 \times d}$;
4 **for** $l = 0$ **to** $L - 1$ **do**
5 $\mathbf{S}^{(l)} \leftarrow \text{softmax}_r(\mathcal{G}_{pool}^{(l)}(\mathbf{A}^{(l)}, \mathbf{X}^{(l)})) \in \mathbb{R}^{n_{l+1} \times n_l}$;
6 $\mathbf{X}^{(l+1)} \leftarrow \mathbf{S}^{(l)T} \mathbf{Z}^{(l)} \in \mathbb{R}^{n_{l+1} \times d}$;
7 $\mathbf{A}^{(l+1)} \leftarrow \mathbf{S}^{(l)T} \mathbf{A}^{(l)} \mathbf{S}^{(l)} \in \mathbb{R}^{n_{l+1} \times n_{l+1}}$;
8 $\mathbf{Z}^{(l)} \leftarrow \mathcal{G}_{embed}^{(l)}(\mathbf{A}^{(l)}, \mathbf{X}^{(l)}) \in \mathbb{R}^{n_l \times d}$;
9 **end**
10 $\mathbf{g} \leftarrow \text{Maxpool}_r(\mathbf{X}^{(L)})$;
11 **return** \mathbf{g} ;

Algorithm 2: The computation flowchart of GCN $\mathbf{Z} \leftarrow \mathcal{G}(\mathbf{A}, \mathbf{X})$

Input:
 $\mathbf{X} \leftarrow$ The features.
 $\mathbf{A} \leftarrow$ The adjacency matrix.
1 $\tilde{\mathbf{A}} \leftarrow \mathbf{A} + \mathbf{I};$
2 $\tilde{\mathbf{D}} \leftarrow \text{diag}(\sum_j \tilde{\mathbf{A}}_{1j}, \sum_j \tilde{\mathbf{A}}_{2j}, \dots, \sum_j \tilde{\mathbf{A}}_{nj});$
3 $\mathbf{H}^{(0)} \leftarrow \mathbf{X};$
4 **for** $k = 1$ **to** K **do**
5 $\mathbf{W}^{(k)} \leftarrow$ the trainable weighting matrix for the k -th step;
6 $\mathbf{H}^{(k)} = \text{ReLU}(\tilde{\mathbf{D}}^{-\frac{1}{2}} \tilde{\mathbf{A}} \tilde{\mathbf{D}}^{-\frac{1}{2}} \mathbf{H}^{(k-1)} \mathbf{W}^{(k)});$
7 **end**
8 $\mathbf{Z} \leftarrow \mathbf{H}^{(K)};$
9 **return** $\mathbf{Z};$
