**1： Comparison of GNNs and SPIC models**

**GNNs**

Run 20times, 64 hidden features

|  |  |  |  |
| --- | --- | --- | --- |
| GNN\_Features | Cora | CiteSeer | PubMed |
| GCN | lr=0.1,wd=5e-2 | lr=0.2,wd=5e-2 | lr=0.2,wd=5e-3 |
| SAGE | lr=0.1,wd=5e-2 | lr=0.2,wd=5e-2 | lr=0.2,wd=5e-3 |
| AGNN | lr=0.02,wd=5e-4 | lr=0.02,wd=5e-2 | lr=0.2,wd=5e-3 |
| GAT | lr=0.02,wd=5e-2 | lr=0.02,wd=5e-2 | lr=0.02,wd=1e-3 |

**SPIC models**

Run 20times, k=3, beta=1.0

|  |  |  |  |
| --- | --- | --- | --- |
| Power\_Features | Cora | CiteSeer | PubMed |
| D\_A\_D(SGC) | lr=0.5,wd=5e-3 | lr=0.1,wd=5e−2 | lr=0.5,wd=5e-4 |
| D\_inv\_A | lr=0.5,wd=5e-3 | lr=0.1,wd=5e−1 | lr=0.5,wd=5e-3 |
| P\_AGNN | lr=0.5,wd=5e-3 | lr=0.1,wd=5e−1 | lr=0.5,wd=5e-4 |
| P\_GAT | lr=0.02, wd=5e-2 | lr=0.02, wd=5e-2 | lr=0.5,wd=5e-4 |
| P\_GAT\_am | lr=0.02, wd=5e-2 | lr=0.02, wd=5e-2 | lr=0.5,wd=5e-4 |

**Test on PPI**

F1 score

K=2, 20 times

|  |  |
| --- | --- |
| PPI\_GAT | ppi\_F1 |
| GAT | lr=0.001,256\*4heads |
| P\_GAT | lr=0.002 |
| P\_GAT\_relu1 | lr=0.002，k=2,beta=1 |
| P\_GAT\_General | lr=0.002，k=2 |
| P\_GAT\_w | lr=0.002，k=2 |
| GCN | lr=0.03,w\_d=5e-6 |
| D\_A\_D(SGC) | lr=0.05,w\_d=5e-6,k=2 |
| DAD\_relu1 | lr=0.05,w\_d=5e-6,k=2 |
| D\_A\_D\_General | lr=0.005,w\_d=5e-6,k=2 |
| DAD\_w | lr=0.05,w\_d=5e-6,k=2 |

**2：Graph Feature Space Exploration**

**Feature Redundancy**

|  |  |  |
| --- | --- | --- |
|  | Cora\_800 | Cora\_193 |
| GCN | lr=0.1,w\_d=5e-2 | lr=0.1,w\_d=5e-2 |
| SAGE | lr=0.2,w\_d=5e-2 | lr=0.2,w\_d=5e-2 |
| AGNN | lr=0.02,w\_d=5e-4 | lr=0.02,w\_d=5e-4 |
| GAT | lr=0.02,w\_d=5e-2 | lr=0.02,w\_d=5e-2 |
| D\_A\_D(SGC) | lr=0.5,w\_d=5e-3 | lr=0.5,w\_d=5e-3 |
| D\_inv\_A | lr=0.5,w\_d=5e-3 | lr=0.5,w\_d=5e-3 |
| P\_AGNN | lr=0.5,w\_d=5e-3 | lr=0.5,w\_d=5e-3 |
| P\_GAT | lr=0.02,w\_d=5e-2 | lr=0.02,w\_d=5e-2 |

**GNN tests on Cora with random features**

|  |  |  |  |
| --- | --- | --- | --- |
| GNN\_r\_Features | r\_Cora300 | r\_CiteSeer500 | r\_PubMed1000 |
| GCN | lr=0.002 w\_d=5e-4 | lr=0.002 w\_d=5e-4 | lr=0.5 w\_d=5e-1 |
| SAGE | lr=0.002 w\_d=5e-4 | lr=0.02 w\_d=5e-4 | lr=0.5 w\_d=5e-1 |
| AGNN | lr=0.02 w\_d=5e-4 | lr=0.02 w\_d=5e-4 | lr=0.5 w\_d=5e-1 |
| GAT | lr=0.02 w\_d=5e-4 | lr=0.02 w\_d=5e-4 | lr=0.02 w\_d=5e-3 |

**DAD test on Citation networks with random features**

K=20, 10times

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| space-explore | r\_Cora\_100 | r\_Cora\_300 | r\_Cora\_500 | r\_Cora\_1000 |
| D\_A\_D(SGC) | lr=0.2 w\_d=5e-3 | lr=0.2 w\_d=5e-3 | lr=0.2 w\_d=5e-3 | lr=0.2 w\_d=5e-3 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| space-explore | r\_Cite\_100 | r\_Cite\_300 | r\_Cite\_500 | r\_Cite\_1000 |
| D\_A\_D(SGC) | lr=0.2 w\_d=5e-2 | lr=0.2 w\_d=5e-2 | lr=0.2 w\_d=5e-2 | lr=0.2 w\_d=5e-2 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| space-explore | r\_Pubmed\_100 | r\_Pubmed\_300 | r\_Pubmed\_500 | r\_Pubmed\_1000 |
| D\_A\_D(SGC) | lr=0.5,wd=5e-4 | lr=0.5,wd=5e-4 | lr=0.5,wd=5e-4 | lr=0.5,wd=5e-4 |

**DAD test on Citation networks with random features**

K=20, 10times

|  |  |  |  |
| --- | --- | --- | --- |
| SPIC\_r\_Features | r\_Cora300 | r\_CiteSeer500 | r\_PubMed1000 |
| D\_A\_D(SGC) | lr=0.2 w\_d=5e-3 | lr=0.2 w\_d=5e-2 | lr=0.5 w\_d=5e-4 |
| D\_inv\_A | lr=0.2 w\_d=5e-3 | lr=0.2 w\_d=5e-2 | lr=0.5 w\_d=5e-4 |
| P\_AGNN | lr=0.2 w\_d=5e-3 | lr=0.2 w\_d=5e-2 | lr=0.5 w\_d=5e-4 |
| P\_GAT | lr=0.1 w\_d=5e-2 | lr=0.01 w\_d=5e-2 | lr=0.1 w\_d=5e-1 |

**3：Random Laplacian**

1:r\_GNN

2: Random P\_GAT based on randomly initializing the attention vector.

R\_GAT\_sm

R\_GAT\_am

10times

|  |  |  |  |
| --- | --- | --- | --- |
| R\_GNN | Cora | CiteSeer | PubMed |
| r\_GNN\_sm | lr=0.02,w\_d=5e-4,k=2 | lr=0.2,w\_d=5e-2,k=2 | lr=0.02,w\_d=5e-3,k=2 |
| r\_GNN\_am | lr=0.02,w\_d=5e-4,k=2 | lr=0.2,w\_d=5e-2,k=2 | lr=0.02,w\_d=5e-3,k=5 |

2: k=3,10times

|  |  |  |  |
| --- | --- | --- | --- |
| R\_GAT | Cora | CiteSeer | PubMed |
| r\_GAT\_sm | lr=0.02,w\_d=5e-4,k=3 | lr=0.2,w\_d=5e-2,k=3 | lr=0.01,w\_d=5e-3,k=3 |
| r\_GAT\_am | lr=0.02,w\_d=5e-4,k=3 | lr=0.2,w\_d=5e-2,k=3 | lr=0.01,w\_d=5e-3,k=3 |