
Deeper and Better: Mitigating Oversmoothing and Oversquashing in MPNNs via Local Riemannian Geometry

(Further Details on Visualization)

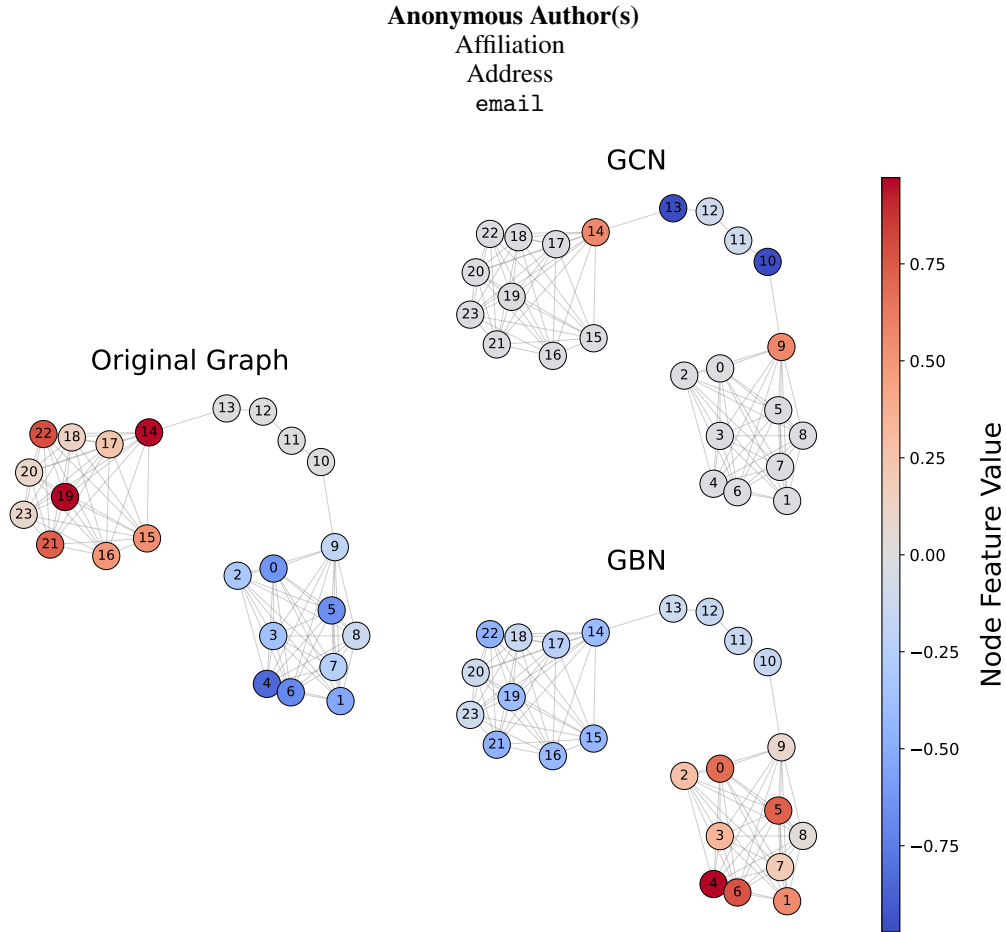


Figure 1: Case Study

Case Study We visualize the graph transfer task in Fig. 1 to investigate the model performance, comparing the vanilla GCN and the proposed GBN. To be specific, the experiment is conducted on the graph where two 10-node complete graphs (i.e., the source on the left numbered 14-23 and the target on the right 0-9) are connected by a line numbered 10-13 (i.e., topological bottleneck). The nodes are randomly assigned in $[0, 1]$ in the source, while $[-1, 0]$ in the target. The node value in the connecting line is “0”. The task is to swap the values in the source and target components. As a result, GCN results in the messages being severely “squashed” in the bottleneck, as shown in the nodes numbered 9, 10, 13 and 14. In contrast, the proposed GBN allows messages to pass through the bottleneck, thanks to local bottleneck adjustment.