

Table 1 Node classification performance (Macro-F1, Micro-F1), The best and 2nd best are noted in red and blue, respectively.

	Citeseer		Pubmed		Reddit		Co_CS		Co_Ph	
	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1
Random	70.96 \pm 1.61	64.39 \pm 1.69	77.55 \pm 2.10	76.78 \pm 2.03	92.35 \pm 1.34	92.17 \pm 1.31	90.27 \pm 1.42	77.35 \pm 5.21	90.76 \pm 2.03	82.82 \pm 4.86
AGE	72.21 \pm 0.97	67.72 \pm 1.14	80.13 \pm 1.56	79.23 \pm 1.64	92.66 \pm 0.70	92.58 \pm 0.70	92.87 \pm 0.62	91.62 \pm 1.03	92.82 \pm 1.00	88.11 \pm 1.69
ANRMA	70.74 \pm 1.41	64.83 \pm 2.20	77.14 \pm 2.35	75.88 \pm 2.50	91.10 \pm 0.88	91.02 \pm 0.86	92.55 \pm 0.89	89.92 \pm 3.15	90.79 \pm 1.65	82.95 \pm 4.02
ALG	70.63 \pm 1.34	65.73 \pm 1.41	79.09 \pm 1.24	78.29 \pm 2.47	91.92 \pm 1.50	90.18 \pm 2.09	90.92 \pm 1.31	91.30 \pm 1.51	89.57 \pm 3.89	87.18 \pm 2.73
Grain	70.50 \pm 1.09	65.74 \pm 1.13	78.33 \pm 1.38	75.67 \pm 2.05	92.39 \pm 0.72	92.25 \pm 0.76	90.45 \pm 0.99	83.38 \pm 2.24	92.17 \pm 1.19	84.88 \pm 2.43
GPA	72.16 \pm 0.65	67.19 \pm 0.98	80.13 \pm 0.84	78.89 \pm 0.85	92.81 \pm 0.65	92.70 \pm 0.66	92.93 \pm 0.25	81.74 \pm 1.01	91.99 \pm 0.43	86.18 \pm 0.75
ALLIE	72.74 \pm 0.75	67.19 \pm 1.04	79.2 \pm 0.85	78.29 \pm 0.88	92.73 \pm 0.71	92.62 \pm 0.73	93.28 \pm 0.21	83.42 \pm 0.87	89.87 \pm 0.34	71.72 \pm 0.47
GraphCBAL	72.50 \pm 0.84	67.51 \pm 1.14	81.76 \pm 0.65	80.46 \pm 0.86	93.64 \pm 0.59	93.51 \pm 0.64	94.32 \pm 0.37	93.69 \pm 0.44	94.59 \pm 0.23	90.47 \pm 0.41
GraphCBAL++	72.22 \pm 0.90	67.11 \pm 1.13	81.24 \pm 0.65	80.11 \pm 0.74	93.49 \pm 0.52	93.33 \pm 0.57	93.57 \pm 0.42	93.19 \pm 0.37	94.36 \pm 0.27	90.26 \pm 0.45

Table 2 Imb-ratio and standard deviation of labeled nodes. The best and 2nd best are noted in red and blue, respectively.

	Citeseer		Pubmed		Reddit		Co_CS		Co_Ph	
	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD
Random	0.27 \pm 0.10	5.46	0.50 \pm 0.13	4.98	0.47 \pm 0.1	1.99	0.03 \pm 0.02	16.27	0.14 \pm 0.05	15.51
AGE	0.46 \pm 0.08	5.04	0.61 \pm 0.13	2.93	0.26 \pm 0.06	6.88	0.14 \pm 0.04	7.72	0.50 \pm 0.11	1.74
ANRMA	0.34 \pm 0.11	5.24	0.47 \pm 0.13	5.48	0.39 \pm 0.09	4.72	0.08 \pm 0.02	16.71	0.14 \pm 0.06	15.52
ALG	0.61 \pm 0.22	3.32	0.95 \pm 5.54	1.33	0.73 \pm 0.17	0.42	0.89 \pm 0.04	0.28	0.90 \pm 0.07	0.62
Grain	0.25 \pm 0.07	7.61	0.43 \pm 0.05	7.85	0.38 \pm 0.35	5.79	0.06 \pm 0.43	18.06	0.20 \pm 0.01	12.57
GPA	0.34 \pm 0.06	5.78	0.36 \pm 0.03	7.47	0.47 \pm 0.03	5.11	0.02 \pm 0.01	13.51	0.06 \pm 0.00	24.12
ALLIE	0.28 \pm 0.06	6.12	0.45 \pm 0.05	6.08	0.35 \pm 0.04	6.52	0.02 \pm 0.00	12.49	0.01 \pm 0.00	25.47
GraphCBAL	0.45 \pm 0.05	4.42	0.66 \pm 0.06	3.31	0.47 \pm 0.04	4.33	0.52 \pm 0.03	3.6	0.61 \pm 0.04	3.04
GraphCBAL++	0.57 \pm 0.10	2.96	0.82 \pm 0.05	1.72	0.66 \pm 0.06	2.22	0.69 \pm 0.04	2.08	0.81 \pm 0.03	1.53

Figure 1 The class distributions of the test dataset and validation datasets.



Table 3 The classification performance of GraphCBAL and two reinforced baselines under different validation datasets. The best is noted in red.

	Citeseer		Pubmed		Reddit		Co_CS		Co_Ph	
	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1
GPA(val_balance)	71.82 \pm 0.94	65.81 \pm 1.20	76.04 \pm 1.03	75.15 \pm 0.97	91.80 \pm 0.87	91.74 \pm 0.84	93.36 \pm 0.37	83.86 \pm 1.39	87.73 \pm 0.26	69.33 \pm 0.36
ALLIE(val_balance)	71.60 \pm 0.86	65.16 \pm 2.00	76.95 \pm 1.10	75.94 \pm 1.12	92.18 \pm 0.66	92.10 \pm 0.69	93.61 \pm 0.37	84.46 \pm 1.41	89.14 \pm 0.25	70.62 \pm 0.31
GraphCBAL(val_balance)	71.74 \pm 0.96	66.87 \pm 1.05	81.66 \pm 0.71	80.60 \pm 0.86	93.69 \pm 0.62	93.57 \pm 0.65	93.31 \pm 0.41	93.01 \pm 0.39	94.11 \pm 0.22	89.94 \pm 0.38

	Citeseer		Pubmed		Reddit		Co_CS		Co_Ph	
	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1
GPA(val_missing)	69.59 \pm 0.92	64.88 \pm 1.15	79.32 \pm 0.84	77.47 \pm 1.12	91.83 \pm 0.86	91.75 \pm 0.85	89.71 \pm 0.21	64.01 \pm 0.23	87.73 \pm 0.26	69.33 \pm 0.36
ALLIE(val_missing)	70.51 \pm 0.91	65.65 \pm 1.25	79.49 \pm 0.94	78.08 \pm 1.10	92.14 \pm 1.04	92.04 \pm 1.04	91.24 \pm 0.32	71.70 \pm 1.56	89.44 \pm 0.31	82.66 \pm 0.65
GraphCBAL(val_missing)	70.41 \pm 1.10	62.58 \pm 1.23	76.07 \pm 1.22	75.04 \pm 1.30	90.92 \pm 1.35	90.83 \pm 1.94	90.41 \pm 0.60	83.74 \pm 2.94	91.65 \pm 0.65	86.23 \pm 1.02

Table 4 The class balance results of GraphCBAL and two reinforced baselines under different validation datasets. The best is noted in red.

	Citeseer		Pubmed		Reddit		Co_CS		Co_Phy	
	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD
GPA(val_balance)	0.23±0.05	7.75	0.28±0.03	11.57	0.15±0.03	10.25	0.02±0.0	12.90	0.00±0.00	31.74
ALLIE(val_balance)	0.22±0.06	7.76	0.30±0.04	10.80	0.27±0.03	7.87	0.02±0.0	13.33	0.00±0.00	29.04
GraphCBAL(val_balance)	0.52±0.07	3.97	0.68±0.05	3.91	0.54±0.04	3.60	0.59±0.03	3.25	0.73±0.03	2.46

	Citeseer		Pubmed		Reddit		Co_CS		Co_Phy	
	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD
GPA(val_missing)	0.28±0.05	7.86	0.13±0.02	14.26	0.17±0.03	10.46	0.00±0.00	16.53	0.0±0.0	31.74
ALLIE(val_missing)	0.28±0.05	7.40	0.16±0.02	13.40	0.24±0.04	8.83	0.00±0.00	15.62	0.05±0.01	30.27
GraphCBAL(val_missing)	0.33±0.06	6.24	0.61±0.07	4.38	0.28±0.04	9.00	0.22±0.06	5.72	0.30±0.02	9.61

Table 5 The statistics of the datasets.

Dataset	Nodes	Edges	Features	Classes	Imb-ratio	Edge Hom.
chameleon	2277	31421	2325	5	0.74	0.23
squirrel	5201	198493	2089	5	0.43	0.22
snap-patents	2923922	13975788	269	5	0.9	0.07

Table 6 Node classification performance(Macro-F1, Micro-F1), The best and 2nd best are noted in red and blue, respectively.

	Chameleon		Squirrel		Snap-patents	
	Micro-F1	Macro-F1	Micro-F1	Macro-F1	Micro-F1	Macro-F1
GPA	32.11 ± 2.60	29.71 ± 2.85	23.83 ± 0.61	15.30 ± 1.26	20.07 ± 0.20	19.12 ± 0.33
ALLIE	31.67 ± 2.76	29.07 ± 3.19	22.95 ± 0.60	14.95 ± 1.21	20.61±0.25	19.87 ± 0.28
GraphCBAL	39.47 ± 2.30	37.65 ± 2.43	24.00 ± 0.68	16.02 ± 1.14	26.04 ± 0.55	22.59 ± 0.61
GraphCBAL++	40.72 ± 1.82	38.87 ± 2.34	23.09 ± 0.83	14.64 ± 1.35	25.17 ± 0.53	20.11 ± 1.05

Table 7 Imb-ratio and standard deviation of labeled nodes. The best and 2nd best are noted in red and blue, respectively.

	Chameleon		Squirrel		Snap-patents	
	Imb_ratio	Label_STD	Imb_ratio	Label_STD	Imb_ratio	Label_STD
GPA	0.41 ± 0.08	6.8	0.02 ± 0.0	20.29	0.11 ± 0.0	117.15
ALLIE	0.41 ± 0.06	6.73	0.02 ± 0.0	20.04	0.10 ± 0.0	113.57
GraphCBAL	0.60 ± 0.09	3.37	0.21±0.02	11.67	0.38±0.06	69.15
GraphCBAL++	0.59 ± 0.12	3.5	0.23±0.02	10.49	0.28±0.03	93.73